Mobile Application that Promotes Citizen Participation to Counteract Insecurity in the District of Los Olivos

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ARTICLE INFO	ABSTRACT
	Nowadays, in Peru, there are several problems, where crime is one of the most prominent; we see this reflected daily in the various criminal acts that occur in our capital city, which generates fear, distrust and insecurity in the population. For this reason, we propose the development of a mobile application that can provide relevant information on crime incidents occurring in the district of Los Olivos. The application has the function of notifying users and district authorities about incidents of citizen insecurity in order to generate various lines of communication, which, by being more efficient, provide an immediate response to these criminal acts, thus reducing crime rates in the district of Los Olivos. In addition, this application promotes citizen participation and empowers the population to be part of the decisions in public policies, it will also allow the Police of the Jurisdiction to take the necessary actions since they will have updated and accurate information on their mobile device. For the development of the mobile application was chosen the Scrum methodology because it allows greater efficiency in the development stages. Finally, its structure will be made with the Kotlin language, which will have the necessary Application Programming Interfaces (API's) and similar to Google Maps, to visualize and make use of these adding risk notifications about a crime in key locations, storing the information in a relational database for distribution through the virtual store of PlayStore applications.

1. Introduction

Nowadays in our country, as mentioned by the National Institute of Statistics and Informatics, known as INEI, there are several problems that concern the citizens of our country, one of the most important being crime at 41.8% and the lack of citizen security at 16.2% [1]. Due to the large number of companies located in our capital, amounting to 27,102 companies in Lima that were reactivated in the last quarter of 2021, it is one of the most targeted and preferred by crime [2]. Undoubtedly, the capital is the center of concentration of businesses and is home to too many people, one of the

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districts most affected by insecurity according to National Institute of Statistics and Informatics [3] is Los Olivos, which concentrates 5.8% of the complaints of crime, making it one of the three districts with the highest rate of citizen insecurity in 2021. Some of the facts that demonstrate the previous statement are show in the aggravated robberies, as well as in the thefts towards real estate, vehicle theft, assault in public transportation, theft of technological devices, purse snatching, and many other crimes that are observed in the daily life of the people [4]. Around 325,000 inhabitants live in this district; however, the district of Los Olivos only has three police stations, 476 police officers and 232 security guards, who are the only ones to protect the security of the inhabitants, which only demonstrates the strong presence of fear and insecurity among the inhabitants [5].

In addition, citizen participation has played a relevant role in public policies, making it necessary for the population, together with municipal authorities and the National Police, to work together to fight crime, robberies and assaults. As mentioned in Article 85 of the Organic Law of Municipalities, the Municipalities are responsible for decreeing, maintaining and consolidating a Citizen Security System within their jurisdiction, with the active participation of the National Police of the jurisdiction and the citizens [6]. In other words, all of us who belong to a given district are responsible for seeking the necessary conditions for the security of its inhabitants, with their participation.

However, the situation of citizen insecurity is reflected in two dimensions: objective insecurity and subjective insecurity. Through objective insecurity there is the quantity of facts, i.e. seeing crime through figures, either in victimization or homicides; on the other hand, in subjective insecurity there is fear, uncertainty and constant fear, that crime becomes a fact, this is based on the perception of insecurity itself, as well as trust towards institutions [4]. Therefore, having this position clear, there is a need to safeguard the integrity and security of all individuals, using technologies against crime, for this not only need ideas, but also human talent to help translate these ideas into a viable technological solution.

This is where we find Reach, considered a social network but based on geolocation for the fight against crime [7]. One of the applications that allows solving these security problems, allowing alerting about crime incidences, by reporting the crime in order to take the necessary actions by the authorities [8]. One of the problems identified for the development of this application is the fear of retaliation by criminals against whistleblowers, as well as the lack of trust in our police authorities and the fear of sharing information.

In research by Vasquez Vargas and Valderrama Villa [9], it is mentioned that the use of mobile apps has increased notoriously, due to portability and especially mobility, which makes it a very powerful technological tool to combat citizen insecurity. This in order to favor the national police, since it was necessary to provide the technological service to help reduce crime rates. In this implementation for the police service of Chimbote, geolocation technology was used, which allows access to the location of users through coordinates; other technologies used were Bluetooth, because most cell phones have it; Wi-Fi technology also offers this type of connection with the use of wireless radio signals; the QR code, allowed storing information through a matrix of points. For the development of this implementation, the experimental method has been used, with an identified population of citizens with smartphones, and a sample of 500 citizens. The application has as requirements an operating system of Android 4.0 as a minimum, developed with Android Software Development and with the help of a database manager such as MySQL. In addition, the business related processes identified are: Register interventions carried out by the police, Register various emergencies, Consult records, Report records; all this in order to have statistical data of crime incidents in Chimbote. In this way, the users of this application would be police personnel and citizens. Among the results obtained thanks to this mobile solution, is the optimization of human and technological resources and, above all, costs. In addition, improving and facilitating the security

