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Mobile application for control and management of citizen security

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ABSTRACT

Currently, Peru is one of the countries with the highest levels of citizen insecurity in Latin America, and its capital is considered the thirtieth most populated city in the world, thus being one of its territories with the highest percentage of citizen insecurity, providing a poor quality of life to its citizens as they feel unsafe when passing through different places and being victims of any criminal act. Therefore, this research work is developed to support this problem through the implementation of a mobile application that manages and controls citizen insecurity. Applying the research method based on design and scrum methodology, which together generate greater control over changes during project development. In addition, resources and the support of different tools were used for its study and execution, such as marvelApp for the design and prototyping of the mobile application and android studio. Obtaining highly viable results for the support of citizen security through a suitable and fully viable mobile application.

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1. INTRODUCTION

In recent years, citizen insecurity has been on the rise throughout Latin America, causing a criminal collapse within society. Despite the economic growth of many countries in this continent, measures are still not being taken to address this problem in an adequate and feasible manner [1]. Although it is true that this problem is not new in Latin America, it has been recognized for centuries as one of the main regions with the highest levels of violence and citizen insecurity. Moreover, instead of developing an evolutionary growth with respect to this problem, it has regressed, even reaching new levels of insecurity [2], [3].

Likewise, Peru, in comparison with other countries within the Latin American continent, has had a larger scale growth in citizen insecurity, having among its criminal acts 23 victims for every 100 Peruvians over 15 years of age; having a notorious growth in comparison with previous years, allowing the United Nations Development Program (UNDP) to consider the country as the second territory in Latin America with the greatest citizen insecurity [4]. Peru has 196 provinces, of which one of them is the one with the greatest citizen insecurity in the entire Peruvian territory. This province is Lima, according to studies by the National Institute of Statistics and Informatics (INEI) [5]. The capital of Peru is a representation of 29.7% of the country with about 10 million inhabitants, composed of eighteen districts, being the thirtieth most populated city in the world [6]. In recent years, Lima has experienced an increase in citizen insecurity, which has been detrimental to the quality of life of its citizens. This problem is one of the main reasons why the country is unable to develop properly in terms of a better quality of life [7].

For all of the above reasons, this research work is carried out with the objective of providing assistance for the control and management of citizen insecurity in Metropolitan Lima through the development of a mobile application that will benefit and improve the quality of life of all the inhabitants of the province of the capital of Peru, in order to prevent criminal attacks. This research work is divided into different sections. Section 2 was aimed at reviewing the literature; likewise, in section 3 the development of the project-oriented methodology is established; likewise, in section 4 the case study; in section 5 the results are shown together with the discussion of the research work. Finally, section 6 establishes the last part, which is oriented to the conclusion and future work.

2. LITERATURE REVIEW

Nowadays, one of the main problems of society is citizen insecurity, which has repercussions in the economic, emotional and physical spheres. Therefore, in this phase of the literature review we focused on the feedback of five research works oriented to the implementation of mobile applications for citizen security (See Table 1). In order to observe the weaknesses of each mobile application and how it can be enhanced through the restructuring and improvement of a new mobile application focused on citizen security, under the knowledge collected.

Table 1. Public safety apps

App	Functionality	Difficulty
Citizenguard	The application performs its functions around google maps, makes emergency calls through a list of contacts, in addition to notifying a dangerous area [8].	It does not have a user-friendly design, and it does not store information or allow the user to rate the elapsed time of the site, and it does not allow the user to really know which site is dangerous independently.
BSeguro	Contains an SOS activation through voice activation, performs an alarm to pre-selected contacts and sent routing [9].	It has unsafe functionalities for the user that can worsen the user's risk situation, instead of performing voice activation it should contain a panic button.
Mobile geographic–UPC	The mobile application is oriented only to security by routes directed to a single entity located in different sites, its functionalities are to identify the safest routes, request service to the police, emergency calls and advice [10].	The mobile application does not contain a unique value, instead of tips it should contain an environment for user interaction to comment on their experiences in the places they have visited, and the mobile application has a precarious and user-unfriendly design.
SAVIA	Contains a locator of persons accused of violence, recording information on these persons, and allowing authorities to follow up on them [11].	The mobile application is not viable because the locator can be manipulated, and it is advisable to generate a structuring of the routes between levels so that the user can be guided according to what is displayed in the mobile application.
P rototype of smart	The mobile application has a panic button and the selection of the type of emergency that can visualize a person walking through the city, can issue alerts and emergency call [12].	This mobile application does not have a user-friendly interface, nor does it have an incident log or risk level signals for each route traveled by the user.

