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Implementation of a mobile application oriented to the tourism sector

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ABSTRACT

Currently, countries around the world are experiencing a health crisis due to the rapid spread of COVID-19. As a result, different sectors of the state and the citizens' economy have been affected. However, in Peru, the most affected sector has been tourism, since it contributes 4% of the gross domestic product and generates most of the jobs. The objective of the research is to develop a mobile application that allows the user to be guided on their trip, and that promotes national tourism, both from foreign and national visitors, carrying out the implementation in six phases under the scrum methodology; which consists of 3 sprints (deliverables) at the level of the entire project, which had a total duration of 6 weeks in which 35 story points were developed. In the same way, the prototypes corresponding to the functionality that the application will fulfill were added, allowing a better understanding for the reader. Finally, the difficulty in the use of the application and the fulfillment of its functionality was obtained as a result, this was carried out with the intervention of 20 users external to the project, in order to achieve its effectiveness.

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1. INTRODUCTION

The tourism sector has been seriously affected by the spread of COVID-19 in the world, since this virus had a great impact on all nations due to its rapid expansion, affecting different states and leading them to take drastic decisions to curb its spread. Likewise, these decisions taken by the state affected its entire population due to the restriction of several activities that allowed the generation of economic income for its citizens [1]. The government's decision to stop the tourist industry was taken for sanitary measures since this activity was the central valve for the spread of COVID-19 [2]. However, shortly after the economic reactivation in other countries they were allowed with a variety of restrictions. In addition, many of the countries had closed their borders to prevent the spread of the virus, due to these restrictions the tourism sector only allowed visits by local citizens and with a limited capacity, which generated a low income in their activities. These restrictions were established by the activities that were developed in tourist sites, some of which included the rental of equipment to perform their practice [3]. Likewise, Peru is one of the countries with the greatest tourist diversity, which includes: customs, gastronomy, and landscapes, among others, [4]. On the other hand, the tourism sector not only promotes our customs but also allows us to be an income tool for the regions with the highest poverty rate. An example of this could be the region of Puno, which has a poverty rate of 24.2% and yet is composed of numerous tourist sites, which could serve as an economic livelihood for its inhabitants [5]. On the other hand, tourism represented 9% of the gross domestic product (GDP) of the peruvian

state, attributing to its greater importance in the national economy. However, Peru was greatly affected by the closing of its borders and national restrictions, experiencing a 19% decline in its economy in 2020 [6]. On the other hand, tourism is an activity to get to know and interact with new landscapes and leave aside the stress of the city. However, in order to get to know a tourist site, it is necessary to hire a guide to guide us and inform us about the history of the place. The lack of capacity in the tourist centers and the lack of training for the guides are the essential problems that prevent a more fluid visit by tourists [7]. These problems prevent further development of tourism, despite the fact that there are more places that can be made known for the benefit of their inhabitants through tourism.

The importance of this research is to promote national tourism, in order to contribute to the economy of the government and the people who benefit from this activity. Peru has many more tourist sites that can be made known. The objective of this work is the implementation of a mobile application that allows to recognize the images of tourist places through the camera and be able to provide a brief review of the place; in addition, it can be a tourist guide advisor.

In this research work, a perspective on the impact of artificial intelligence in the tourism sector, with the implementation of a mobile application that allows improving the tourist experience, providing the facility of historical knowledge. Fadzil *et al.* [8], indicates that the integration of information and communication technologies (ICT) is the key element for an improvement in the teaching of tourist sites, which has a history. The analysis was carried out through the use of a mixed methodology; it also obtained a result that tourism education with the use of ICTs has an eater experiential learning. Concluding in this way that digital media have a greater impact when accessing information to generate optimal knowledge. In addition, the authors, [9], [10] infer that the changes seen in the tourism sector have been brought about by information technology (IT). He also warns that a new era is coming with a greater impact of IT in the tourism sector, which will improve the experience of foreign and domestic visitors. Using a proprietary methodology, it shows that tourism-related micro-enterprises are adapting to the new technological change. In other words, the changes seen so far in the tourism sector are only the beginning of a new technological era, which will automate some activities.

