International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 3
DOI: https://doi.org/10.17762/ijritcc.v11i3.6198
***Article Received**: 15 December 2022 **Revised**: 19 January 2023 **Accepted**: 16 February 2023*

Prototype of a Mobile Application for the Detection of Car Accidents on the Roads of Peru

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Abstract—According to studies of the World Health Organization at least around 1. 35 million deaths and between 20 to 50 million injuries are caused due to car accidents, due to this fact the present research work seeks to mitigate this figure before the problem of car accidents on the roads of Lima, that is why a mobile application was designed whose objective is to detect and report accidents, when performing this action the driver sends his contact information (ID, phone, email, family number) and location in real time to the nearby authorities such as police stations or hospitals and likewise the message comes as a notification to their families. For its development we used the agile methodology Scrum whose structure was very useful to display the information proposed, also design tools such as Balsamiq and Marvel App were used to create the interface. Finally, it is concluded that car accidents is a problem that negatively affects our society, also with the application it was possible to design an interactive application that will be very useful for drivers if it is ever implemented, on the other hand, this research seeks to encourage researchers to use technological means to improve the quality of life of people and thus continue to advance as a socie.

Keywords-Mobile aplication , Accidents, Scrum, Balsamiq, Marvel App

I. INTRODUCTION

Nowadays, automobile accidents occur frequently; according to the World Health Organization, about 1.35 million deaths and between 20 and 50 million injuries are caused by automobile accidents every year [1].

Because of this problem, it is known to be one of the leading causes of death among the economically active population aged 15 to 44 years, and more than 75% of traffic accident deaths occur in this age group, and studies show that 90% of traffic accident deaths occur in developing countries [2]. In the coming years, it is expected to be more difficult to control such accidents, due to the accelerated economic growth and the increase in the number of accelerated vehicles. [3].

In Peru, automobile accidents occur in broad daylight due to the negligence and lack of awareness of drivers, the deficiency of the authorities in managing traffic, the poor structuring of roads is also a major inconvenience to be taken into account and finally the carelessness of pedestrians when crossing the streets.

Because of this, the following research work seeks to design a mobile application for both drivers and passers-by capable of detecting in real time the automobile accidents occurring on the roads of northern Lima [4]. In this way, the aim is to alert the authorities of the automobile accidents that occur during the day and in this way keep a detailed record so that in the near future the safety and monitoring of these areas can be improved.

This research work is composed as follows: Section II presents the Review of the Literature. Section III defines the methodology to be applied to the project and defines each stage in a theoretical manner. Section IV describes the case study, Finally, Section V defines the conclusions and future work.

II. LITERATURA REVIEW

In this stage, research related to the use of technology applied to accident detection, results and conclusions will be addressed, with the purpose of analyzing the cases and providing contributions for future improvement.

As it is known, there are agencies that use Geographic Information Systems, also known as (GIS) with the purpose of analyzing accident data in general. That is why in the following research, a GIS based application was developed, which applies GIS and Traffic Accident Vision System, both of which formed a set of application involving the management of accident database entries. The system was developed by University Putra Malaysia (UPM), using Microsoft Visual Basic 6.0 software on Windows XP platform. The reports issued by UPM thanks to the software are used as a source of information for the development of the database, which includes the location of the accident and in this way the user can make particular queries to obtain the number of accidents [5].

Safety is a thought that we wish to our loved ones, this feeling is what drives the development of the following system called em-bedded whose objective is to cultivate that feeling of safety in the painful situation of an automobile accident. For this purpose, the system is equipped with several sensors capable of detecting the abnormal inclination of a vehicle or in case of a collision. In the event of a collision, the sensor would send a notification and the location of the vehicle to the family

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members. In this way, they made a great contribution to this situation [6].

On the other hand, due to the constant accidents of tugboats, the following research focuses on it, I analyze with the help of algorithms such as A priori, Predictive A priori and FP-Growth, thanks to it they obtained the information for analysis, the results tell us that such research will be beneficial for tugboat operators, in addition to public authorities as it will help to become aware of the accidents occurred [7].

Similarly, the following research focused on the driver, classifying their states and how to help prevent them using a methodology in conjunction with the mobile application, the objective is to analyze the behavior of the unsafe driver, thus seeking to avoid accidents. For this purpose, technologies such as the phone's camera, GPS and microphone were used. The methodology classifies the driver in three states, distraction, drowsiness and danger or out of line, using the high frequency of the pulse to detect these states [8].