service time, referring to the faster response to incidents and emergencies registered by citizens. Knowing the dangerous places, since there is information of the records in a shorter time than traditional; taking into account the above, it was possible to have a more efficient decision on the part of the police authorities. In other words, improvements have been achieved in the security service provided by the police division in Chimbote, since the mobile application allowed for greater efficiency and, above all, to have statistical data in less time.

Among the national background, in 2019 under the context of the COVID pandemic, crime rates increased in various districts of the city of Lima, where the district of Carabayllo, whose population was 333 039 inhabitants, presented a greater relevance. According to the PNP's SIDPOL System Statistics Source, among the most recurrent factors are violence in all its forms, for example, against women, children, adolescents, as well as the vulnerable population, which represents 1.01%, as well as violence against property, which represents 0.88%, among others. In order to reduce citizen insecurity, in 2021, research was conducted on a mobile application that used Android technology for Rapid Assistance used by the Municipality of Carabayllo in citizen security incidents, which aimed to automate the reports of incidents of criminal acts occurred in that district through the use of a platform [10]. In addition, the district's Citizen Security Management together with the police authorities belonging to that jurisdiction had access to all incident records, which were made by the civilian community and municipal administrators. The tests were carried out in the Urbanization Santa Isabel of the same district and all information collected was stored in a MySQL database. For this purpose, the tests focused on two indicators, which were the Cases of Rape and Sexual Assault and the Victims of Gang Presence. Initially, the measurement of these indicators was carried out through PreTest tests, and then with the data collected, which were analyzed with SPSS Statistics software, the veracity of the hypothesis was determined. During the development of these processes, an improvement in data management was obtained, which allowed better decisions to be made and thus reduced some risk actors, for example, people affected by the presence of gangs before using the application were at 144.99% and after using it, they decreased to 43.33%. In addition, sexual aggressions, which were initially at 153.33%, also decreased to 43.3%, which proves that the use of the mobile application contributed to the reduction of incidences and had a significant presence in the district.

As for Lopez Yauri [11], it is mentioned that an attempt was made to determine the influence of another mobile application to combat the problem of insecurity in the province of Chanchamayo where this application, with the support of the citizens, can fight crime and at the same time be used by the security guards of the municipality to reduce the number of criminal acts occurring in the district of La Merced. In addition, this national project developed an application for an adequate management of citizen security, thus demonstrating that these softwares allow the use of technology for the control of crime rates, and through the use of the mobile application it provides better benefits to citizens and, since it is developed for a mobile platform, it provides a very high portability and usability by the citizens [11]. On the other hand, Cáceres Franco and Cajas Carbajal [12] verified that it is currently very viable to develop applications to combat citizen security reaching an internal rate of return (IRR) of 35%, TheShield App clearly demonstrates that not only users but also municipalities find this business idea extremely beneficial because of the tools provided to users and all this at their fingertips. Likewise, Delgado *et al.,* [13] validated that at present the districts of Lima have the necessary resources for the implementation of these applications being a possible solution to contribute against the high crime rate that manages the capital reaching almost 40.5% in Metropolitan Lima.

Therefore, it has been proposed in the research to develop a mobile application that provides information on the various incidents related to citizen insecurity occurring in the district of Los Olivos,

which can notify users and the authorities of the sector to generate adequate axes of communication and provide an immediate response to a criminal act, and thus reduce crime rates in the district, which allows empowering the civil community and allows the Police of the Jurisdiction to make decisions having relevant and updated information on their mobile device.

The technologies are applied in the development of this mobile application will be structured through the Kotlin language for its main code in the Android Studio environment in order to generate an application to be distributed by the PlayStore. Also, in the part of consumption of Application Programmin Interfaces (API's) various maps are needed, for which Google Maps is used to visualize and make use of these adding risk notifications according to the crime. On the other hand, the data storage will use Firebase: Realtime Database and Cloud Storage to store the images. As for the methodology of the project will be the SCRUM methodology. Finally, version management will be with GitHub.