Finally, after studying different methods of application of technologies in the different problems of society oriented to citizen security, it has been possible to know different ways to support this research work. However, a mobile application has not yet been developed that covers different areas providing greater reliability and excellent security for every citizen, which is why this research work will cover the innovation of a mobile application that generates greater accessibility and understanding of the use of software in different areas and needs along with security support for a better quality of life.

3. METHOD

For the planning and methodological development of this research work, the implementation of the scrum methodology was determined. This method provides a better structural organization that contains a good guide for the development of software oriented to the creation of mobile applications. This methodology helps to control the changes that may arise during the development process, providing better feasibility and standardization. Thus, avoiding the loss of resources and generating better development features. In the same way, the Java programming language is proposed as a development tool along with android studio and the SQLite framework as a database control; likewise, MarvelApp was used to design the prototype.

3.1. Scrum

It is a methodology designed for adaptation, iteration, speed, flexibility, and efficiency in order to deliver relevant value quickly throughout the project. Ensuring transparency of information and a collective

accountable work environment, as well as providing continuous growth. Scrum is structured in such a way that it is adaptable to the development of any project regardless of its difficulty, as can be seen in Figure 1. In addition, it is the most recommended methodology for the implementation of this type of development that has a large number of changes throughout its execution, reducing most of these by the structure, strategy and technique of this agile methodology.

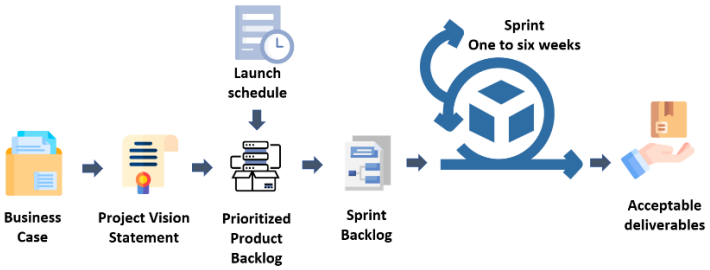


Figure 1. Development of the scrum methodology

3.1.1. Scrum development stage

The scrum framework is developed describing each of its stages. This allows you to take into account all your activities and tasks to be carried out during the process. After that, continuous improvement can be made after a deep analysis.

a) Initiation stage: in this stage the requirements are determined, then converted to user stories, which are established to start the planning of the project [13]. These requirements are obtained after conducting interviews with those involved. Also, user stories are done using an established scheme.
b) Planning stage: in this stage estimates are made on user stories, based on the amount of resources that will be necessary to use, another of the analyzes carried out in this stage is the prioritization of user stories. Determining the order in which the user stories will be developed, taking into account how fundamental their development is for the operation of the system [14], [15]. Likewise, the speed of the sprints is determined, based on the time it takes to be developed.
c) Implementation stage: in this stage the creation of the Product Backlog is developed, which contains the collection of previous processes, with added characteristics according to the analysis obtained in the previous phase [16]. On the other hand, the user stories developed in each sprint are presented. Keep in mind that each sprint has a duration of 2 to 4 weeks in theory.
d) Feedback stage: an analysis of all the developed processes is carried out, analyzing what can be improved for future projects. The successes and mistakes are taken into account first of all aspects for better decision-making in the future [13]. This is done through a meeting between those involved.

3.2. Development tools

3.2.1. Java

It is a programming language that provides security and satisfaction on a large scale on the requirements of mobile devices in both hardware and software [17], [18]. In addition, by using this language, you get applications protected against hackers, Java along with android studio offer ease of development in the face of object-oriented program codes having the opportunity to reuse them. Another benefit of implementing this programming language is that it reduces errors by providing help in identifying them.

3.2.2. Android studio

Android studio provides an integrated development environment, also based on IntelliJ IDEA. In addition, it offers the different functionalities that increase the productivity when developing the application. One of the advantages of using android studio is that the execution of the application is in real time, the compilation is also easy and fast [19], [20]. It also makes it easier to distribute, reuse and structure the code in the best possible way.