It is known that with the advancement of science new technologies were developed, which were applied in the tourism sector, such as the use of a mobile application with artificial intelligence, in order to achieve improvements in their services to meet the requirements of the customer, for it was applied various mathematical methods in which it was established, a grouping of users similar in requirements and expectations, and as a result, the mobile application software, favored the mode of travel of people, paying attention to the needs of users, using the most favorable of the internet [11], [12]. However, the authors [13], [14] comment that currently, there are a variety of tourism-oriented applications, and users download them for testing, but approximately 26 of the apps are executed only once because a certain percentage have poor usability and do not meet the user's expectations. Using a proprietary methodology that allows them to establish 3 stages of tourism consumption, and an analysis of other applications, resulted in several recommendations, both for applications already created and for those to be created in the future, which specifies optimal functionality as well as relevant and attractive information for a good understanding of the user.

While it is true, in the tourism mobile applications, the aspects that stand out the most, is the tourist information, which offers about certain places, where every well-informed person can access those sites without any inconvenience, but disabled people can not access, for that reason we developed a tourism application capable of providing information on accessible places for all types of people, by means of different methodologies, in which several aspects are analyzed, as the requirements by the clients, as the development of the application, among others, and as a result, an optimal, intuitive, easy to handle application was offered, fulfilling the requirements and the different guidelines of use [15], [16]. In summary, several authors contributed to the implementation of different applications oriented to the tourism sector, each one giving a functionality in its section, but with the same purpose, fulfilling the requirements of the users either by applying artificial intelligence oriented to all types of people, as well as technologies oriented to experiential learning, in addition to informative applications for all types of people. However, the way tourism evolves through the Internet will be a trend in tourism development in the future, for that reason, it is worth mentioning that, in the sections already mentioned, certain improvements can be made, such as innovation in their platforms, highlighting new points, using new technologies, since new implementations, would generate greater interest and a better valuation by users.

2. METHOD

This methodological section describes in detail the steps to follow for the implementation of the mobile application. In this case, the agile scrum methodology was used, since it allows us to carry out joint development with the stakeholders of the product. In addition, on the software development side, we will use

tools such as C# for the programming language, structured query language (SQL) server 2019 as a database manager, Xamarin as a multi-platform tool, and the visual studio 2019 IDE. On the other hand, Marvel was also used for the design of the prototypes of the application.

2.1. Scrum

Currently, the scrum agile methodology [17] is the most used by organizations for the implementation of software, since it allows the elaboration of defined requirements, is flexible to the customer's changes and establishes results in a certain period of time [18]. The roles that scrum is composed of are subdivided into 3 parts: the product owner, scrum master, and team [19]. The product owner is in charge of managing the backlog and customer requirements; the scrum master is the person who guides the correct implementation of the methodology and facilitates the meetings; and the team can be composed of up to 9 members or depending on the project, in order to fulfill the established tasks. Likewise, the points mentioned above are visualized in Figure 1, which establishes the phases of the scrum methodology, such as the delivery of the backlog by the product owner, the definition of the sprints, and the development of the sprints, the daily meetings and finally the retrospective.