2. Methodology
2.1 Scrum

This methodology allows better planning by focusing on the management and solution effectively minimizing time and costs in an incremental manner [14]. Introduced by Takeuchi and Nonaka to define a product development approach, aimed at incremental in an integral way with multidisciplinary teams [15], which allows us to collaborate efficiently by performing prioritized deliverables that generate value to the project as shown in Figure 1.
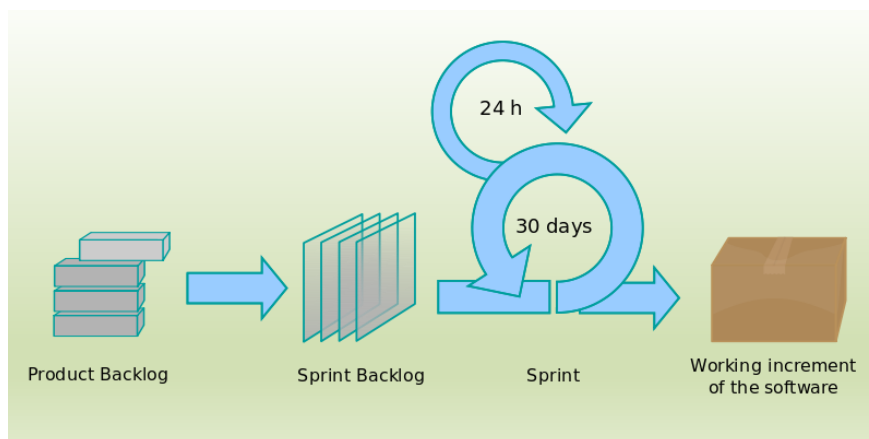
Fig. 1. Scrum Methodology

2.1.1 Product owner

It is in charge of maximizing the value of the product, as well as the return on investment, it manages the Product Backlog, creating a prioritized list of functionalities [16].

2.1.2 Scrum master

It is the person in charge of enforcing the Scrum methodology has an important role, as it must exercise servant leadership; serve as a guide to support everyone in his or her framework [16].

2.1.3 Development team

They are the group of professionals with multidisciplinary competencies and skills in an autonomous and organized manner, who are in charge of the delivery of the product increments, which are the sum of the finished items of the spring backlog, i.e., they are in charge of the creation of the increments [15,17].

2.1.4 User stories

They explain in a general way about a software function described from the end user's point of view. They are the requirements that the software must solve according to the customer's needs, which are short and simple [18].

2.1.5 Product backlog

A list of product requirements be displayed here, ordered from most important to least important.

Among the main requirements shown in Table 1, we have the registration of users to the platform, where each user will have their own password to access from their device. Another requirement is the registration of incidents and the generation of reports in the event of a criminal act, which provide all the relevant information and thus make better decisions. In addition, another requirement provides graphical information to all users focusing on the areas with the highest incidence of criminal acts, specifying which acts were committed in the vicinity, which be notified to users through notifications.

Table 1
Requirements

No	User Stories
1	As a citizen, I want to register in the platform to be able to make my reports and contribute to my community.
2	As an administrator, I want my users to see incidents in real time so that they can know which areas are the most insecure.
3	As a user, I want to be able to reset my password on the platform to access in case I forget my password.
4	As a citizen, I want to receive an alert in case something was reported near my location to keep me informed.
5	As a security guard, I want to see which areas have the highest crime rates in my district in order to provide more patrols and reduce insecurity.
6	As a user, I want to be able to use the platform from my cell phone to make it much easier for me to access.
7	As a user, I want to be able to report a criminal act so that my community and the relevant authorities can be informed.
8	As an administrator want a report where I can filter the most frequent criminal events so I can see the detailed information according to those filters.
9	As a citizen, I need to view my latest reports in an orderly fashion to be certain that they were received.

2.1.6 Sprint 0

This is a work environment configuration meeting where the programming language to be used and the database is tested.