Finally, while it is true that accidents are sometimes unavoidable, this happens due to multiple factors, this fact leads us to have victims caused by the accident, with this in mind, a mobile application was developed whose objective is to help the victims of the accident. A passerby observing the fact from the application can help the victim by taking a picture of the accident and send it to an ambulance or hospital or nearest police station, also allows you to make a provision to obtain the identity of the victim, this image is compared in a linked database, in this way the application seeks to save lives and seeks to be of great help to improve as a society [9].

As demonstrated in the research presented, thanks to the use and advancement of technology it has been possible to create software capable of detecting car accidents, either through a program or an application, however, although the designs fulfill their function and purpose can be improved, to seek interactivity between the user and the application, which is why we seek to present an attractive and efficient design capable of meeting the needs of the user.

III. METHODOLOGY

For the development of this project, we chose the Scrum methodology, because it is governed by appropriate steps to present the information to be shown, on the other hand, we will mention the technological tools to be used for further development.

A. Scrum

Scrum is an agile software development methodology which consists of small work teams, which contribute their work interdependently, the effort is collaborative because each one contributes the task assigned to him. Scrum is characterized by its deliverables, also known as Sprint, due to these structures we chose to use the Scrum methodology, the following Figure 1 shows its work structure in more detail [10].

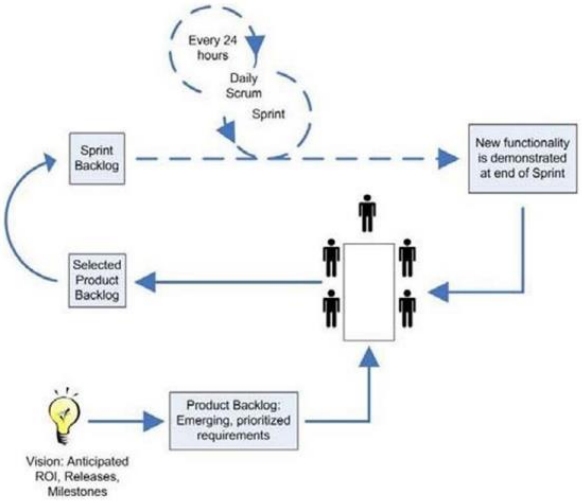

Figure 1. Example of a ONE-COLUMN figure caption.

1) Roles: For this study, we have used the three roles proposed by Scrum, which are: Product Owner, Scrum Master and Development Team [11].

2) Planning: In this stage the project is planned, together with the work team, meetings are held where everyone is involved in order to define the activities to be performed, the number of deliverables is defined and the time it will take to perform them [12].

3) Development: In this stage the Sprint of the project is developed, which were established in the planning stage, that is why the prototypes of the mobile application are shown following the details established by the team [12], [13].

4) Review and Retrospective: This is the last stage within the activities established by Scrum, where a meeting is held at the end of a deliverable, where the team performs inspections, adaptations, improvements to the product, and also discusses the progress made so far and what aspects can be improved for a future delivery [14].

B. Software Tool

For future research, the main tools for its development are the following.

1) Kotlin: Kotlin is a programming language, so declared Google in 2017. Kotlin is mainly used to develop Android applications [15].

2) Firebase: Firebase is a relatively new technology; however, it is capable of handling a large amount of unstructured data and is mainly used to store information from Android applications [16].

3) Balsamiq and Marvel App: Balsamiq and Marvel App are software and web tools used for the design of mobile and web applications. That is why these tools were used to develop the prototypes [17].

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IV. CASE STUDY

A. *Roles*

To assign the corresponding roles, a meeting was held to establish their functions within the team, this decision was made based on their capabilities and experience. Table 1 shows the role of each team member within the project.

TABLE I. TEAM ROLES

Roles	Responsible
Scrum Master	Enrique Lee Huamaní
Product Owner	Enrique Lee Huamani
Development Team	Ricardo Leon Ayala
Development Team	Brian Meneses-Claudio
Development Team	Alicia Alva Mantari

B. *Planning*

Once the roles were established, another meeting was held where the tasks to be performed were determined, the user stories were established and it was determined that the project will have 3 Sprint.

1) Sprint 1 : For Sprint 1, we focused on the visual section of the application, which is why we focused on the design of the interface that the user interacts with when using the application, Table 2 shows the following user stories.

TABLE II. SPRINT 1 USER STORIES

N	User Stories
1	As an administrator, I want the application to have a practical design, to efficiently access the functionalities.
2	As an administrator I want the application to allow editing the user's personal information to avoid information theft.

2) Sprint 2 : For Sprint 2, we focus on the operational and functional section of the application, which is why we detail the main features that the application will have to improve its functionality and the interaction between the user and the application, in Table 3 the following user stories are observed.

