

Mobile Application Design: Sale of Clothes Through Electronic Commerce

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Abstract—During the COVID-19 pandemic, small clothing sales companies lost economic income and customers due to a lack of digital transformation, causing the dismissal of many employees. Due to this problem, our objective is to design an e-commerce mobile application for the sale of clothes, so that Small and medium-sized enterprises dedicated to this area generate income and retain their customers. For this, the Rational Unified Process (RUP) methodology was applied, because this methodology provides a structured way for companies or developers to visualize the development of the software, and for the validation by expert judgment, the survey and the questionnaire were used as instruments. Obtaining as a result a positive rating for the design of the mobile application and its acceptance to accommodate what is reflected. In conclusion, the e-commerce mobile application was successfully designed, backed by expert judgment, so that Small and medium-sized enterprises can offer their products and generate income, as well as build customer loyalty.

Keywords—Mobile application; COVID-19; e-commerce; RUP; sale of clothes

I. INTRODUCTION

At present, worldwide, mobile applications have become elements of vital importance for electronic commerce. Since, during the pandemic, many companies have gone downhill, especially small companies due to lack of financial resources for digital transformation. Large companies, however, showed a slightly different result compared to small companies. This is due to the use of smartphones, which has generated a lot of innovation and with it, the creation of mobile applications, including the e-commerce application [1].

During the COVID-19 pandemic, mobile applications for online commerce or also called electronic commerce, gained a large number of new users, and in the same way, people's lifestyles have changed [2]. Therefore, today consumers choose to use these applications to make purchases from the comfort of their home. Because mobile applications have emerged as a form of innovation for the e-commerce business, since it provides convenience and ease to consumers by saving time and effort. In this sense, people prefer the use of electronic commerce applications, in particular to make purchases or orders, in this way, protect themselves from the COVID-19 coronavirus [3].

In addition, mobile e-commerce applications can help small businesses that sell clothes, and other sectors that have the home delivery modality, prosper. In the same way, it will allow consumers (customers) to make their purchases from the comfort and safety of their homes [4]. According to the study carried out in India, the habits adopted during the COVID-19 coronavirus pandemic are driving the growth of mobile applications related to electronic commerce. Because these applications help save time, resources and efforts for consumers. Therefore, it is one of the key reasons why small businesses can prosper [5]. Likewise, the use of the mobile application generates great benefits for the company, such as: quick and easy access to information, optimization of the average time in making and delivering purchases or orders and, consequently, improvement in customer loyalty.

For this reason, the present research work offers a viable solution to small companies dedicated to the sale of clothes, using an electronic commerce mobile application. In order to help small businesses prosper in the current market, to which they are directed.

Therefore, the proposed research will help automate and provide a solution to the problem of face-to-face clothing sales that currently exists, allowing customers to order or purchase with confidence and security from the mobile application. In this way, allow small businesses to provide services at home. Since the mobile application is key to continue generating income and sustain itself in the current market. Likewise, with this form of technological innovation, it not only benefits customers, but also small businesses and people who work as delivery people, since the mobile application is a system that helps the efficiency of the business and involves several people that require a job. In the same way, the RUP methodology will be applied since this methodology provides a structured way to visualize software development. It also provides a detailed plan for each of the development phases.

The objective of the research is to design a mobile application for the sale of clothes through electronic commerce, applying the RUP methodology, which makes it easier for small businesses to generate income and retain their customers. The beneficiaries of the research are the people who sell clothing to generate income through the proposal of the mobile application, all through electronic commerce.

This research is made up as follows: Section II explains the review of the literature: analysis of different investigations related to the research work; Section III defines the RUP methodology and its different phases that were used in the research work; Section IV the development of the methodology; Section V presents the results; Section VI the discussions; Section VII the conclusions and finally Section VIII future work.

II. LITERATURE REVIEW

In the research work, the subject of e-commerce mobile applications was addressed. For this reason, in this section it will focus on analyzing the different investigations related to the research work, where it provides us with its objectives, methods, results and conclusions.

The author Hawa [6], states that the internet, applications and e-commerce allow consumers to be reached, since these mobiles allow the availability of clothing; therefore, sales increase. He developed the study with the aim of exploring the acceptance of personalizing clothing online, with the purpose of reaching the market through segmentation. Applying the qualitative method; the interview and questionnaire for data collection. The sample consists of 13 participants from diverse cultural backgrounds. Their findings contribute to a large-scale quantitative study. In addition, it is of interest to great executives of management and marketing of garments.

The author M.Subchan [7], manifest that electronic commerce allows consumers to carry out purchase and sale transactions in a simple and fast way. Likewise, it presents that the Muslim clothing store ayu fashion shops, offers a variety of Muslim clothing such as: hijab, tunic and couple; therefore, the purpose of the study is to create a sales system using electronic commerce technology, applying the waterfall methodology. Concluding that consumers of these online clothing stores can order from anywhere. Likewise, it provides the solution to the problems faced by Muslim fashion stores that are currently evolving.