2.2 Flowchart

The flowchart of the mobile application is shown in Figure 2, where the process begins when the user logs in, or otherwise proceeds to register, and then enters the mobile platform, and if he/she wants to report a criminal act, the user will have the option to register the data and therefore view the registered reports. In addition, if the user does not wish to report criminal acts, he/she will have the option to search for criminal reports through selection filters, and thus visualize a map showing the areas most affected by citizen insecurity or the areas with the most criminal reports. Therefore, it will allow activating the option to receive alerts in case there is a report close to the user's current location; the process ends when the user wants to log out.
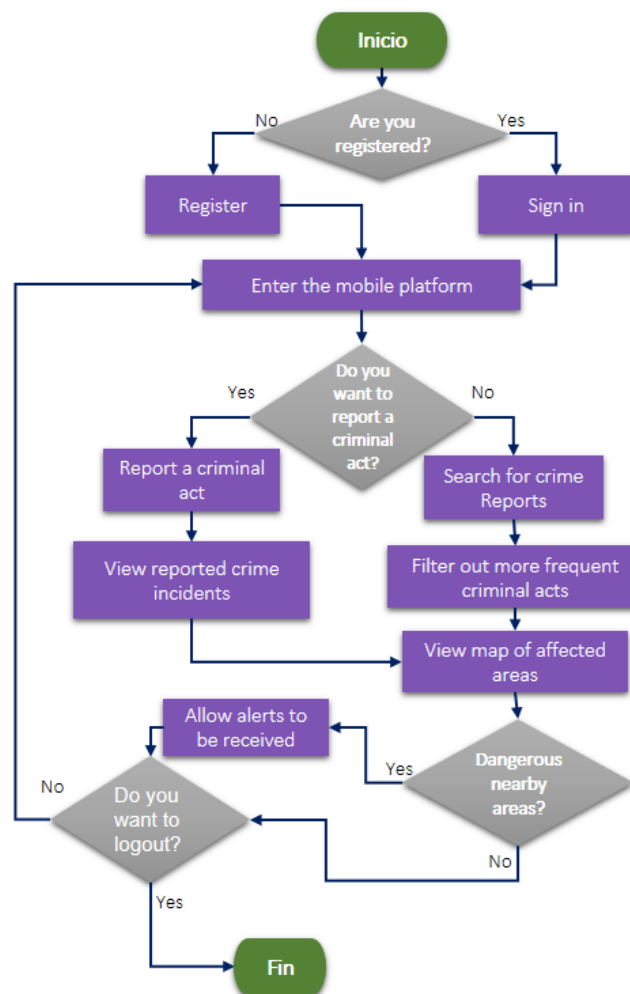

Fig. 2. Flowchart

As shown in Figure 2, our process path includes the following:

2.2.1 Login

To start the process, the user must log in to the application by entering his or her personal data, such as surname and first name, e-mail, date of birth and password. When the data is validated, the user will be taken to the mobile platform menu. For this operation, it will be developed with the Kotlin language. This will allow it to comply with the operation of login and logout of the application.

For the result of this process, two options are taken into account; the first one is that the login is successful or failed login. In case of failure, the application will display an error message; otherwise, the application will receive the user's credentials. In the case of logout, the same logic is proposed; if the user fails to logout successfully, an error message will be displayed, in the case of a successful logout, a false status variable will be set, where this change will allow the application's login view to be updated.

2.2.2 Recording crime incidence

To start the process, the user must collect the relevant information about the criminal incident in order to send it to the server. Once the information is stored on the server, it is encrypted in order to safeguard the information and prevent it from being altered. This data storage will be done through Realtime Database for the records and Cloud Storage for the storage of the photo of the incidents.

2.2.3 Search for crime reports

For the process of searching for crime reports, the user accesses the server information, which is encrypted and stored in a database. This search is performed through query instructions, which allows us to return the requested information in a secure way. Likewise, the information can be filtered depending on the type of criminal incident.

2.2.4 Search for crime reports

For the process of displaying maps of affected areas, the application uses the Google Maps SDK for Android API, to create a MapView object which is displayed in the view, for which it uses the location of the person and places it with a latitude and longitude that is shown on the mobile screen thanks to an object of type camera [19]. Subsequently, for the creation of markers that indicate different types of risk, a function is used that allows the creation of an object of type Marker which contains different titles, colors and icons of markers that represent different types of criminal activities that are displayed in real time for all our users [20].

2.3 Software Architecture

In Figure 3 shows the architecture model of the application being Android Studio our development environment for coding with the use of the Kotlin language; in addition, we will use Google Maps Programming Interfaces, known, as APIs to add risk notifications regarding a criminal act. The connections with the server will be done through Firebase.
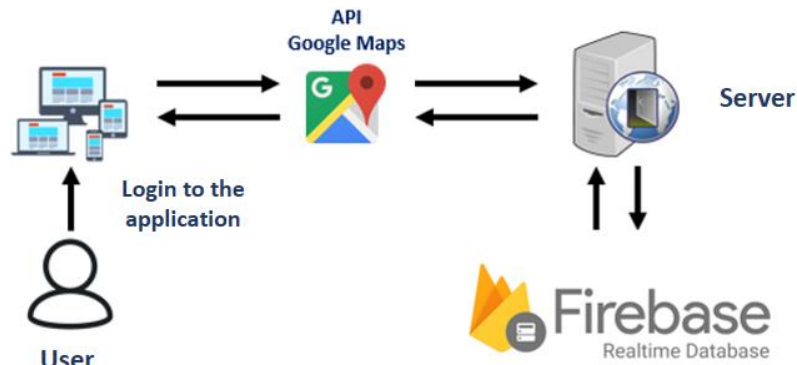
Fig. 3. Software Architecture

2.4 Prototypes

The prototypes for the development of the application are shown from the access to the application to the generation of the alert by means of a notification.