TABLE III. SPRINT 2 USER STORIES

N	User Stories
1	I as the administrator want the application to work with Google maps so that the user feels comfortable and familiar with the navigation interface.
2	I, as the administrator, want the application to have special signage within Google maps to indicate to the user on which routes accidents have been detected.

3) Sprint 3 : For Sprint 3, we focused on the additional functions of the application to improve the user experience, that is why we focus on the accident reporting device which will serve to alert the authorities about the accident in detail, in addition to the function of alerting in case the user suffers an accident, in Table 4 the following user stories are observed.

TABLE IV. SPRINT 3 USER STORIES

N	User Stories
1	As an administrator, I want the application to allow me to report an accident so that the user can directly file a report or alert the nearest authorities about the event.
2	As an administrator, I want the application to allow me to report an accident so that the user can send his information and location to the authorities and family members.

C. *Development*

1) Development of Sprint 1: Sprint 1 was developed based on the user stories of Table 2, which focuses mainly on the initial interface of the application, its design was proposed in order to provide efficiency and be easily usable by the user, as shown in Figure 2, we have 5 icons which indicate the following: The "profile", where the user is going to enter his data in order to be contacted or found quickly by the authorities or his relatives, the design of the profile can be seen in Figure 3, "settings", "Accident search" where the user will enter how to find nearby places where accidents have been reported, "Report" in this section the user can detail the accident to send it to the authorities and finally the "Alarm" this function allows you to send your location and data to the nearest authority headquarters to alert in case the user has suffered an accident.

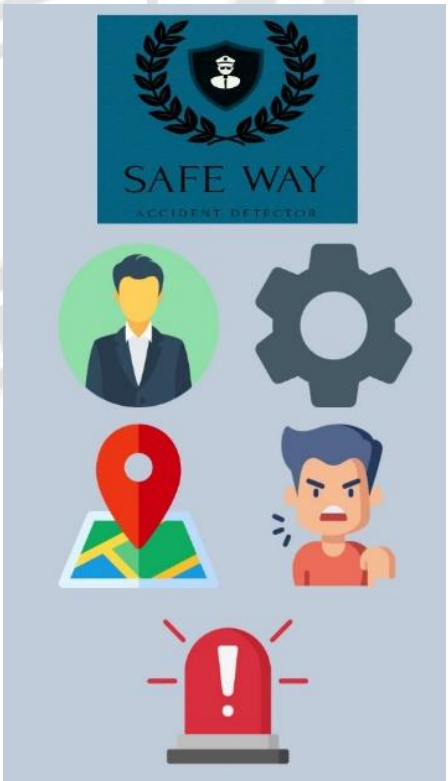

Figure 2. Home.

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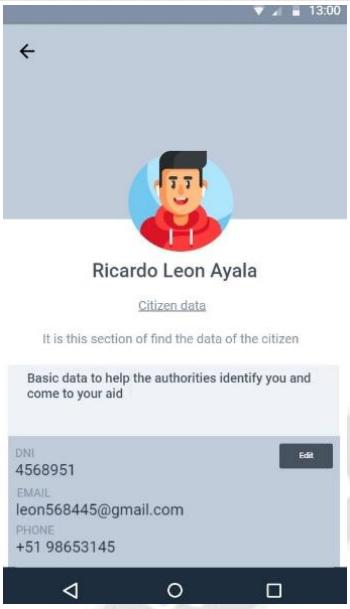

Figure 3. Profile.

2) Development of Sprint 2: Sprint 2 was developed based on the user stories in Table 3, which focuses on the functionality called "Accident Search", as shown in Figure 4, the interface is similar to Google maps, it was done in this way so that the user already knows or is familiar with this application can handle navigation comfortably, in addition we chose to add the alarm symbology which indicates in which areas accidents have been reported in real time, this information can be useful for the driver to take precautions when continuing with his route, perhaps take an alternate path to the one that was intended or in case the report is of a family member to come to his aid.

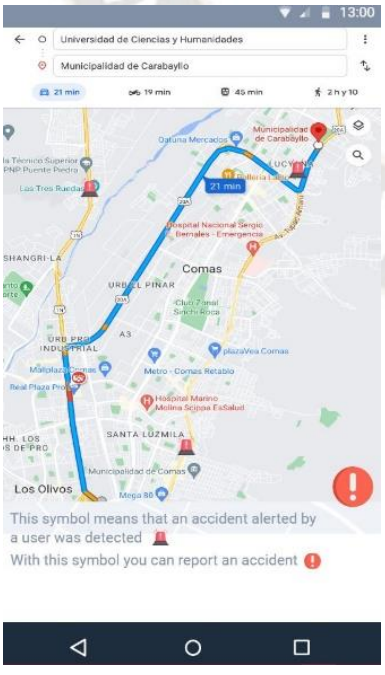

Figure 4. Accident serach.