The authors Purwaningtyas and Rahadi [8], in their study, aim to determine the factors that affect the sale of clothing through electronic commerce; To do this, they reviewed and came to a synthesis of 36 previous articles related to their research. Obtaining a result, that the factors that affect the sale of clothing through electronic commerce are the price, the design and style of the product, the promotion, the quality of the product, the availability of product information, the variety of products offered, ease of use and quality of service during the purchase. The study's findings are of great use to businesses selling garments on e-commerce platforms in Jakarta, Indonesia.

The authors BĂLĂȘESCU et al. [9], state that the development of electronic commerce platforms is of vital importance for the clothing sales market. The study analyzes clothing sales via e-commerce in Romania; For this, it is intended to know the opinions of clothing consumers, who use electronic commerce applications to make their purchases. In this way, determine the reasons why they choose to buy clothes online. Concluding that the results obtained in the study will be very useful for online clothing sales companies through applications, which will help

improve their services. Likewise, for companies that want to enter the e-commerce business through their applications.

The authors Ramirez et al. [10], in the investigation present the development of an electronic commerce platform, to give the greatest flow of sales of sports and casual clothing. Similarly, they state that during the COVID-19 pandemic, many clothing sales businesses were affected; For this reason, the electronic commerce platform was developed, applying the Scrum methodology to solve the problem. According to the statistics they obtained, the acceptance by the clients was evidenced, since, from the moment it was put into service, the business obtained positive results. Concluding that e-commerce applications increase sales by making it easier for consumers to buy online.

The authors Soegoto et al. [11], state that there is a rapid development of technologies; one of them is the development of mobile applications as a means for the sale and purchase of a product. The purpose of the research is to design a mobile application for the sale and purchase of various types of Japanese anime t-shirts. Also, as a means of promotional marketing. For this, the qualitative descriptive analysis method was applied, in order to help Japanese anime fans to find different types of t-shirts. Likewise, it concludes that the mobile application facilitates the purchase and acts as an intermediary between consumers and the favorite anime product.

The authors Gomero-Fanny et al. [12] in their research work made a prototype of electronic commerce for the sale of clothes. To do this, they applied the scrum methodology. The objective was to design a web system for clothing sales under the agile SCRUM methodology. Which allowed them to design web system prototypes meeting the needs of the organization. The results were divided into 4 Sprint deliverables to analyze the user stories, where a maximum score of 21 and a minimum of 16 were obtained. Concluding that this system will focus on meeting the requirements of customers, with adaptations to the organization according to their needs, which will benefit the organization and its customers.

So also the authors Tupia-Astoray and Andrade-Arenas [13], state that currently Small and medium-sized enterprises (SMEs) have stalls and physical stores as the only means of sale. For this reason, in their study, e-commerce web prototypes for sale were made, applying the SCRUM methodology covering the established procedures, being a peculiar proposal and with a beneficial approach. Obtaining as a result, design of innovative prototypes complying with the procedures established under the SCRUM methodology. Therefore, the proposal made can be implemented by different SMEs that wish to improve their online sales, with a good management organization.

The authors Lazo-Amado et al. [14] mention in their research work that the COVID-19 pandemic generated a great loss of sales in the Peruvian market. For this reason, the objective of the study is to develop a model to optimize sales with the use of digital marketing, applying the DesignScrum methodology, which is a hybrid of Scrum and Design Thinking. To carry out the test, a survey was conducted with customers, who gave their opinion regarding the prototype. Then, the digital marketing proposal was raised. Concluding that the marketing model according to the needs of the company will

benefit its sales through electronic business.

In summary, different research works have been studied and it was found that most of the authors focus on the development of web applications with attributes such as quality, design, reliability, price and various options associated with web applications. applications, and others focuses on the factors that influence customers to use the mobile application. However, they do not focus on the development of the mobile application, on the security that it can provide to the user. Likewise, they do not attribute the forms of payment to facilitate the consumer and can use them with confidence and security. Consequently, they are exposed to not achieving customer satisfaction and loyalty.

III. METHODOLOGY

This section focus on applying the RUP methodology, which is made up of phases.

A. Metodología RUP

The RUP methodology is a software development process that divides the process into four distinct phases, such as: start, build, build, and transition [15]. The four phases are as follows (see Fig. 1) :

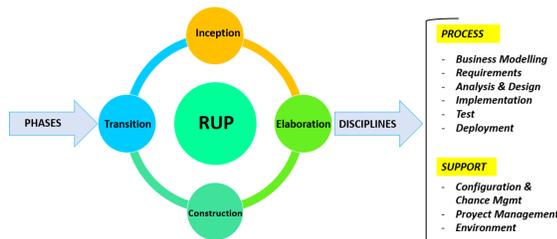


Fig. 1. Phases of the RUP Methodology.

1) *Start*: in this initiation phase, the project is defined. Likewise, it is determined if the project is feasible. In addition, the vision and objectives are defined, as well as the scope of the project. Similarly, it focuses on business modeling and identifying its requirements.

2) *Elaboration*: in this phase, the use cases are selected, which will allow defining the architecture of the system to be developed. Likewise, we proceed with the specification of each of the use cases and the analysis of the domain is carried out. In the same way, the design of the preliminary solution is carried out.