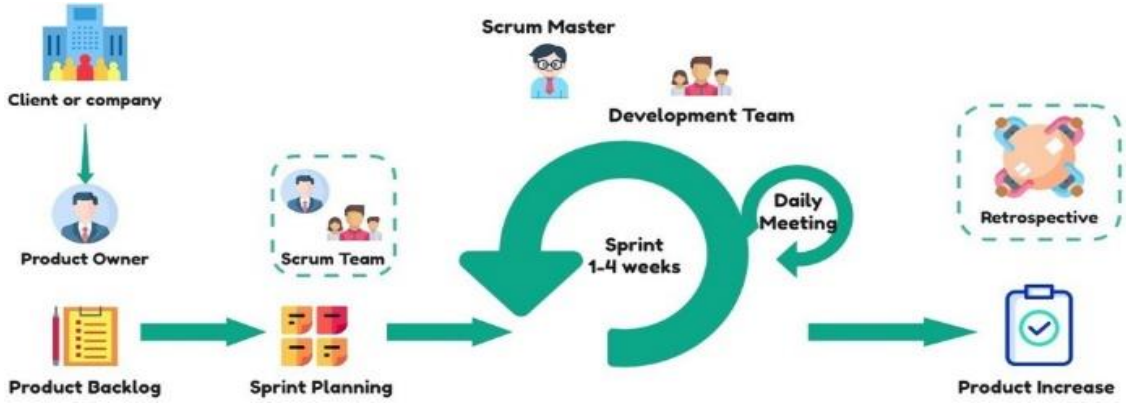


Figure 1. Scrum process flow

2.2. Case study

This section explains in detail how the implementation of the mobile application is carried out, under the agile scrum methodology approach. Likewise, each essential phase and the processes that are developed in each section are detailed. On the other hand, the application has different modules that add value to the system, such as the landscape recognition module and the tourism suggestion module. For a better understanding of the application, Figure 2 shows the flow diagram of the proposed system which indicates the operation from the beginning to the end of the process.

2.2.1. Initial stage

A. Requirements

In this process, the requirements of the mobile application are established, to meet the objective established by the client or organization. In addition, the stakeholders of the project are introduced, such as the product owner, the scrum master and the development team. After knowing the requirements of the product, it would be divided into jobs (user stories) that will be assigned to different members, to then estimate the effort it would take to carry it out.

B. User stories

In this process, the user stories are established and, in turn, the acceptance criteria, which will be incorporated into the product backlog. The stories are defined by the product owner, for this, a correct representation of the requirements established by the client must be ensured. Its representation must be understandable for all those involved in the project, which will allow a correct estimation of time and effort, and then be divided into tasks that are assigned to each member.

C. Backlog

In this process, the user stories are established and ordered according to their priority from most important to least important. The product owner and the development team participate in this phase. Table 1

below shows the user stories required for the implementation of the mobile application and the priority of each one of them.

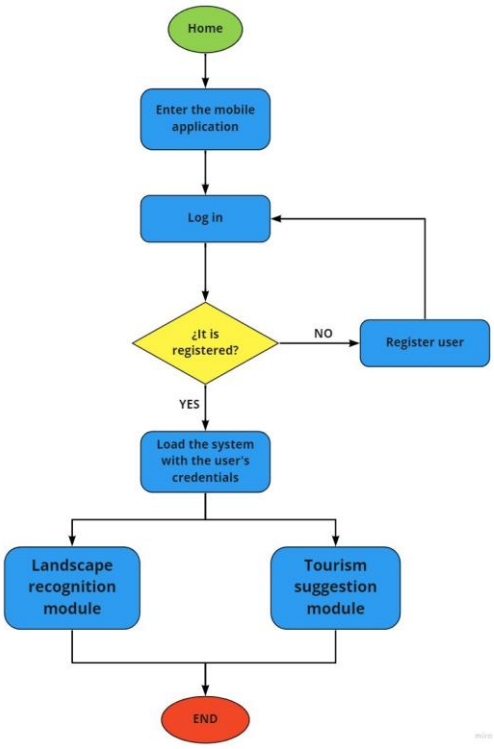


Figure 2. System flow

Table 1. Product backlog

Nº	User stories	Priority
1	As the administrator, I want the application to allow the registration of users, in order to give them access to the system.	1
2	As the administrator, I want the application to have a login to be able to save information for each user.	2
3	As a user, I would like a guide to the application, in order to know its functionality.	8
4	As a user, I want the application to provide me with assistance options for my tourist trip.	5
5	As a user, I want the application to allow me to recognize tourist sites and provide me with brief information about them.	3
6	As the administrator, I want the application to be able to detect touristic places near the user, in order to provide an alternative suggestion to his destination.	4
7	As a user, I want the application to provide me with information about the tourist place I am going to, in order to have knowledge about my destination.	7
8	As the administrator, I want the application to show a form when logging in for the first time, to obtain brief information about the user's tourist preference.	6

