International Journal of Engineering Trends and Technology
ISSN: 2231 – 5381 / https://doi.org/10.14445/22315381/IJETT-V71I3P242

Volume 71 Issue 3, 395-406, March 2023

Original Article

Design of a Mobile Application for the Control of Pet Care

Diana Conde López[1], Lesdi Gavilán Colca[2], Laberiano Andrade-Arenas[3], Michael Cabanillas-Carbonell[4]

[1,2]*Facultad de Ingeniería y Negocios, Universidad Privada Norbert Wiener, Lima, Perú.*
[3]*Facultad de Ingeniería, Universidad Tecnológica del Perú, Lima, Perú*
[4]*Facultad de Ingeniería, Universidad Privada del Norte, Lima, Perú*

Corresponding Author: mcabanillas@ieee.org

Received: 07 October 2022 Revised: 16 March 2023 Accepted: 22 March 2023 Published: 25 March 2023

Abstract *- Activities they perform. A problem that apparently is not very important arises or becomes more evident. Talking about the carelessness that we often, without being intentional, have with our pets, the circumstances force us mostly to have tragic endings with them. Therefore, with the advancement of technology, we have the opportunity to greatly reduce this end and thus give utility to the current resources being presented. The objective of the research work is to develop a prototype of a mobile application using the Balsamiq mockup tool and take as a reference the care model of experts in animal care. In this way, it is possible to have better control and monitoring of the health and other care of our pets. For this use, the Rational Unified Process (RUP) methodology since it is the most appropriate for producing high-quality software, giving us a complete vision in the development of each phase that this methodology presents. Likewise, a positive result is obtained by the expert judgments of the evaluation of the design of our application. As a result, the proposed objective was achieved by obtaining a prototype that can help meet some needs of people who require support in the care of their pets, thus leaving an open the door to continue adding and improving the development of this project.*

Keywords *- Balsamiq, Control, Mobile application, Methodology RUP, Pet care.*

1. Introduction

Animal welfare is an issue emphasized in society worldwide, both in the natural and domestic environment [1]. The care of domestic animals is of great relevance. Since by enjoying the good care that should be provided to them, humans will also benefit from it [2]. At present, the issue of animal care has been a topic of secondary or low interest. Due to the situation Peru and the world are going through regarding human health, there has been a deficit in our faithful companions' care. As evidenced in parks, streets and other places crowded and inhabited by people in every place. Where animals are neglected and, in the worst cases, abandoned. That is why it is necessary to consider the respective care and attention of our pets, as pointed out by the author [3].

Thus, thanks to the progress that technology has been having day by day, it has become an ally in the development of human tasks. Therefore, technology becomes an auxiliary tool to facilitate our relationship in the care of our children, as mentioned by the author [4]. One can see that we have tools that contribute to the care one should have with our pets. A very clear example of how to apply them is mentioned by [5].

Showing us how one can organize and use the data needed for better care. An analysis was made of people's need for the support of applications that facilitate medical treatments, making use of our smartphones, mentioned by the author [6], demonstrating that the care of our faithful friends cannot be separated from the use and innovation of technology. In human health care, a great contribution is being developed with mobile tools for the control and care each person and situation deserves, as mentioned by the author [7]. So, one can mention that in the same way, mobile applications are also used for animal care. Having seen all of the above and the very fact that people with busy schedules, work, study and other activities also want to enjoy the company of their pets. Moreover, seeing the importance of animal care, the present work developed is of interest [8] since it contributes to the mutual need between man and his pet, which is the welfare and tranquillity of the period of the company between them.

The objective of the research work is to develop a prototype mobile application using the Balsamiq mockup tool and take as a reference the care model of experts in animal care. In this way, we can better control and monitor our pets' health and other care. Likewise, use was made of the RUP methodology.

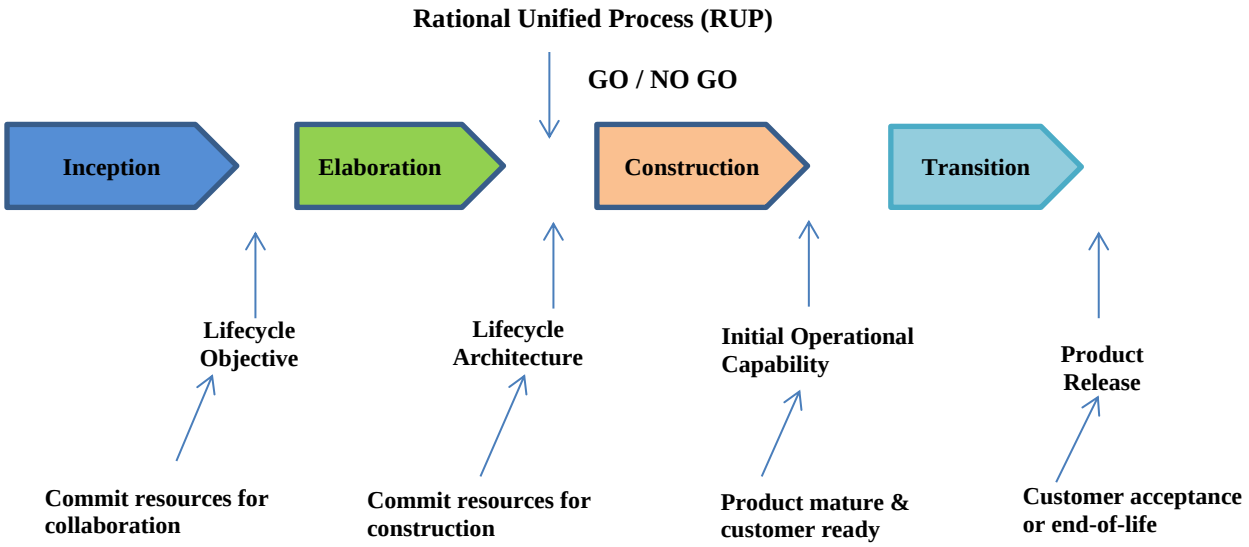


Fig. 1 RUP phases

This is a product of the Software Engineering Process; its approach is disciplined to assign tasks and responsibilities. This methodology aims to produce high-quality software. Therefore, it works by establishing a set time and a budget to meet the needs of the end customer [9].