3) Development of Sprint 3: Sprint 3 was developed based on the user stories of Table 4, which focuses on the "Report" and "Alarm" functions. The interface is shown in Figure 5, in which the user can report an accident to the nearest authorities or health centers so that they can come to his aid, when reporting is sending its location and the data previously filled by the user, in addition it allows you to detail the fact so that health centers take it into account when carrying the implements, you can also add one or more photos to validate the veracity of the report and to publicize the seriousness of the facts.

In Figure 6, is the "Alarm" section which allows the user to report in case he/she has suffered some kind of car accident, for this the application with the help of external sensors working together with the application would detect if the vehicle made an unusual movement, if that were the case the application would automatically send the information and location of the user to the authorities and family members. On the other hand, the alarm can be activated manually to report accidents on the spot.

Figure 5. Accident reporting.

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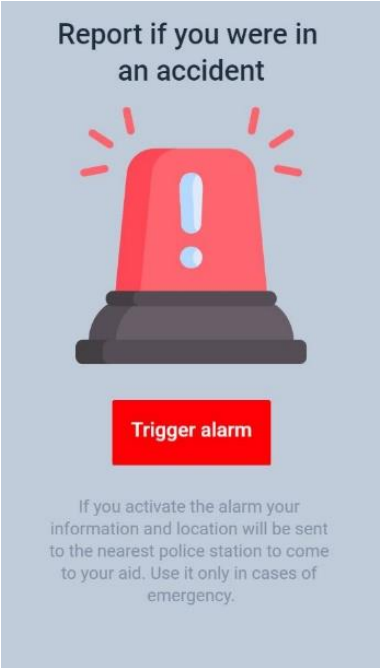

Figure 6. Alarm.

D. Analysis of traffic accidents on highways from 2016 to 2020.

As shown in Figure 7, the graph shows the number of deported accidents segmented in years and its measurement in percentages, from the following graph it was analyzed that in 2020 there were 3526 traffic accidents occurred in national and departmental roads, compared to 2019 the amount was reduced by 13.20%, which year was also the one with the highest number (4062 accidents were recorded).

As it has been shown, the number of accidents has been reduced, however there is no significant difference between one and the other, because the cause has not yet been addressed by governments, the lack of administration, the deficiency in the structuring of roads and the disinterest of the authorities causes that these accidents continue to occur year after year, which is why the following research seeks to help drivers to become aware of the current situation in our country, in turn provide that security that is so lacking when traveling the roads.

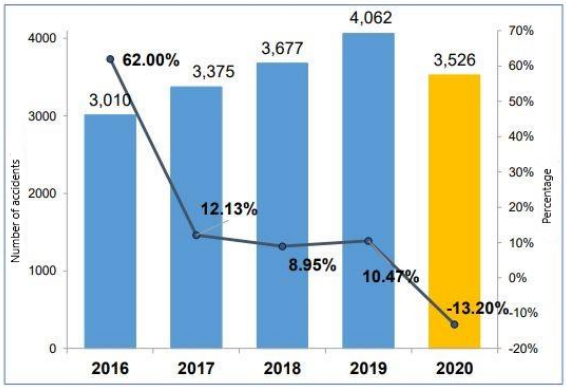

Figure 7. Traffic accidents occurred in 2016-2020

V. Conclusion

In conclusion, thanks to the agile methodology Scrum it was possible to present the following research work because it was useful to show the information in a structured way, also the tools it provides, such as user stories, Sprint, Product Backlog, as well as the creation of roles helped to streamline the process for the creation of the application.

In addition, with the help of design tools such as Balsamiq and Marvel App, it was possible to develop the design of the application for the detection of automobile accidents on Peruvian highways; its dynamic interface contributed to the creativity of the development team to elaborate each functional stage of the application.

Finally, this research work seeks to help drivers to improve their experience during their transit, as well as to provide the security of knowing that in the event of an accident, they are not alone to face the problem, on the contrary, they will always travel accompanied by the authorities and their beloved family members.

VI. Future Work

In the future, it is expected that an entity dedicated to the development of mobile applications will develop the application and take it to the testing and implementation stage, since it will be of great help to drivers, on the other hand, it is expected that this research will encourage researchers to seek and investigate possible solutions to the great problem facing the country, traffic accidents.

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For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

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