3) *Construction*: In this phase, the construction or coding of the software is carried out, which is carried out following a series of iterations. Afterwards, it begins with its implementation and proceeds with its respective tests, in order to find flaws or defects in the created software.

4) *Transition*: In this phase, the construction or coding of the software is carried out, which is carried out following a series of iterations. Afterwards, it begins with its implementation and proceeds with its respective tests, in order to find flaws or defects in the created software.

B. Design Tool

In this section, the design tools for the prototype of the mobile application were detailed.

1) *Figma*: In this project, the use of the Figma tool was used, an intuitive cloud-based application that allows designers to work without previously downloading the software [16]. It also allows the contribution of a work team in real time.

2) *StarUML*: This tool is developed under the Unified Modeling Language (UML) and Modeler Driven Architecture (MDA) standards, which allows modeling diagrams required for development and implementation in software projects. In the same way, it allows to obtain a better view of their operation [17].

C. Development Tools

In this section, the mobile application development tools were detailed.

1) *Kotlin*: Modern programming language, it is statically typed, capable of running on the Java Virtual Machine (JVM) platform. Likewise, it presents great advantages to the developer, such as: the reduction of the level of complexity of the code that is usually written during the development of the mobile application. In addition, it contains a large number of material design components that can be used to support UI/UX related interfaces [18]. Similarly, it is compatible with the java language, thanks to NativeScript.

2) *SQLite*: The chosen database engine is SQLite, developed under the sql language. This database manager is fast, highly reliable, self-contained, and small with big features [19]. Therefore, it allows you to store in a simple, fast and efficient way. Also, the implementation of this is very simple and light. Similarly, it is robust and totally free.

3) *Android Studio IDE*: Android Studio is free and open source software. Likewise, it is the software most used by developers for the development of Android mobile applications. In addition, it provides developers with the fastest tools to create applications for all types of Android devices. Also, the editing of the source code is world class. Since, it features debugging, performance tools, a very flexible build system. Which allow the developer to create unique and high-quality applications [20]. With this, scalable projects can be carried out quickly and efficiently.

IV. DEVELOPMENT OF THE METHODOLOGY

In this section, the business model and the system model were developed to develop the mobile application.

A. Business Modeling

1) *Current Business Process*: Fig. 2 shows the current business model, which is working without the proposed mobile application.

2) *Business use case Modeling*:

- Business actor: Fig. 3 shows the actors of the business.
- Business use case diagram: Fig. 4 the business use cases.

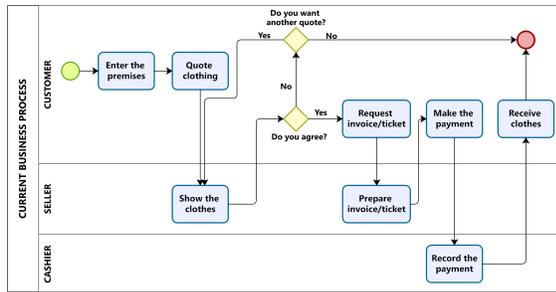


Fig. 2. Current Company Process.

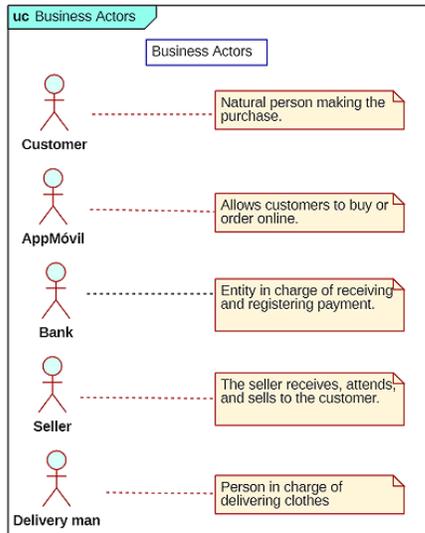


Fig. 3. Business Actors.

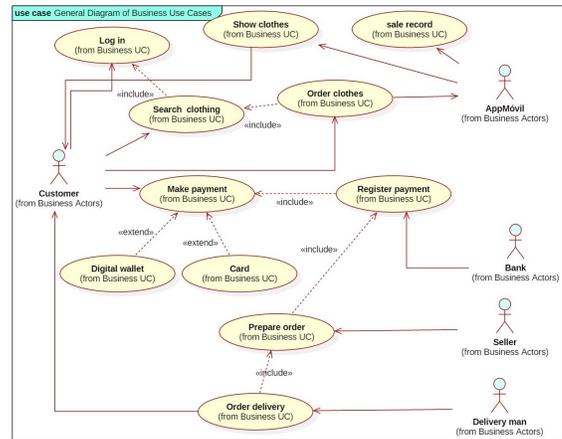


Fig. 4. Business Use Cases.