This paper is structured as follows: Section 2 looks at the literature review, Section 3 the methodology, Section 4 the results and discussions, and finally, Section 5 the conclusions.

2. Literature Review

This research paper will discuss the importance of care and attention that should be given to animals, focusing on pets. We will see how technology also influenced for good in this need, and mobile applications are of great help and effectiveness.

The author [10] conducted a study where he showed the effectiveness of the applications on the end user, collecting information from a population of 200 students of Sultan Zainal Abidin University (UniSZA) in the Faculty of Informatics and Computer Science. As a result, the effectiveness of the user using a web-based system which is 0.633, while the effectiveness of the one using a mobile application is 0.973. This tells us that the developers of both mobile applications and web-based systems must improve to continue to have an acceptable results in terms of users.

The author [11] points out that universities were forced to opt for distance education due to the global pandemic. He points out how digital tools were a great alternative to continuing education, not necessarily with a computer but with a mobile device, thus introducing the use of mobile applications. In this way, he shows us how digital tools, as well as mobile applications, became transcendental to perform the tasks or jobs that people have as a routine.

Verified that the author [12] gives us a view of the country of Portugal, mentioning that they conducted an online survey to classify the information obtained regarding the care people provide to their pets. They found that there is a large percentage of people who acquire or adopt an animal but do not give it the attention, care and proper control of its health.

The author [13] presents an example of a mobile application that he developed for the care of pets, using the Android platform for its development and as a source of information for experts in domestic pets. Resulting in the development of the application and analysis of the functionality, all with due advice to users.

See that [14], his article shows us that caring for our pet's help is required. Since many people's time is taken up with work, study and other activities. Therefore, an intelligent device was developed based on MQTT (Message Queuing Telemetry Transport) that dispenses food and water, monitoring it through a mobile device. In this way, another tool is presented so that the welfare of our pets can be carried out peacefully.

A bibliographic review was conducted to analyze the issues related to the control of pet care since it will help to feed more to the research work.

3. Methodology

This section will present the methodology used to develop the mobile application.

3.1. RUP

The main characteristics of RUP are:

Iterative Software Development. It has a Requirements Management. It makes use of component-based architectures. It uses the Visual Software model. Performs Software Quality Verification. Applies Software Change Control [15].

Works with two dimensions: Horizontal axis represents time and demonstrates the aspects of the process life cycle, seeing the phases that indicate the emphasis given in the project at a given instant.

Vertical axis representing disciplines, which group activities logically defined by nature. The RUP software life cycle is decomposed into four phases, shown in Figure 1.

3.1.1. Inception

The purpose of this phase is to define and agree on the project's scope. Identify all the entities (actors) with which the system will interact, identify all the use cases and describe the most significant ones, and produce the plan of the phases and the subsequent iterations [16].

3.1.2. Elaboration

In this phase, the problem domain is analysed, a basic architecture is defined to understand the complete system: its scope, functional and non-functional requirements, and performance requirements. The project is planned considering available resources so that the cost and schedule for completion of the development can be predictably determined [28].

3.1.3. Construction

Here all missing components and application features are developed and integrated into the product, and much of the work is programming and testing. At this point, whether the software, sites and users are ready to operate without exposing the project to high risks is decided. This phase provides a built product along with documentation [18].

3.1.4. Transition

In this phase, the product is released and delivered to the user for real use; at this point in the life cycle, user feedback should be taken primarily to adjust, configure, install and see the usability difficulties of the product [19]. At this point, it is decided if the objectives were achieved and if another development cycle should be started.

3.2. Development Tools

In this section detail the tools that were used for the development of the application.

3.2.1. Android Studio

Software that includes an operating system and middleware (hidden software that works as a translator between an operating system and applications, enabling communication and data management in distributed applications). It features a standard Android development kit (SDK), which includes an application programming interface (API) where applications are created in Java language [20].

3.2.2. SQLite

It is an open-source database engine; it is transactional and also lightweight. It takes up little storage space in memory, making it ideal for creating a database on various mobile operating systems [21].

3.2.3. Java Programming Language

It is an object-oriented programming language that is portable and simple. Its syntax is similar to that of C++; it works with multiple inheritance interfaces, cryptographic security, concurrency support, powerful libraries, GUI tools, and GUI tools [22].

3.3. Methodology development

In this section, the aforementioned phases of the RUP methodology will be developed:

Table 1. User Requirements

N°	Entity - Object	User Requirements
RU1	User	User management
RU2	Pet	Manage pet
RU3	Control	Manage control

Table 2. Functional requirements

N°	User Requirement	System Requirement
RS1	User management	New user
RS2	User management	Save user
RS3	User management	List user
RS4	User management	Remove user
RS5	User management	Update user
RS6	Manage pet	New pet
RS7	Manage pet	Save pet
RS8	Manage pet	List pet
RS9	Manage pet	Remove pet
RS10	Manage pet	Consult pet
RS11	Manage pet	Update pet
RS12	Manage control	New control
RS13	Manage control	Save control
RS14	Manage control	List control
RS15	Manage control	Consult control
RS16	Manage control	Update control
RS17	Manage control	Generate report

3.3.1. Requirements

By identifying the user's needs, a quality project can be realized.