3.2.3. SQLite

It is a transactional database manager that is lightweight, autonomous and open source, which differs by storing persistent data in a simple way, being very important for the development of mobile applications [21]. In addition, it has different benefits when used with android studio, because android has different packages that offer a better performance alternative where it takes advantage of resources through

compatibility, allowing data to be recorded in a structured way, establishing a more simplified development. At the same time, its biggest advantage is that it is easy to learn, being ideal for people with little experience in database administration.

3.2.4. MarvelApp

It is a tool that facilitates the user to make prototype designs that are interactive and include digital platforms. Likewise, it offers us the canvas platform to design the functional models to be created, where each component can be freely positioned according to what is needed, so the tool helps to design the mobile application [22]. One of the qualities of using this tool that differs from others is that it is compatible with other platforms [23].

3.3. Case study

3.3.1. Initial stage

For the initial stage of this research work, a survey was conducted among university students in Lima, through which the requirements for the mobile application were obtained. As a result of these requirements, they were analyzed and converted into user stories, which on some occasions will be mentioned as HU with the corresponding number. The user stories determined for the development of the mobile application were ten as shown in Table 2.

Table 2. User stories

Number	Description
User Story 1	I as a user want the application to have a virtual assistant to guide me and make its usability easier.
User Story 2	I as a user would like the mobile application to have emergency call functionality to issue help prevention reports.
User Story 3	I as a user want the mobile application to contain the function of a help button that sends my location to three contacts that I select in order to leave a trace of my location in case of emergency.
User Story 4	I as a user want the mobile application to contain a map where the zones are divided by security level to know where to go safely.
User Story 5	I as a user want the mobile application to have different forms of registration to select according to my preference.
User Story 6	I as a user would like the mobile application to contain a comment area to rate the places visited in terms of security.
User Story 7	I as a user want the mobile application to provide me with the areas with less traffic, but which are safe so that I can take the fastest way to my destination.
User Story 8	I as a user want the mobile application to have a technical help mode so that in case, I have any mishap regarding my vehicle I can get immediate help.
User Story 9	I as a user want the mobile application to have a technical help mode so that in case, I have any mishap regarding my vehicle I can get immediate help.
User Story 10	I as a user want the mobile application to have different login options to select according to my preference.

3.3.2. Planning stage

As a second process carried out for the development of the mobile application, the analysis and determination of each user story were executed, separating the two main characteristics for its execution: the estimates and prioritizations as shown in Table 2. The estimates made for each of the user stories were implemented through the planning poker strategy where the scrum development team evaluates through their knowledge and experience how long it would take to develop each of the user stories according to a qualification based on the Fibonacci scale. On the other hand, the study of the prioritization of the user stories goes according to the importance at the level of operation that these have within the application, asking which one has greater relevance.

Another step in the planning stage is to establish the user stories according to a time division for their development, also called sprint. These sprints vary according to the number of story points and the experience the scrum development team has. The total number of user history points determined in this research work is 71 points, divided into three sprints as shown in Figure 2. Likewise, these history points are equivalent to the development speed that each sprint will have. For the first sprint, one awarded 21 points, for the second sprint one assigned 26 velocity points and finally, for the third sprint one awarded 24 user story points.

After carrying out the speed study according to the development sprint for the mobile application, the product backlog was established, which contains the analysed previous points, such as prioritisation and estimation. In addition to the points analysed, two new features were added. On the one hand, the origin was added, which separates according to the function performed by each user story; in this case, it was separated into four origins. Likewise, the user stories were added in order according to their corresponding sprint concerning their prioritisation. Finally, as a new criterion, the status of each user story was added, which at this point in the project has the initials PE, which refers to a Pending status.