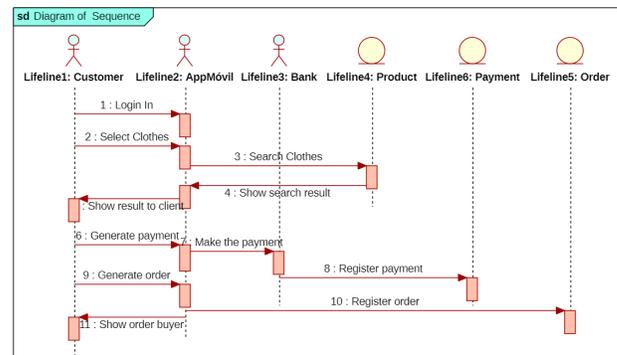


Fig. 5. Business Sequence Diagram.

3) Business Analysis Model:

- Business Sequence Diagram: Fig. 5 shows the sequence of business clothing sales steps.

B. Requirements Capture

- Functional Requirements: Table I shows the functional requirements of the mobile application for the sale of clothes.

TABLE I. FUNCTIONAL REQUIREMENTS

N°	Functional Requirements
1	User register
2	User authentication
3	List of products
4	Validate user
5	Search product
6	add to cart
7	generate payment
8	Register order
9	Search order
10	Cancel an order
11	Search category
12	Customer maintenance
13	Remove product from cart
14	Generate electronic bill
15	Print invoice

- Non-Functional Requirements: Table II shows the non-functional requirements of the mobile application for the sale of clothes.

TABLE II. NON-FUNCTIONAL REQUIREMENT

N°	Non-Functional Requirement
1	The response time for order search is no more than 1 second.
2	Friendly, dynamic, descriptive and informative interface
3	Payment options
6	The system will have to be updated by users
5	The graphical interface of the system must be easy to read for the user
6	Allow remove product added from cart
7	Track purchase order with location in real time.
8	Request verification code when creating the account.
9	Request the password when deleting the account.
10	When creating the account you must accept the privacy terms
11	You must have the option to register with google.
12	You should have the option to log in without registering.

C. Modeling of System Use Cases

- System actor: Fig. 6 shows the actor that will interact with the mobile application.
- System use cases: Fig. 7 shows the use cases of the system.

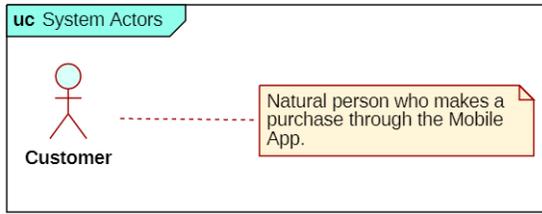


Fig. 6. System Actor.

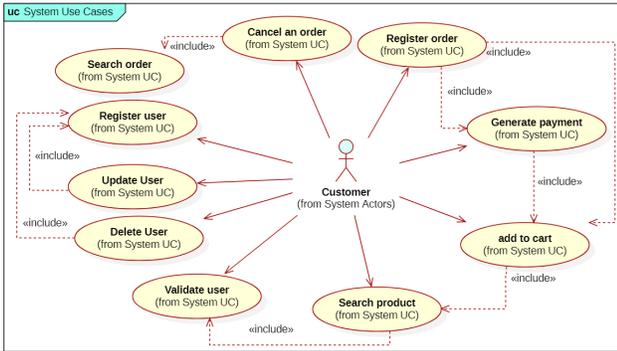


Fig. 7. System Use Cases.

D. System Analysis Modeling

- System activity diagram: Fig. 8 shows the sequence of activities that the client must carry out to register or buy the clothes through the mobile application.

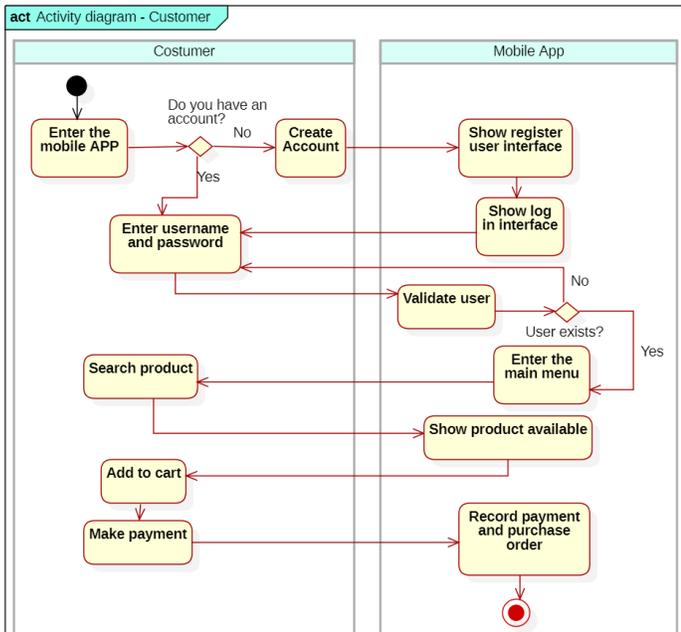


Fig. 8. System Activity Diagram.