Functional Requirements

The functional requirements of the system are shown in Table 1 and Table 2.

Non-functional Requirements

In Table 3, observe the requirements that the system needs.

Table 3. Non-Functional requirements

N°	Requirements
1	The interface must be user friendly
2	It must be easy to navigate, interact and use.
3	It must show the information correctly and quickly
4	It must have a stable database for the correct storage of data
5	The application must be created so it can be moldable and receive adequate maintenance in the future.

3.3.2. Modeling

In this section, see the modelling of the system.

System Use Case Diagram

Figure 2 shows the Use Case graph, where the interaction between the application and the user can be observed.

Actors

The actors interacting in the system are shown. As can be seen in Table 4.

Requirement Diagram

The interaction within the system is shown in Figure 3.

Table 4. Actors

Actor	Description
User	Person or entity that will require the service of the application.
System Administrator	The person who administers the system.

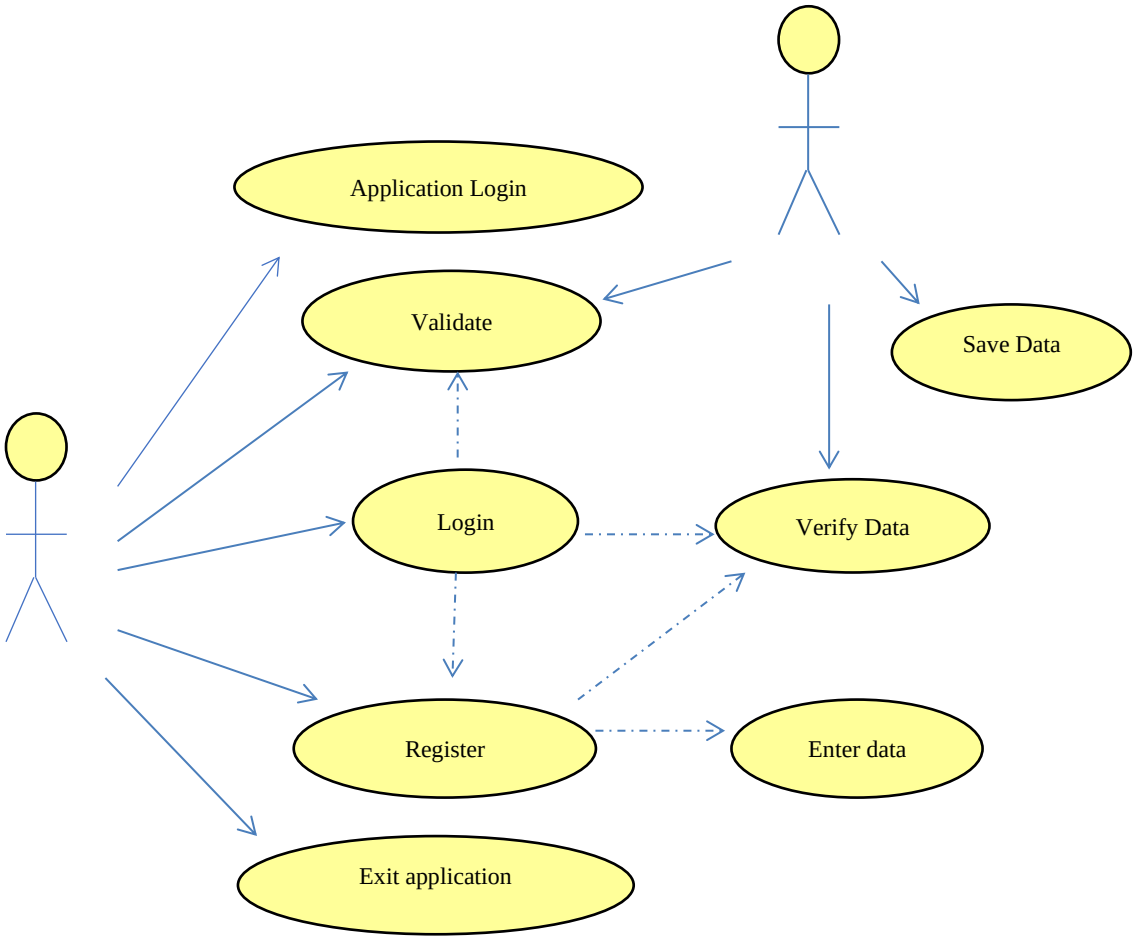


Fig. 2 Use Case Diagram

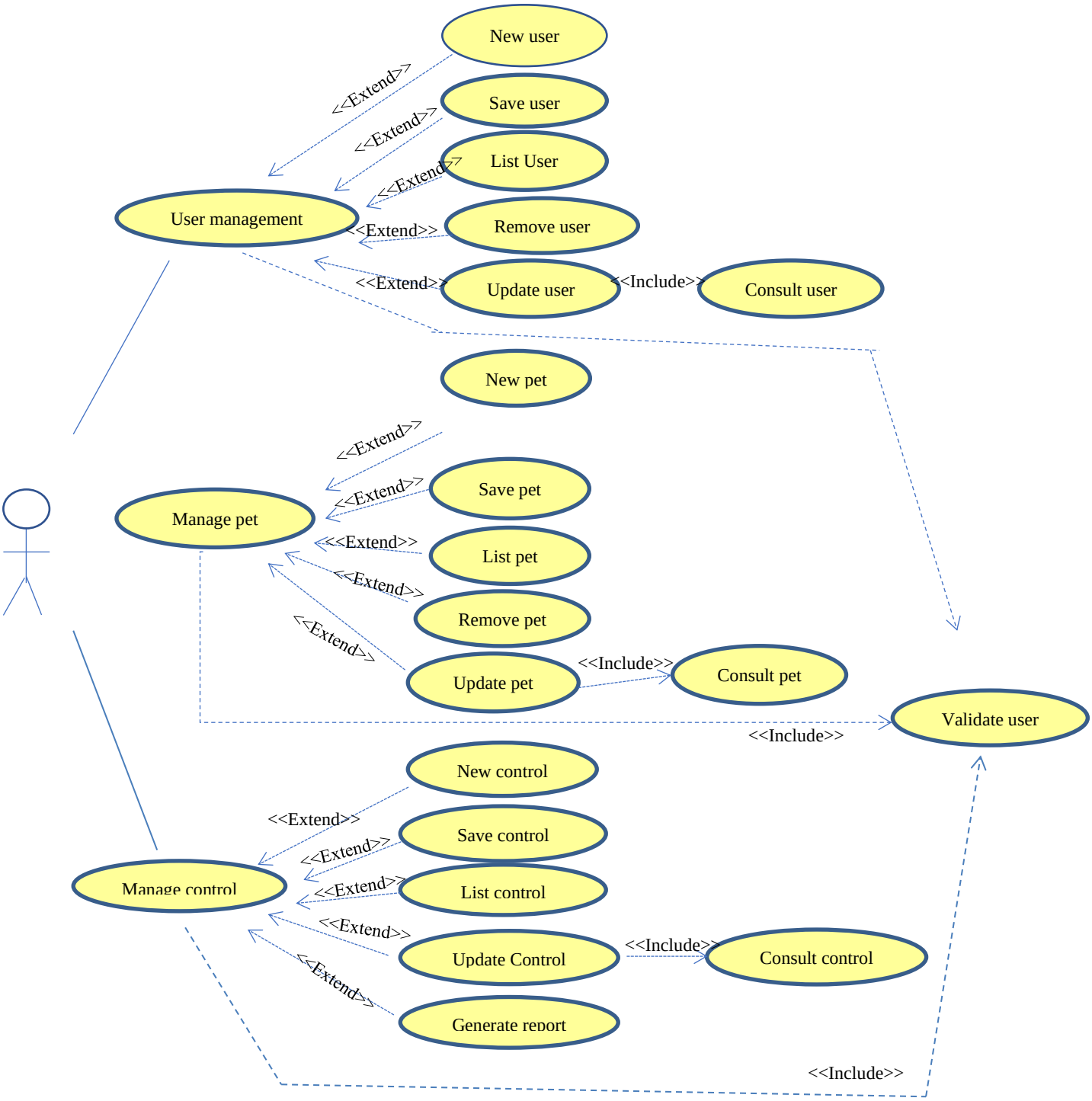


Fig. 3 Requirements Diagram

3.3.3. Analysis and Design

This section will show the Conceptual, logical and physical models of the database, followed by the prototype of our application. The third model of the database can be seen in Figure 4.

The prototypes of the application could then be observed. The opening (a) and welcome (b) windows can be seen in Figure 5.