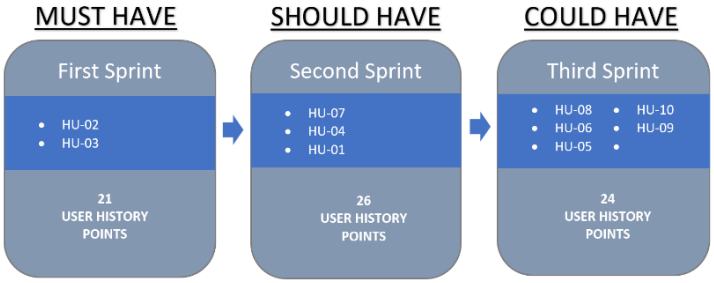


Figure 2. Speed of development

4. RESULTS AND DISCUSSIONS

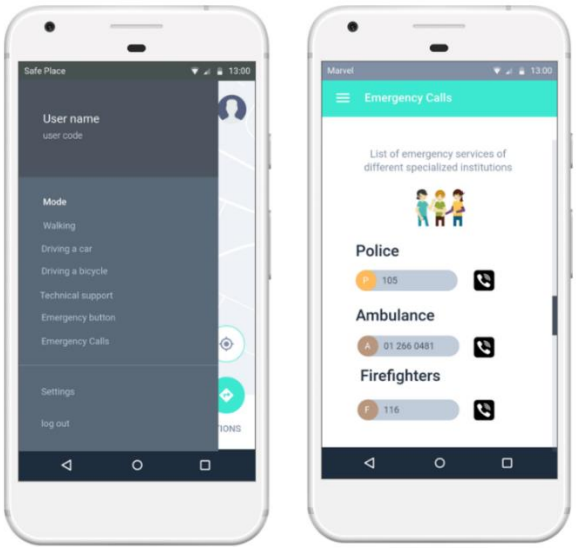
4.1. Implementation

Through this stage of the scrum methodology, the sprint was developed through the user stories obtaining different analysis results. Before starting with the presentation of the implementation of the user stories through the prototypes, it is necessary to show the functions of the mobile application or the access of the tabs within the application that can be seen in Figure 3, precisely in Figure 3(a). On the other hand, for this stage, it was also determined the separation by sprint for the realization of a detailed study, both in the fulfillment of the needs by the user stories and in the course and fulfillment of the project process through the burn down chart diagram.

4.1.1. First sprint

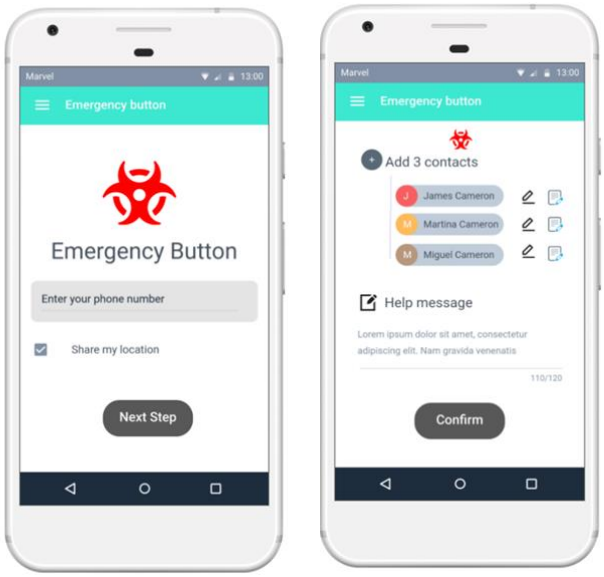
For the review of the first sprint, the functionalities of the established user stories were detailed, which must comply with the detailed needs. For the execution of the first sprint, two user stories were determined, among which 21 story points are taken, which will be equivalent to their development speed. As the first user story, user story number two was created, this has the functionality to provide a list of contacts of services that cover emergency cases, in order to report an event quickly and accurately in case of not knowing any number of these services as shown in Figure 3(b).

Also, to finalize the first sprint the user story 3 was made; this has the purpose of providing the function of a panic button so that in cases where the user feels in danger by pressing twice, the side button of the mobile can send to 3 contacts their location and a general or personalized message, this configuration depends on how the user selects and indicates the data, such as whether the location is placed, the number of origins and the three contacts entered by the user, within Figure 4, exactly at in Figure 4(a) and Figure 4(b) displays the configuration of the process.