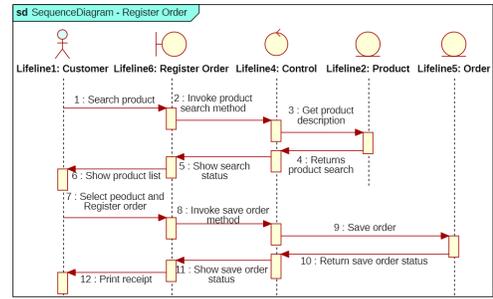


Fig. 9. System Sequence Diagram - Register Order.

- Register User: Fig. 10 shows the user registration sequence in the mobile application.

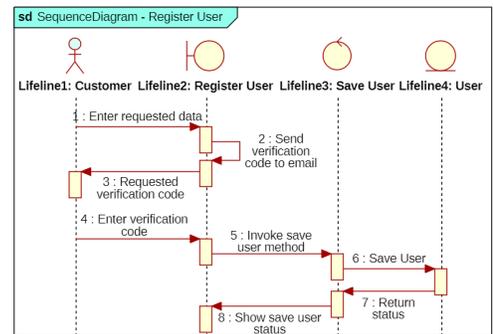


Fig. 10. System Sequence Diagram - Register User.

- Update User: Fig. 11 shows the user data update sequence in the mobile application.

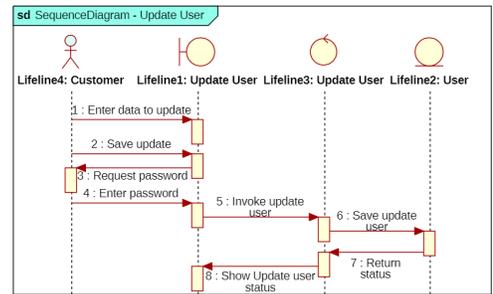


Fig. 11. System Sequence Diagram - Update User.

- Delete user: Fig. 12 shows the sequence for deleting the user account in the mobile application.

- Entity-Relationship Diagram: Fig. 13 shows relationship of the database entities.

E. Construction of the mobile application

In this section you will focus on mobile application design.

- System Sequence Diagram - Register Order: Fig. 9 shows the order registration sequence.
- System sequence diagram - user

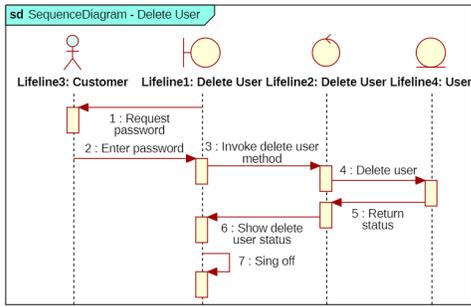


Fig. 12. System Sequence Diagram - Delete User.

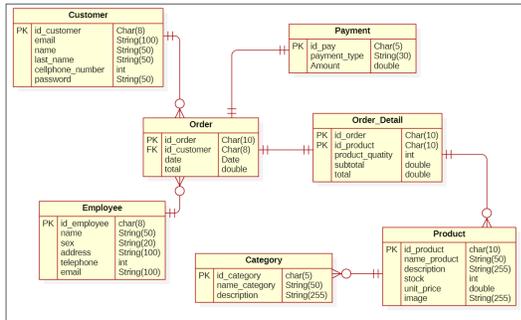


Fig. 13. Entity Relationship Diagram.

V. RESULTS

A. About the Prototype

Fig. 14 presents the login and user registration modules. The registration module allows you to create an account and by creating it, the user gets access to the virtual store. Similarly, the login module allows the user to validate their data for security reasons and make purchases with confidence.

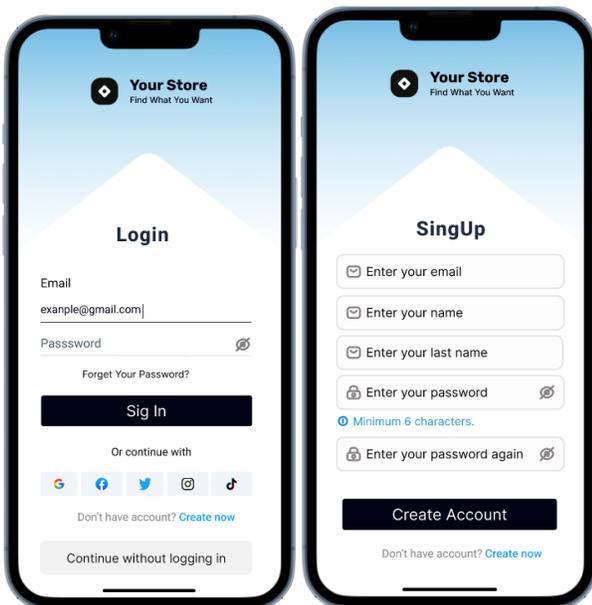


Fig. 14. Sign in and Sign up Prototype.