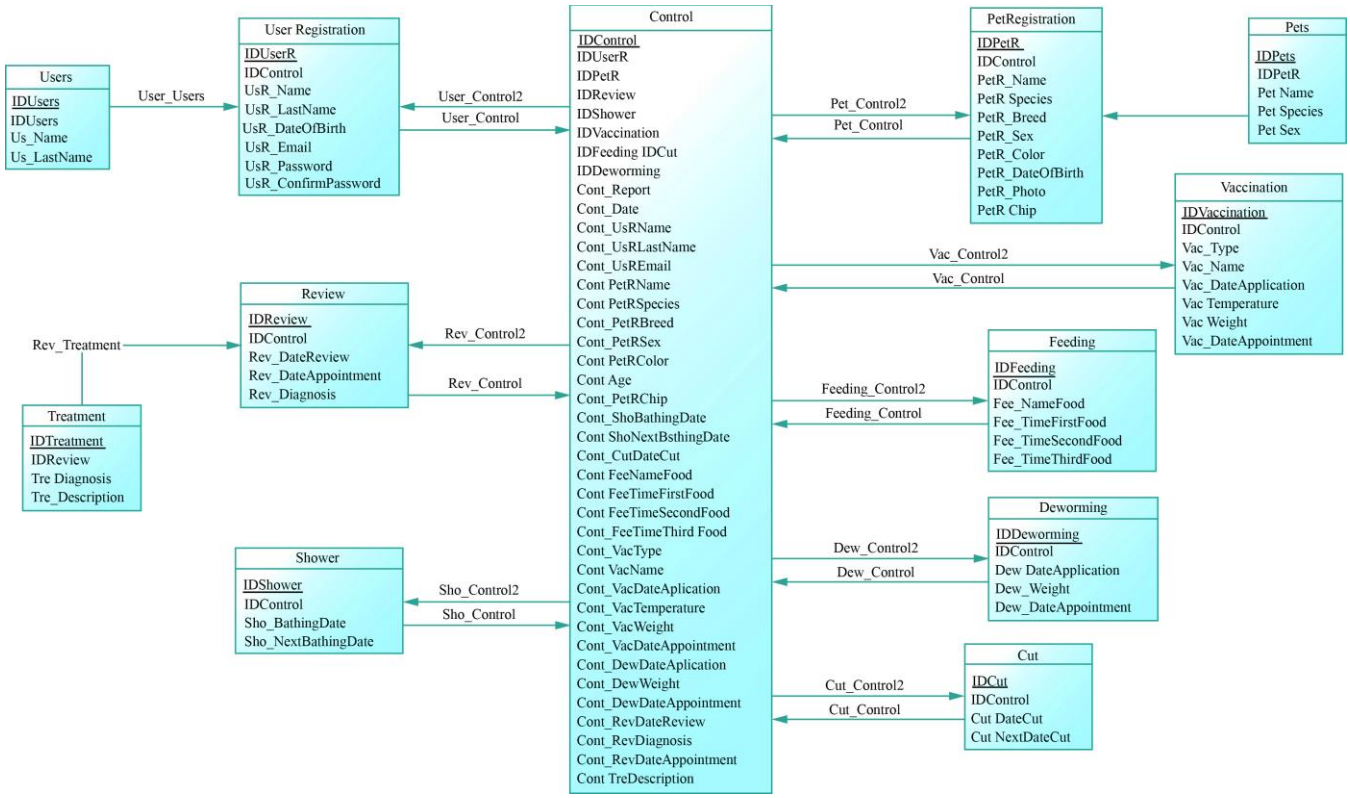
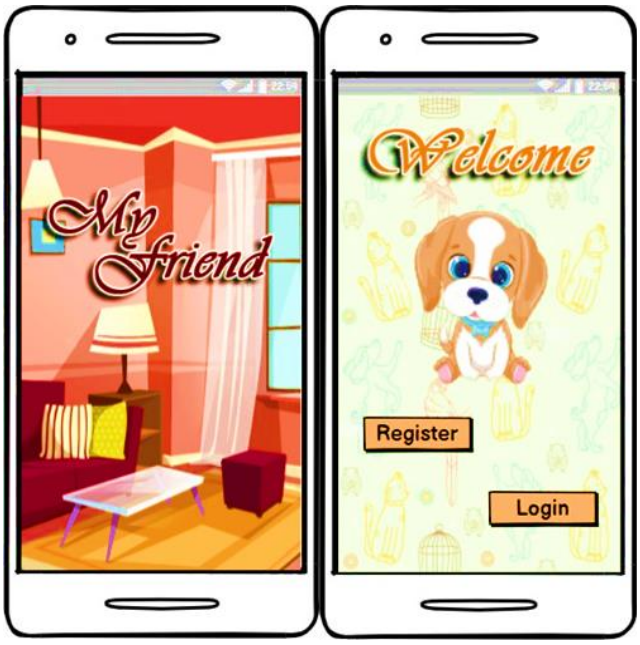


Fig. 4 Physical Model of the database



(a) **(b)**

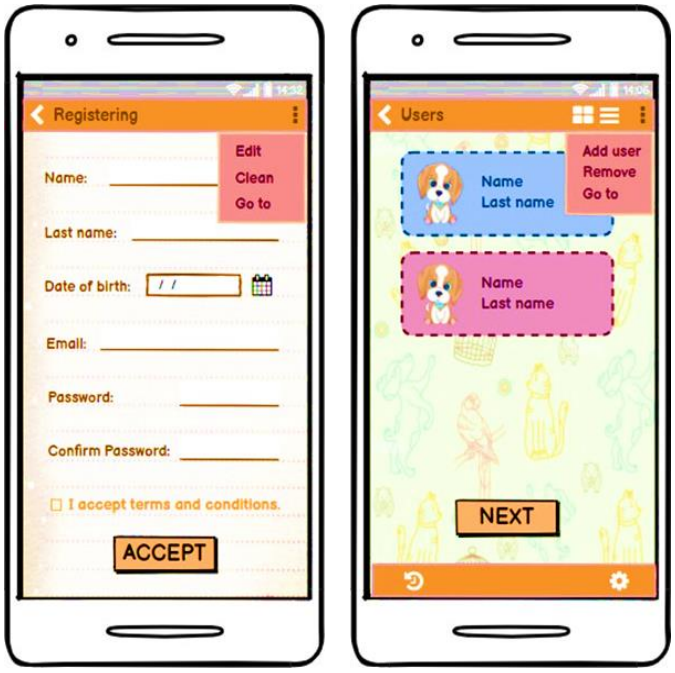
Fig. 5 Mobile application: (a) Initial windows and (b) Register – Login

(a) **(b)**

Fig. 6 Mobile application:(a) User login and (b) Go to the main window

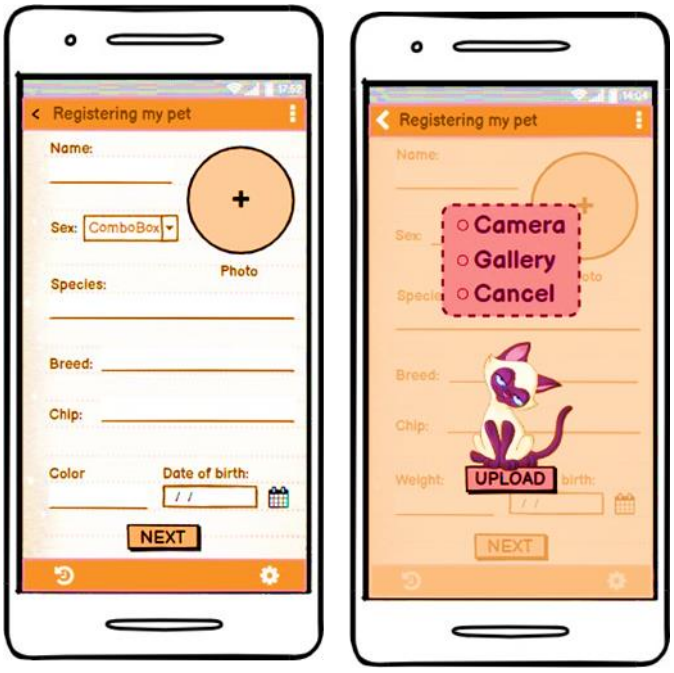
Figure 6 (a) shows the login window for the user. Also, in Figure 6 (b), you can see the icon as an option to take you to the main window. Figure 7 (a) shows the user registration windows and the modification options. Figure 7 (b) shows the user list windows and the configuration options.