(a) (b)

Figure 3. First and second prototype: (a) functions and (b) HU-02



(a) (b)

Figure 4. Third and fourth prototypes: (a) HU-03-Part and (b) HU-03-Part

Finally, in the review of the first sprint it was verified that the development of the user stories in this sprint complied with the description of each of these; the points of user stories completed by days can be seen in Figure 5. The burn down chart was developed, in this chart was established as axis (Y) the points of user stories and as axis (X) the days in which these stories were developed. It can be determined from this chart that within the first sprint, there were not many variations according to the ideal development process over the real one, ending on the same day that its conclusion was planned.

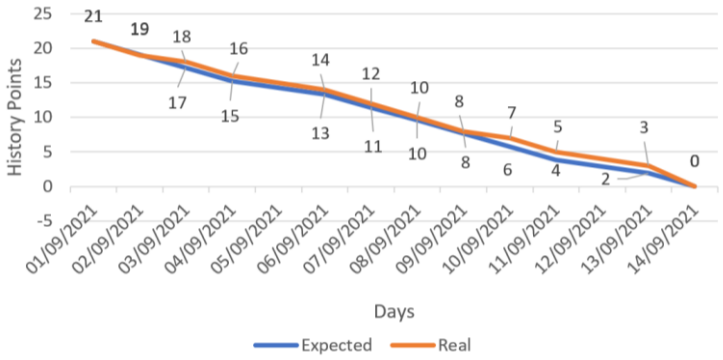


Figure 5. Burn down chart-first sprint

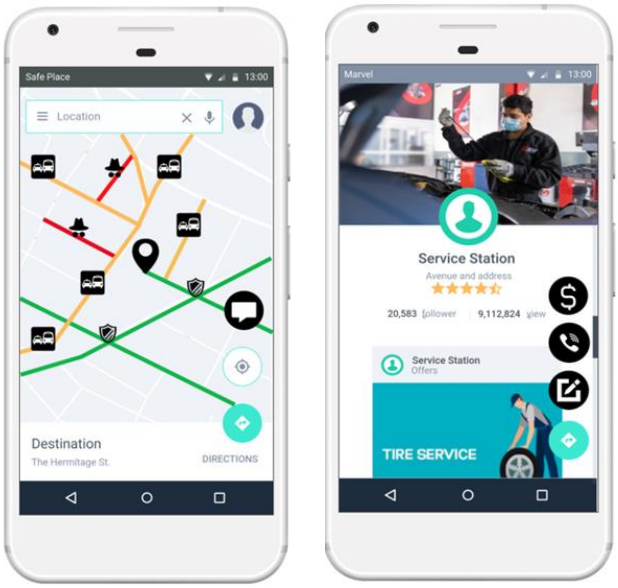
4.1.2. Second sprint

For the development of the second sprint, three user stories were established, between which twenty-six user story points were accumulated, equivalent to the speed of the present sprint. As the first user story, we executed user story number seven, which has the objective of showing a real-time map that indicates the roads according to a safety range employing three colours, where green refers to a safe road, orange is an intermediate safety range, and red is unsafe, in Figure 6, exactly in Figure 6(a) it is shown according to a vehicular mode. Similarly, for the development of the second user story of the first sprint, user story 4 was executed where a real-time security map was established but in pedestrian mode. As the last development for the second sprint, user story number 1 was developed, which consisted of implementing a voice assistant that guides the user through a path according to the map in real-time, taking into account the security map established in the previous stories.

Finally, after the presentation of the second sprint, it was observed that the needs established in the user stories of the current sprint were met. This allowed the development of the burn down chart shown in Figure 7, determining that there was a deviation between the actual time and the expectation that was established, but that in the end, it was possible to recover the time, allowing it to be completed according to the proposed time.

4.1.3. Thrid sprint

For the last sprint, five user stories were established, between which 24 user stories points are generated, which are equivalent to the speed of the third sprint. As the first user story for this sprint, user story number 8 was developed, which has the objective of generating a map mode that shows the nearest technical services for cars, has the functionality of being able to guide to their arrival, quick call, local evaluation, and a payment for the application, as shown in Figure 6, exactly in Figure 6(b).