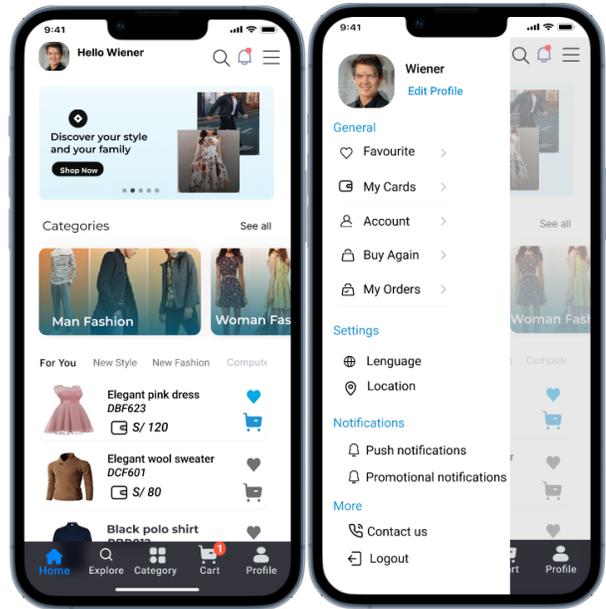


Fig. 15. Prototype Main Menu and Navigation Menu.

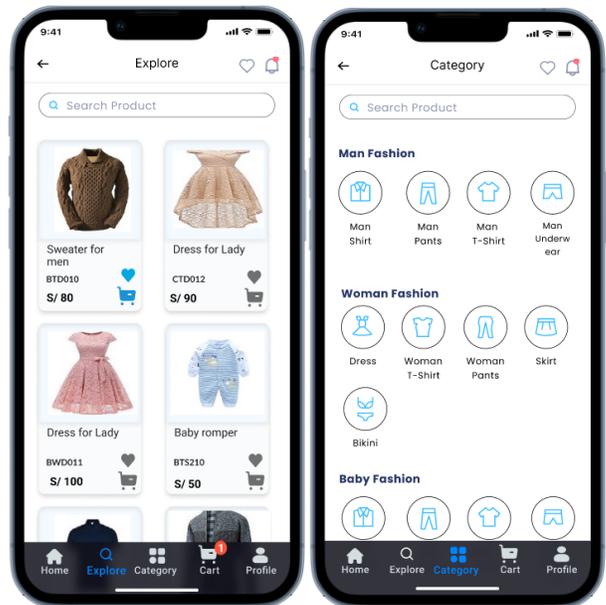


Fig. 16. Prototype Explore and Category.

In Fig. 15, the main menu and the navigation modules are presented. The main menu module shows the recently published products (clothes) with their respective prices and their shopping cart button to facilitate the user's choice. Likewise, the navigation menu module makes it easier for the user to navigate in the application by presenting different options in a simple way.

In Fig. 16, the exploration and category modules were presented. The explore module makes it easy for the user to search for the clothes they want and in the same way the module filters the product with its respective prices according to what the user is looking for. Likewise, the category module

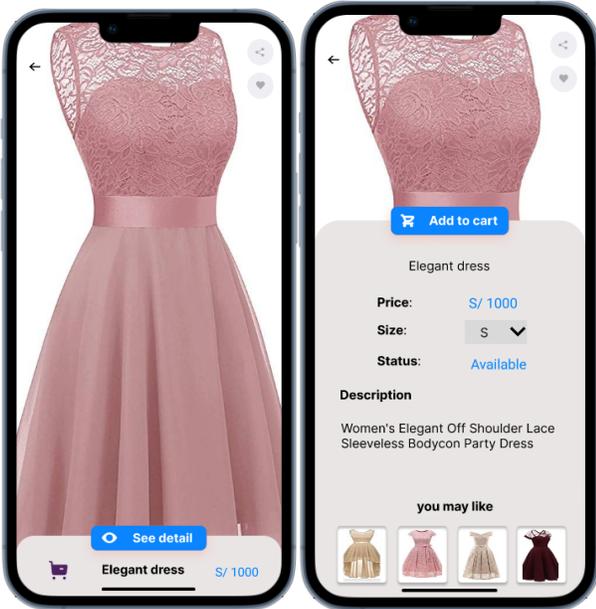


Fig. 17. Prototype to See and See in Detail.