Figure 8 (a) shows the wizard selection window, and Figure 8 (b) shows where the pets will be added from. In Figure 9 (a), you can see the pet registration windows, and in Figure 9 (b), the pet photo extraction.



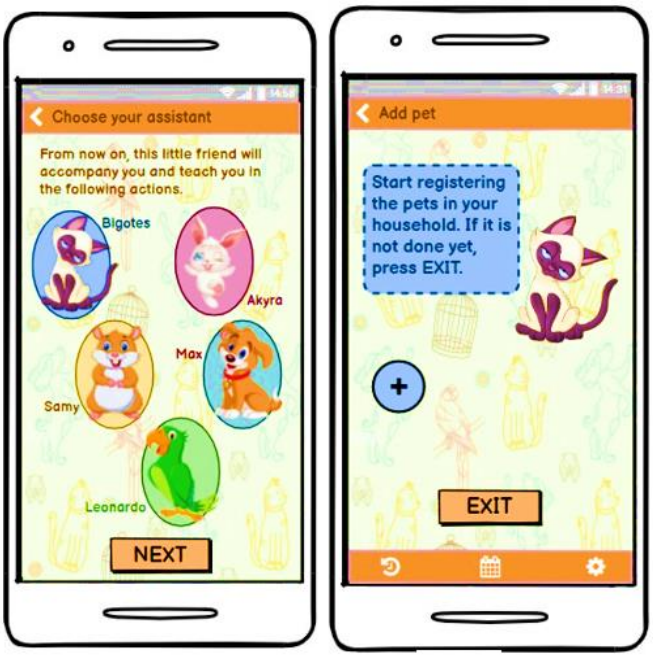
(a) (b)

Fig. 7 Mobile application: (a)Registration and (b) User List



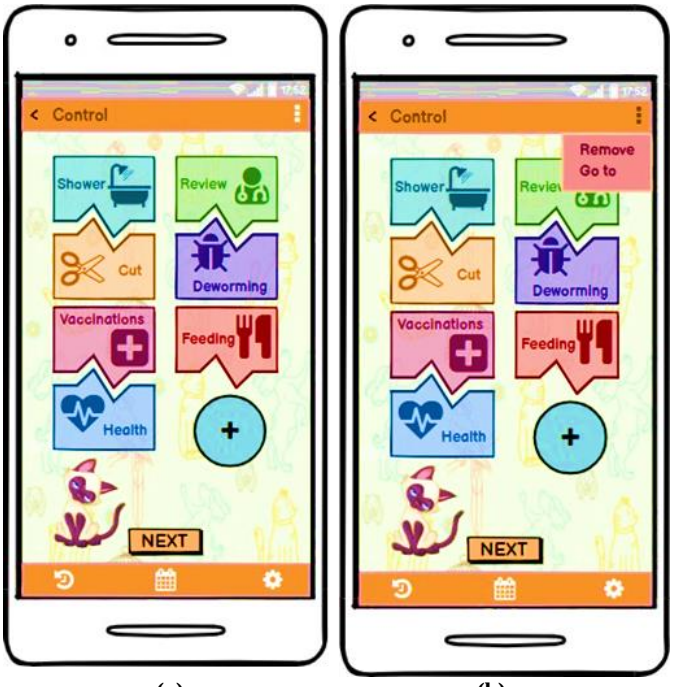
(a) (b)

Fig. 9 Pet registration windows:(a) Pet data and (b) Pet photo



(a) (b)

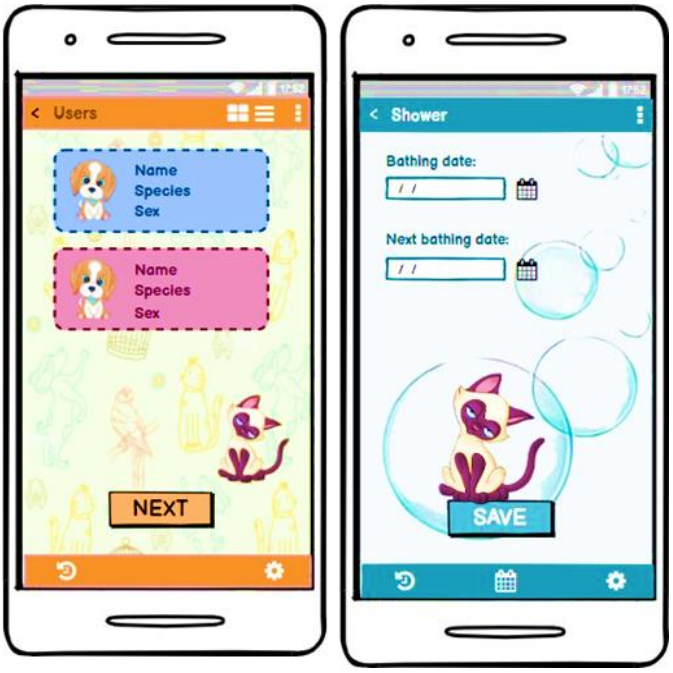
Fig. 8 Pet friendly windows:(a) Assistants and (b) Add pet