(a) (b)

Figure 6. Fifth and sixth prototype: (a) HU-07 and (b) HU-08

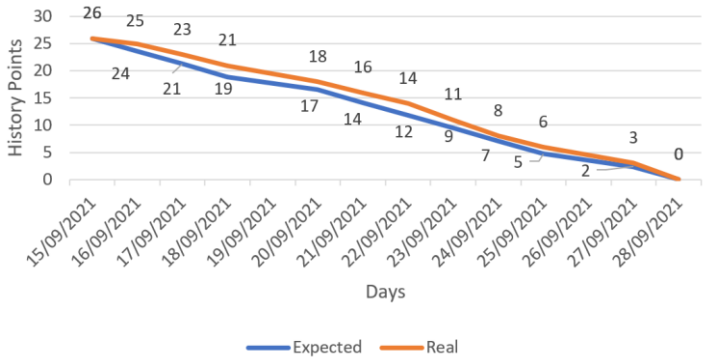
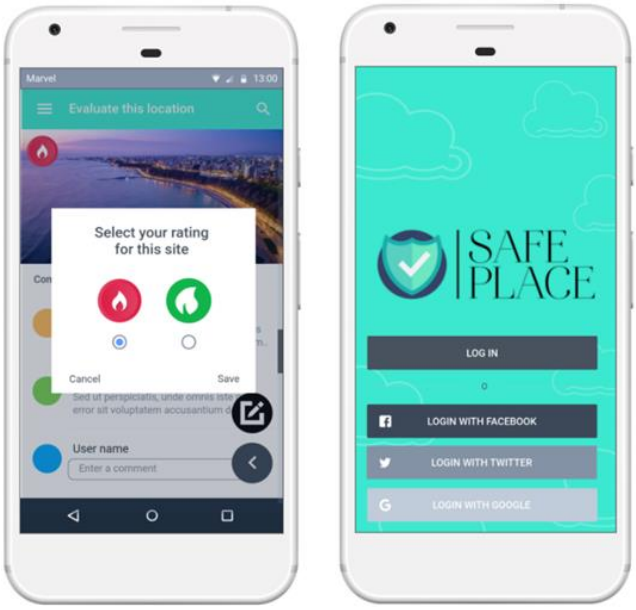


Figure 7. Burn down chart-second sprint

On the other hand, as the second user story of the third sprint, user story number six was developed, which provides a comment area where users can post an opinion and rating on the location where they are located to help update the security of the area. In this case, the rating is divided into two options, the green icon is safe, and the red one is unsafe. The way to evaluate the status of a site is taken according to an average among all the people who have rated the site, as shown in Figure 8, exactly in Figure 8(a). As a

second user story development story number 4 and 10, which consist of providing different ways to log in or register to make use of the application as shown in Figure 8(b).

Likewise, as the last user story for the third sprint, user story number 9 was developed, which consists of providing the user with different ways to pay for technical services for the cars, as shown in Figure 9. On the other hand, at the end of the presentation and review of the third sprint, the burn down chart for the last sprint of the project can be seen in Figure 10, which allows to observe and analyze the process of the third sprint in a comparison between the ideal and the real, showing that the established time was met despite certain variations in some days of development.



(a) (b)