In Figure 4 shows the initial screen where the application is opened. Here we can register to the application for the first time or we can enter the application if we are already registered. The necessary data are the last and first names, an e-mail address, a date of birth, as well as a personal password for access.

In Figure 5 shows the screen where the reports of a criminal activity are registered, as well as the reports generated by other users of the application, where the relevant information is filtered according to the needs of the end user.
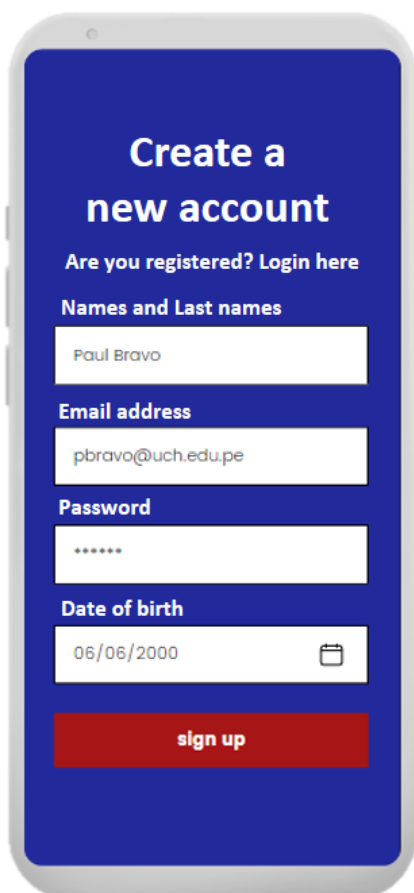

Fig. 4. User registration Screen

Fig. 5. Criminal act Report Screen

In Figure 6 shows the screen where the recurrent areas of a criminal act are displayed, where each criminal act is specified with its respective color to differentiate them from each other. In addition, an alert is generated, which will notify users of a criminal act in a specific area.

Fig. 6. Criminal acts map Screen

2.5 Target Population

Our target population considered in this research are the residents of the district of Los Olivos which are around 325 000 residents according to the data collected in the 2017 census, but the district has only 3 police stations, 476 police officers and 232 security guards; who are the only ones in guarding the security of the population [5]. In addition, 60% of the population is young and 9.8% of the inhabitants are elderly. Regarding the analysis of the population that has mobile telephone service, 25.9% has this service, and 16.58% has mobile Internet service. A sample of 50 residents is considered for the analysis of the use of the application to be implemented.
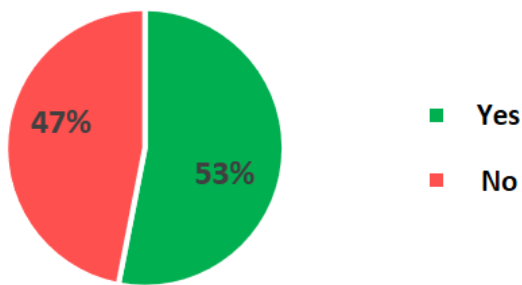
3. Results
3.1 About Surveys

The survey had a sample of 50 people whose average age is 29 years, who are residents of the district of Los Olivos in order to know their opinion regarding crime in the district, and questions were asked about their expectations regarding the efficiency of the mobile application.

In Figure 7 shows the results obtained in response to the question "Have you been a victim of a crime?", where 53% of the respondents answered that, they had been victims of a crime, which indicates that there is a lot of insecurity in the district.
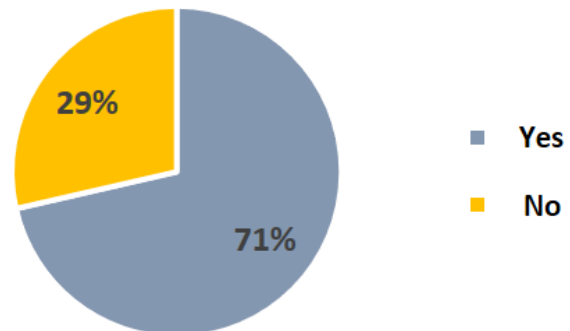
In Figure 8 shows the results of the question "Have you witnessed a crime?", where 71% of the respondents answered that they had witnessed a crime, but 68% would not intervene in a robbery, which is an indication that there is fear of reprisals when confronted with a crime.