(a) (b)

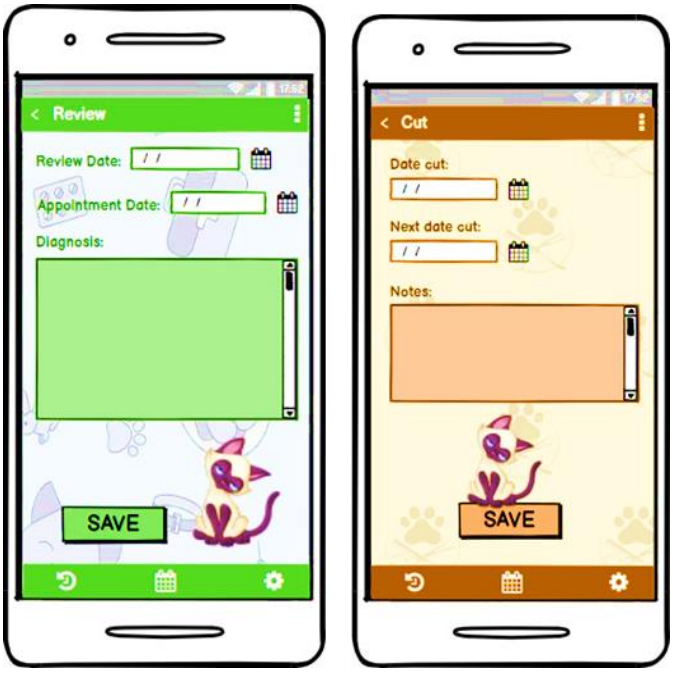
Fig. 10 Control windows:(a) Control items and (b) Option to modify

Figure 10 (a) shows the windows of the list of activities to be controlled, and Figure 10 (b) shows the configuration options of this list. Figure 11 (a) shows the windows for the pet list, and Figure 11 (b) shows the register for the bath control.



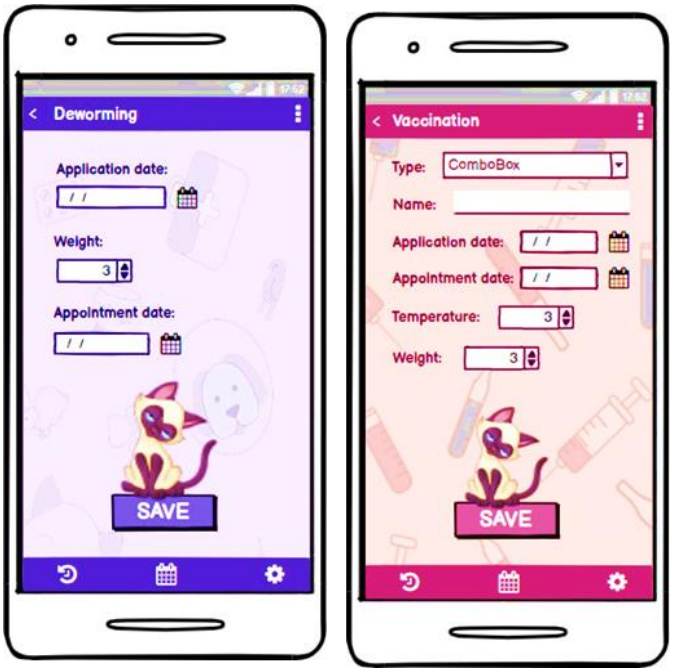
(a) (b)

Fig. 11 Control windows:(a) List of pets and (b) Data for bathing



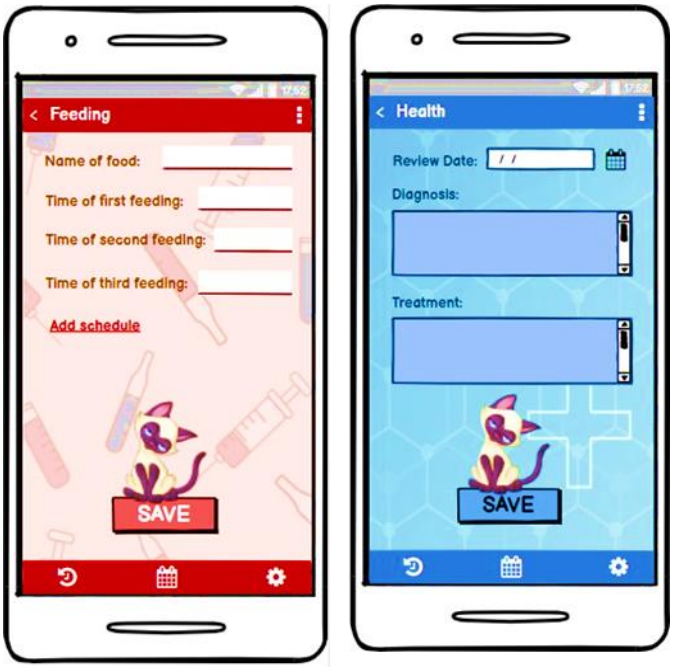
(a) (b)

Fig. 13 Control windows:(a) Review data and (b) Cutting data



(a) (b)

Fig. 12 Control windows:(a) Deworming data and (b) Vaccination data



(a) (b)

Fig. 14 Control windows:(a) Data for food and (b) Health data

Figure 12 (a) shows the registration windows for deworming control, and Figure 12 (b) shows the registration window for vaccination control. On the other hand, Figure 13 (a) shows the registration windows for food control, and Figure 13 (b) shows the registration window for sanitary control.