Figure 8. Seventh and eighth prototypes: (a) HU-06 and (b) HU-04

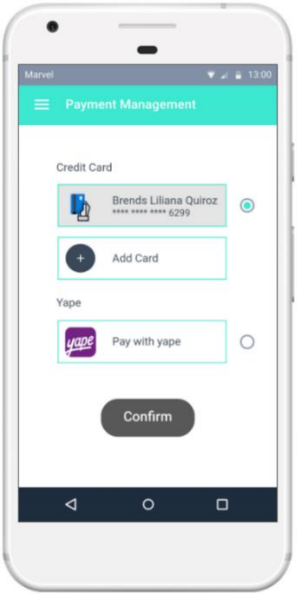


Figure 9. Ninth prototype-HU-09

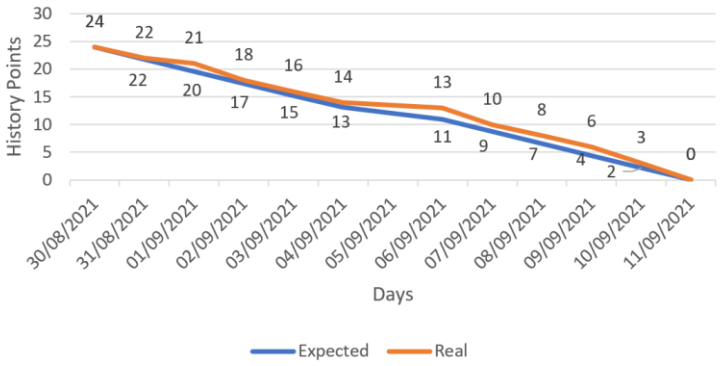


Figure 10. Burn down chart-third sprint

4.2. About the development and execution of the mobile application

To conclude the study on the development of the mobile application and the development of the scrum methodology within the execution of this research work, two important points will be determined for the understanding and functionality under the execution process, for it was separated into software architecture and sequential activity of the project.

4.2.1. Software architecture

The architecture selected for the internal functioning within the structure of the mobile application was the micro-services architecture. This architecture simplifies the growth of applications and the action of migration to the cloud, generates that the application that is involved is flexible and manageable during all the time avoiding a monolithic structure could provide services in a separate way oriented to different datacenter environments to generate a more significant scaling [24].

In the case of the current project, two main administrative lines were established, one for sending oriented to the mobile application and the other for receiving oriented to a web or server administrator using an API that works under different administrative services oriented to its applied database. On the other hand, it is necessary to mention that it should be taken into account that each microservice works independently and can not be coupled with another; in other words, share a single persistence or any element that links them together, as shown in the Figure 11.

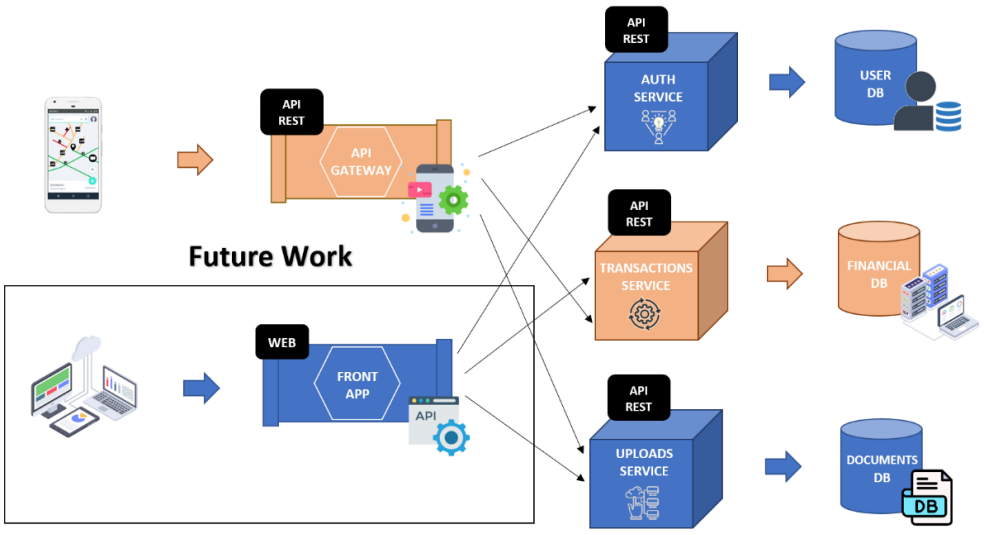


Figure 11. Software architecture

4.2.2. Sequential development process

This research work had a sequential development process, as can be seen in Figure 12 sequential, as can be seen in Figure 12. In which an analysis model was made based on the business process model and

notation technique, where you can see in detail each elaboration that was established in this research work. This makes it easier to understand on a larger scale each of the processes carried out for the completion of the project.