**Fig. 7.** Have you been a victim of a crime?

Fig. 8. Have you witnessed a crime?

In addition, in Figure 9 the results obtained in response to the question: "If there were an application to record crimes anonymously, would you use it? The 96% of the respondents answered that they would use the mobile application, but under certain additional requirements that it should have.

Then, Figure 10 shows the results obtained from the question: Would you recommend the application? The 88% of the people surveyed answered that they would recommend it, 8% answered that they would not recommend it and the remaining 4% mentioned that they should see the application in operation to give an opinion.
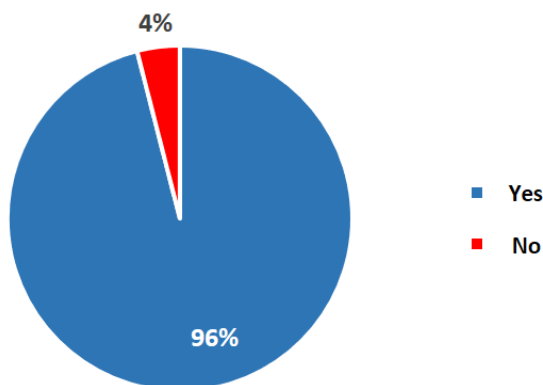
Fig. 9. If there were an application to record crimes anonymously, would you use it?
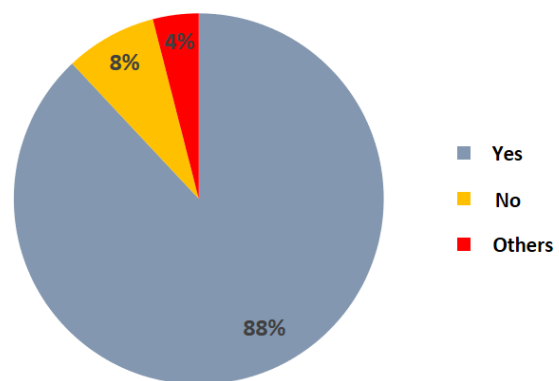
Fig. 10. Would you recommend the application?

Finally, with respect to the question "What would you improve in the application?", the most outstanding answers obtained are the implementation of a quick help button, including personal markers of a user in the event of a crime, synchronization with the National Police, having a

notification alarm after a few seconds after the crime has been reported, adding user comments to follow up on the crime. As for the question "What would you include in the application?", some answers stand out, such as adding the location of safe areas, nearest health centers or places of assistance, also synchronizing the user's location and activating a notification alarm without opening the application or receiving a notification via SMS, in addition to including the times with the highest crime rate in the area.