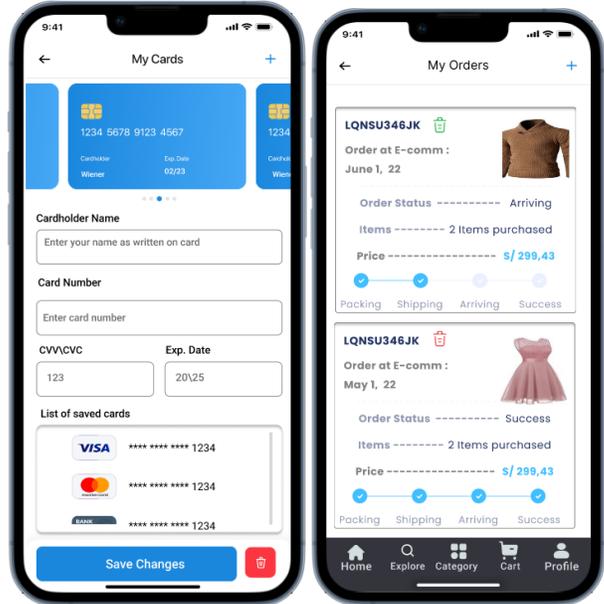


Fig. 19. Prototype of Cards and Purchase Order

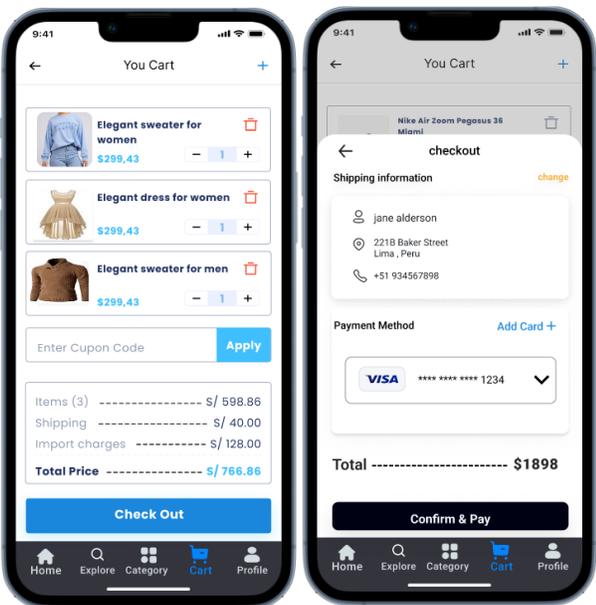


Fig. 18. Shopping Cart and Checkout Prototype.

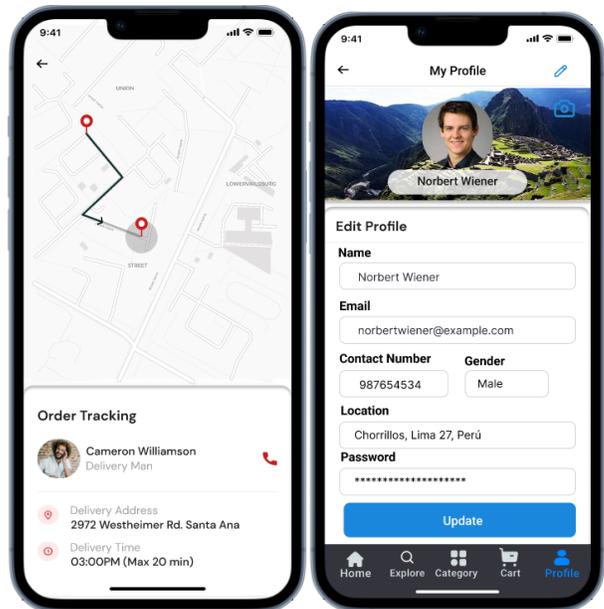


Fig. 20. Order Tracking and User Profile Prototype.

allows the user to search by category, classifying by gender and age.

In Fig. 17, the product view and detail view modules were presented. The product view module allows the user to view the clothing from different angles. Similarly, the detailed view module allows the user to review the information related to the product and make a decision when making the purchase.

In Fig. 18, the modules my cart and verify purchase were presented. The my cart module shows the user the summary or detail of their purchase such as: clothes to buy, quantity to buy, shipping cost, subtotal and total purchase. Similarly,

the purchase verification module shows the information of the purchasing user, such as: name, delivery address and contact number. In addition, the form of payment and the total of the purchase to be confirmed.

In Fig. 19, the modules my cards and my orders were presented. The my card module allows the user to add their cards with which they can make payments for their purchases safely. On the other hand, the my orders module shows the status of the purchase and allows the user to track their purchase.

Fig. 20 shows the purchase tracking modules and the user profile. The purchase tracking module allows the user to follow

their purchase through a map, which shows the location of the personnel in charge of delivering the purchase; as well as staff information, contact number and delivery time. While the profile module shows the user information. It also allows you to update your data.

B. About the Survey

For the survey, an evaluation questionnaire of 5 criteria or dimensions was elaborated, each one with 4 questions as shown in Table III. In which the evaluation of 10 experts was requested on the following criteria that the mobile application must meet: the design, usability, functionality, security and availability of the mobile application.

Regarding the items or questions for the evaluation, the three-point measurement scale was determined, in which Low, Medium and High must be evaluated according to the established criteria.

TABLE III. EVALUATION QUESTIONS

Criterion	Design
P1	¿Does the application present a simple and neat user interface?
P2	¿Does the application present classified products?
P3	¿Does the application have simplified and clear navigation?
P4	¿Does the application present valuable content?
Criterion	Usability
P5	¿Is the application easy to understand and intuitive?
P6	¿Is the app easy to learn to use its features?
P7	¿Is ordering done quickly and easily in the app?
P8	¿Is the app easy and simple to navigate?
Criterion	Functionality
P9	Does the application have a simple and fast payment process?
P10	¿Does the application allow you to add or remove products from the shopping cart?
P11	¿Does the application filter products according to the searched product?
P12	¿Does the application allow the customer to have control of their order?
Criterion	Security
P13	¿Does the application request user authentication to make purchases?
P14	¿Does the application guarantee the integrity of customer data?
P15	¿Does the application maintain the availability of customer data?
P16	¿Does the application present a secure payment process and methods?
Criterion	Availability
P17	¿In the application the shopping cart is always visible?
P18	¿Does the application have payment methods commonly used in your online purchases?
P19	¿In the application is the description of the shipping options?
P20	¿Does the app show available products?