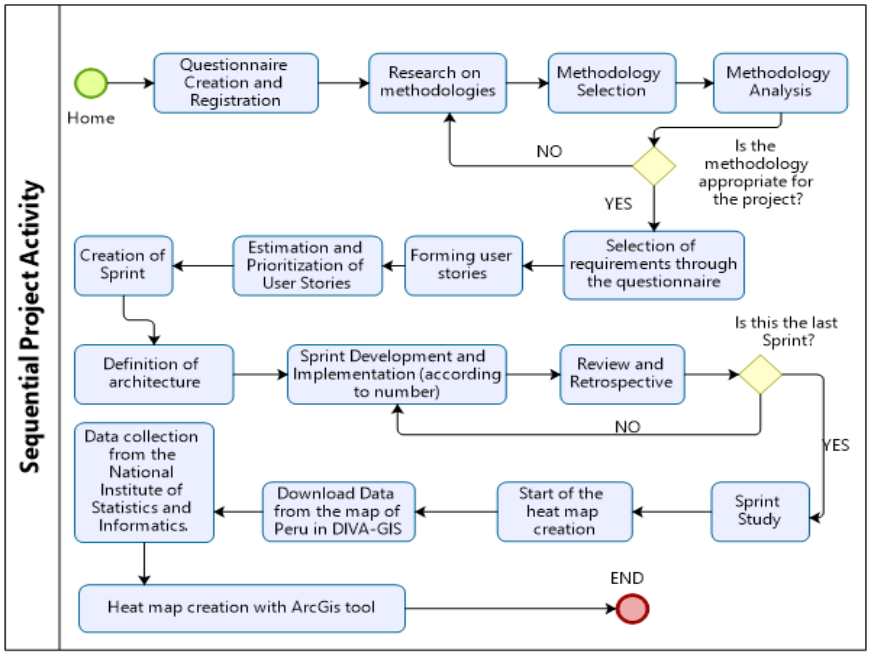


Figure 12. Sequential project activity diagram

4.3. About the method

During the last few years, there has been a methodological comparison between scrum methodology and RUP methodology as to which methodology is easier to use and will have a more significant benefit when implemented in a software development project. Although both methodologies indeed have advantages and disadvantages in executing a project in different areas or with different characteristics. On the one hand, scrum is a methodology that manages a simple framework for cross-functional management to have a high-quality result based on the importance of the business. On the other hand, RUP is handled explicitly at a high level of detail, resulting in a high level of adaptability and applicability for software development [25]. Therefore, to select an appropriate methodology, a comparison was made, as shown in Table 3.

Table 3. Difference between methodologies

App	Functionality	Difficulty
Advantage	Detailed documentation, configuration, and control of possible changes before starting the project, uses risk-driven methods verifying the quality that can be provided to the software.	Deliverables are managed according to the established time and all roles are involved from start to finish, especially the customer or user.
Disadvantages	Changes are only made in a phase but not during the project, which could generate an error, which is why most of the projects covered by this methodology are already completed processes.	Many meetings are held to present little progress, sometimes team members tend to skip steps to reach the final sprint.
Characteristics	Responsibility is fully delegated to the team, encompassing control and management practices without having performed development tests.	It is based on standards and principles, has a highly knowledgeable team and this methodology is prepared for change and resource reduction.
Roles	It is conformed by programmers, analysts, support managers and review specialists through coordination.	It is conformed by a specialized team with transparent work and with high responsibility in fulfilling the deliverables according to the established dates.
Definition	Methodology based on software architecture which delegates responsibilities with the objective of providing the organization of the processes.	Use of good practices in order to perform a collaborative work with the purpose of obtaining a better result by maximizing the quality of the project.

According to the data shown and studied for each of the methodologies presented, the scrum methodology is selected as the most appropriate for the development of a mobile application since it has a change control feature throughout the project in order not to increase or lose specific resources used as would have happened in this case when implementing a methodology such as RUP, also helps to manage risks that could be generated throughout the development process of the mobile application and also provides data transparency throughout the work environment making all roles know what is happening according to the project.

5. CONCLUSION AND FUTURE WORK

Finally, the development of a mobile app was achieved where the objectives established in the user stories were met, which were based on being able to contribute to the help of citizen security, improving the social environment of Peru and all of Latin America. On the other hand, it is concluded that the implementation of the scrum methodology together with the design-based research methodology make up the most suitable structure to carry out the administration of software development, having an adaptable standard. That is why, due to these results, as future work, it is proposed to develop the administrative part of the mobile application; by the software architecture in the future work area where the implementation of this mobile application to help control citizen insecurity will take place. In addition to expanding the study territory to better advance against this problem that worries society. It is also mentioned that technological advances should be used to support and reduce citizen insecurity, which undermines Peru and the different countries of Latin America, providing a low quality of life and development. That is why we must continue to carry out related and beneficial studies for citizen security.

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