3.2 The Application

Based on the prototypes developed, the mobile application was implemented. In Figure 11 shows the main screen of the mobile application.
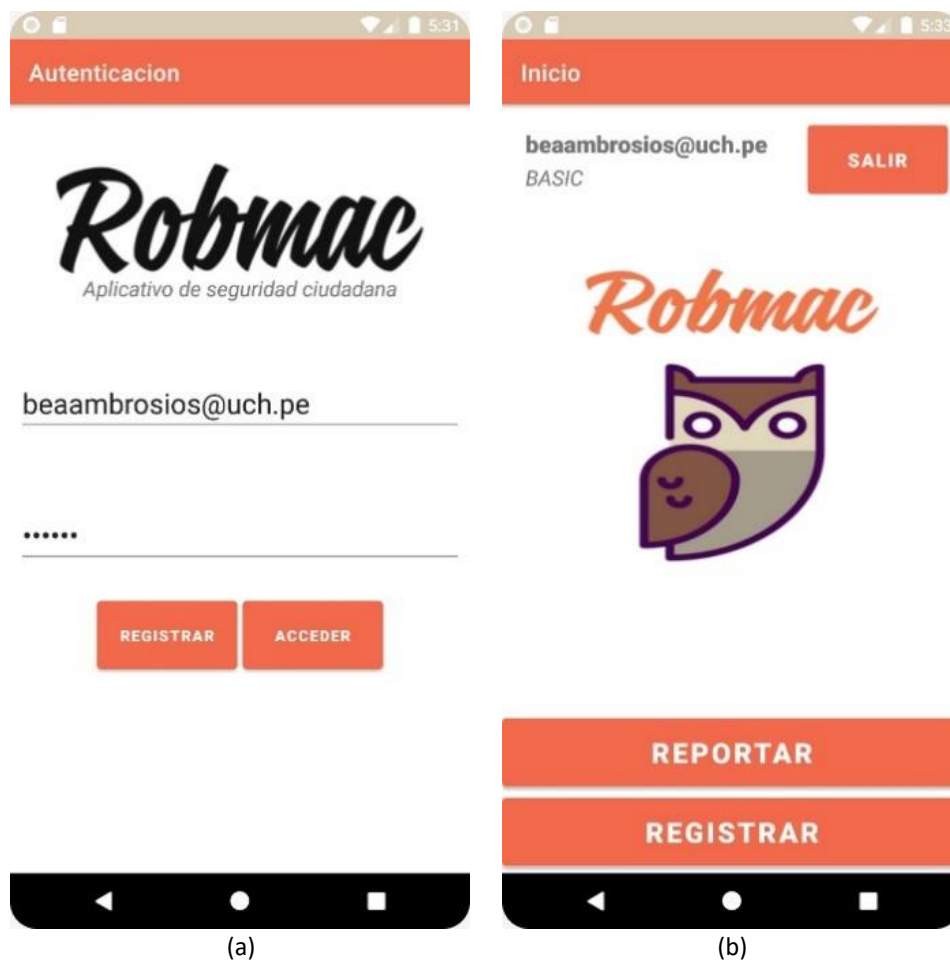
Fig. 11. Main Screen of the mobile application (a) The registration and access screen (b) The screen for reporting and registration

In Figure 12 shows two activities that can be performed in the application: the first screen displays the records of criminal incidents, and the second screen displays the filter of criminal acts.

| (a) | (b) |
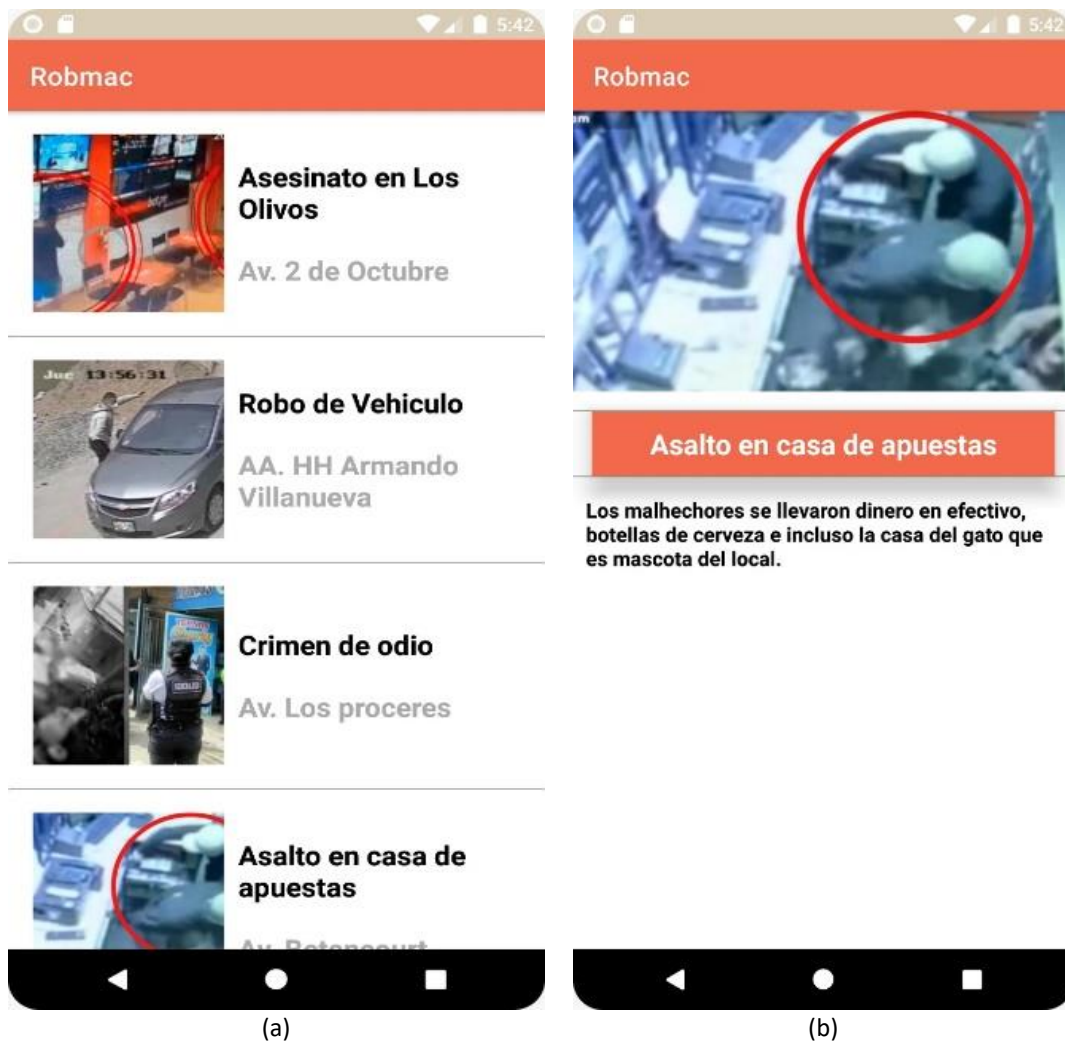
Fig. 12. Event log Screen (a) The screen of the registered crimes (b) The screen where the crimes are filtered