C. About Expert Evaluation

After evaluating the experts and analyzing their answers, the mean and standard deviation of each question were obtained. Also, according to the mean of the question, it was scored on a scale, which includes the following: 0 – 1 = Bass, 1.1 – 2 = Medium, 2.1 – 3 = High. Obtaining a result as shown in Table IV.

According to the results, in the Design criterion, in question 1, does the application present a simple and orderly user interface? An average of 3.00 or also called average was obtained, with a standard deviation of 0.000 to which the experts gave the average as High. Likewise, in the Usability criterion, in question 5, is the application easy to understand and intuitive? A mean of 2.70 with a standard deviation of 0.483 was obtained, to which the experts gave the mean as High.

TABLE IV. RESULT OF THE EVALUATION OF THE EXPERTS

Criterion	Question	Half	SD	Scale
Design	P1	3,00	0,000	High
	P2	2,90	0,316	High
	P3	2,90	0,316	High
	P4	2,90	0,316	High
Usability	P5	2,70	0,483	High
	P6	3,00	0,000	High
	P7	2,80	0,422	High
Functionality	P8	3,00	0,000	High
	P9	2,80	0,422	High
	P10	3,00	0,000	High
	P11	2,90	0,316	High
Availability	P12	3,00	0,000	High
	P13	3,00	0,000	High
	P14	3,00	0,000	High
	P15	3,00	0,000	High
Security	P16	3,00	0,000	High
	P17	3,00	0,000	High
	P18	2,90	0,316	High
	P19	2,80	0,422	High
	P20	3,00	0,000	High

D. About the Methodology

In this section, the comparison between the RUP, Extreme Programming (XP) and Rapid Application Development (RAD) methodologies will be made.

For the evaluation of the methodology, numbers from 1 to 5 were used, where (1) indicates that the practices are unfavorable for the correct development of the project. For its part, (5) indicates that the analyzed criterion is the one with the best compliance with respect to the practices for the development of the project. Obtaining a result as shown in Table V.

According to the results obtained, the RUP methodology has a score of 26, the XP methodology obtains a score of 20, and the RAD methodology obtains a score of 13. Which means that the RUP methodology is the most appropriate to develop the project.

TABLE V. QUANTITATIVE SELECTION CRITERIA

Criterion	RUP	XP	RAD
Budget available	3	4	3
Project size	5	2	1
Limited delivery times	2	4	2
Need for documentation	5	2	1
Staff needed	5	2	1
Adaptability, response to changes	2	4	2
Customer Impossibility	4	2	3
TOTAL	26	20	13

VI. DISCUSSION

In the findings found in the investigation, it was through a survey of the experts, who qualified as high on a three-point measurement scale; low, medium and high. However, the authors' research [14] is different from ours, since they applied a survey to customers, who gave their opinion. Regarding the prototype and the methodology, the authors [12] developed the clothing sales web system applying the agile methodology such as SCRUM, if we compare it with the research carried out, it does not coincide because ours is focused on the design of a mobile application under the traditional methodology that is the RUP. Regarding the segmentation, the authors' research

[11] applies the development of the mobile application only for the sale of Japanese anime t-shirts, which is only for a community that likes anime t-shirt. For its part, our research focuses on the development of the application for the sale of all types of clothing, which is segmented for men, women, boys, girls and adolescents from different cultures. Finally, in our work we came to the conclusion that the e-commerce mobile application for the sale of clothing can generate economic income and help retain customers, in the same way help grow small businesses that are growing. ; agreeing with the authors [7] who conclude that the mobile application allows the customer to make purchases from anywhere, in the same way it helps Muslim fashion stores that are evolving or growing.

VII. CONCLUSION

In conclusion, in the present research work, it was possible to design a mobile application for electronic commerce in a satisfactory manner by users, backed by expert judgment based on 5 criteria: design, usability, functionality, security and availability; which guarantee that the application is of quality, applying the RUP methodology. In the same way, the application makes it easier for small companies or SMEs dedicated to the sale of clothing, to offer their products through electronic commerce, thus improving their economic income and building customer loyalty. Likewise, the RUP methodology is a method that ensures that the development is of the best quality and foresees the changes that occur during the development according to the requirements. In the same way, it shows a global vision and optimizes its development.

A limitation of the investigation was the technological one, due to the retractions that the hardware imposes on us when designing the mobile application. Since, when designing the application, you should think about whether the application will be installed satisfactorily on a wide range of mobile devices, since some are high-end and others are not.

VIII. FUTURE WORK

In addition, it is suggested as future work that this work should be completed with emerging technologies such as, artificial intelligence integrating the application such as chat-bots (virtual assistant) to interact with customers. Likewise, automated personalization, so that the mobile application has the capacity to give recommendations to the client according to their interactions and purchases they make.

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