Figure 14 (a) shows the log windows for food control, and Figure 14 (b) shows the log window for sanitary control. Figure 15 (a) shows the log windows for the general configuration of the application, and Figure 15 (b) shows the general report.

(a) (b)

Fig. 15 Control windows:(a) General configuration and (b) Report

(a) (b)

Fig. 16 Mobile application :(a) Report and (b) Report erasable and downloadable

Figure 16 (a) shows the following windows of the general report, and Figure 16 (b) shows the report, which is erasable and downloadable.

3.3.4. Test

For the appropriate tests, a survey was conducted to evaluate the opinion of 12 experts. For this purpose, the Likert scale was used as a measurement method, classifying them into the following indicators:

"Very satisfied", which has a value of 1.

"Satisfied", which has a value of 2.

"Dissatisfied", which has a value of 3.

"Very dissatisfied", which has a value of 4.

The results obtained are shown in Table 5.

4. Results and Discussions

This section will discuss the results obtained from the developed prototype and the expert judgment survey and will also discuss the comparison of three methodologies.

4.1. About the Prototypes

In the research work developed, with respect to the design of the prototypes can say that it started with a basic model but have a reference in [12], who shows us a model already in operation. Also, [3] shows us a deeper design with more developed implements and tools, which encourages us to have an improvement in the future.

4.2. On Validation by expert judgment

As a result of the evaluation by expert judgment made through a survey, it was obtained that, as a minimum, it has a mean of 1.58, a maximum of 1.75, an average of 1.667 and a high acceptance in the design criterion. As a minimum, there is a mean of 1.42, a maximum of 1.58, an average of 1.52 and a high acceptance in the Usability criterion. Furthermore, it has an average of 1.42, being the average of the same value and a high acceptance in the Functionality criterion (see Table 5).

4.3. On Validation by Expert Judgment

A comparative table of three methodologies, Scrum Cascade and RUP, was made. This can be seen in Table 6. Once these three methodologies have been compared, we can say that the chosen methodology was the most appropriate cascading [30], since for the development of the application, it stands out in the documentation, change control from the initial phase, detailed modelling, support from specialists and stakeholders, covers management practices outside the development practices.

The RUP methodology allows working with processes, activities and tasks throughout the entire project. It also documents all the stages carried out. Agile methodologies such as the scrum framework work incrementally per sprint, where each product must be delivered by sprint, and this must be working. The waterfall methodology works with phases, which are dynamic and is done through iterations; Unlike the Rup methodology, it performs the tasks in phases [25].

Table 5. Expert Judgment

Criteria	Question	Mean	σ	Scale
Design	Do you find it easy to log in?	1.67	0.492	High
Design	Do you find the layout (Color, font size, number of images, etc.) of the application user-friendly?	1.75	0.622	High
Design	Do you think that reference images are suitable for this type of application?	1.58	0.515	High
Usability	Do you find it easy to navigate between the main options of the application?	1.58	0.669	High
Usability	Will the application would make it easier for you to keep control of your pet's activities?	1.58	0.515	High
Usability	Do you find the application useful?	1.50	0.522	High
Usability	Would you use the application?	1.42	0.515	High
Functionality	Would the application help you to prevent your pet's health care?	1.42	0.515	High
Functionality	Would the application change the way you organize your pet care?	1.42	0.515	High

Table 6. RUP vs Scrum vs Cascade

Scrum	Rup	Cascade
As an advantage, you have the necessary knowledge to achieve an objective. Involves from the beginning, everyone has a role and deliverables are made in a timely manner [27].	As an advantage, there is more documentation: configuration and change control. Modeling is guided by the use case. Verify software quality [28].	As an advantage, it has a simple structure with clearly differentiated phases. Costs and workload can be estimated at the start of the project [29].
As a disadvantage have that there are important step jumps on the way to reach the final sprint. There are too many meetings for too little progress.	As a disadvantage, the changes are in an entire phase. Large projects are carried out	The disadvantage is that there is little room for adjustment during the course of the project. Some- times, bugs are only detected once the development process is finished. They are for small projects.
Their roles are the work performed by the team of specialists. Transparency by the team of specialists. Accountability.	Its roles are Analyst. Developers. Managers. Support and specialists. Coordination of revisions	It has roles in the client, project manager, analyst, development and testing team.
It is characterized by being based on principles. It reduces the cost of change at all stages.	It is characterized by embracing management practices without entering into development practices. It delegates responsibility completely to the team.	It is characterized by Dividing each stage of development into phases and completing each one of them in order, analyzing and checking the operation of them at the end. Constant maintenance.

Rup was chosen for the investigation since it was adapted for the required documentation. In addition, the functional and non-functional requirements and the use cases of the business and the system are defined. However, it is true that the methodologies are adaptable and carry out documentation, but they are not the same as the Rup methodology or the cascade methodology. In addition, the Rup methodology is for software development that is carried out in more time than the scrum methodology [26].

5. Conclusion

In conclusion, the objective set out in this research work could be satisfactorily achieved since it was validated by expert judgment. Applying the appropriate methodology RUP, which in each phase helped the best development of the proposed mobile application. It is worth mentioning that there are also factors of limitations for the development of the research, such as technology since the software required for the design of the prototypes is Balsamiq. However, it has a wide range of designs and good results but requires a fixed payment to exploit all its benefits. As future work for this mobile application, it is suggested that the increased development of Machine Learning algorithms for image recognition, sound, and Artificial Intelligence (AI). In order to facilitate and improve the functions of the mobile application.

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