Finally, in Figure 13 shows the screen with a map of a specific area of the district of Los Olivos.
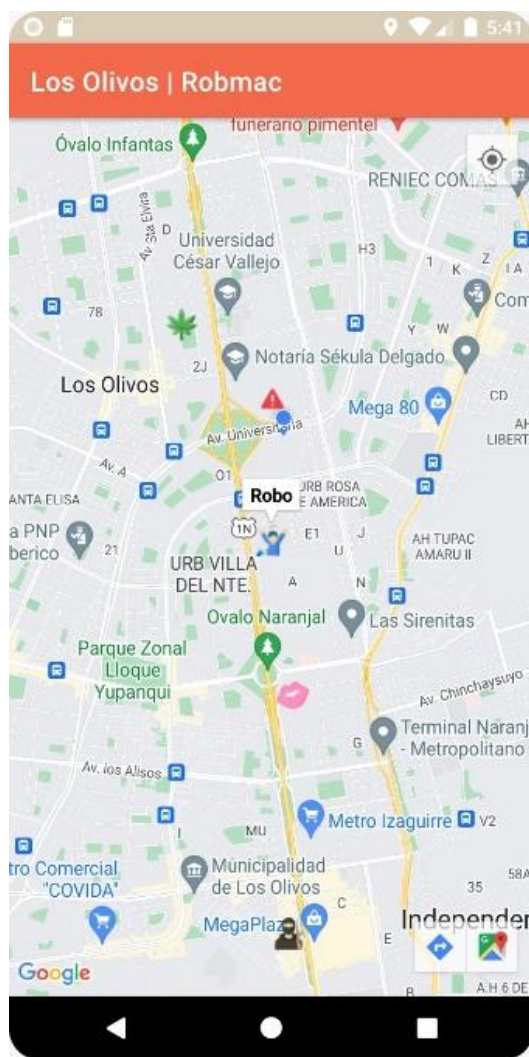
Fig. 13. Incident map Screen

4. Discussions

For the development of the mobile application, various technologies were used that helped to adequately fulfill its function, but some limitations were also encountered, such as the time limitation for the development of other additional functions, which although they do not alter the operation of the main process, but help in the efficiency of the application for the end user. In addition, the budget limitation during the development of the application was a difficulty for its final presentation; however, it was possible to culminate with the main flow presented in Figure 2 of the research. In addition, the implementation of real-time alerts of criminal acts through notifications that will reach the mobile device is planned for the final development of the application. Finally, the lack of knowledge in the use of some technologies, for example, the Android Studio development environment, initially hindered the scope of the project. However, it will be taken into account to improve in further research.

5. Conclusions

Through this research work, a mobile application was developed through the IDE Android Studio, to counteract citizen insecurity in the district of Los Olivos, where its importance lies in mitigating the

problems identified as robberies, assaults, etc. All this with the purpose of putting an end to the fear and insecurity that citizens have, as well as reducing crime rates in the district. In addition, it is advisable to continue implementing additional functions to the application in order to provide more tools to the population to prevent and/or avoid being victims of criminal acts, in addition to working together with the district authorities and strengthen public safety. In addition, a very important factor was the knowledge of the various technologies used for the implementation of this research project, which has been demonstrated in the development of the mobile application. A great help has been the opinions received from the target population, which allowed us to have a perspective of what the user really needs from the application.

Acknowledgement

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