2.2.2. Planning Stage

A. Story estimation

In this case, the estimation was carried out through the planning poker tool, which consists of estimating individually each of the user stories [20]. In order not to be influenced by the other members of the scrum team. Therefore, this estimate is based on the effort it will take to complete each user story. This dynamic was put in place, among the scrum team, recording the results of the estimation by day.

B. Planning of deliverable

Next, the user stories are grouped according to their effort estimation, resulting in the sprint. In this case, a total of 35 story points were found and they were divided into 3 sprints. Likewise, the sprint details the user story, the person in charge of carrying it out, and the estimated time. Thus, the product backlog is obtained, which represents a list of activities to be performed for the development of the project [21].

2.2.3. Implementation

In this phase, the execution of the tasks established in the product backlog is carried out [22], so that the established tasks, the determined time, and other details are fulfilled [23]. In this case, the project implementation will be divided into 3 sprints with a duration of 35 working days. Through the marvel tool, the web and mobile prototypes were designed, having multiple functionalities in their graphics [24].

A. Sprint 1

For this first sprint, a total of 12-speed points were allocated, which is composed of 2 user stories. These aspects are analyzed in detail in Table 2. In addition, the prototypes can be visualized in Figure 3, with subfigure 3(a) representing user story 2 and subfigure 3(b) representing user story 5.

B. Sprint 2

Then, for the second sprint, a total of 12-speed points were allocated which is composed of 3 user stories. These aspects are analyzed in detail in Table 3. In addition, the prototypes can be visualized in Figure 4, with subfigure 4(a) representing user story 1 and subfigure 4(b) representing user story 8. And Figure 5, with subfigure 5(a) representing user story 4 and subfigure 5(b) representing user story 6.

C. Sprint 3

Finally, for the third sprint, we had a total of 11-speed points, which is composed of 3 user stories. These aspects are analyzed in detail in Table 4. In addition, the prototypes can be visualized in Figure 5, with subfigure 5(a) representing user story 4 and subfigure 5(b) representing user story 6. And Figure 6, with subfigure 6(a) representing user story 7 and subfigure 6(b) representing user story 3.

Table 2. First sprint

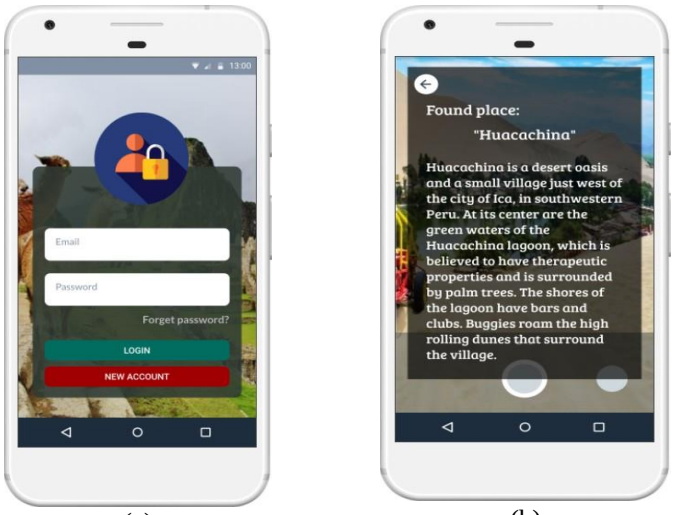
	Description
User story 2	As the administrator, I want the application to have a login to be able to save information for each user.
User	Tourist.
Estimated time	3 days.
Developer	Oscco Carlos.
Acceptance criteria	It provides the user with greater security in their data and searches information since it is necessary to authenticate to access the application.
User story 5	As a user, I want the application to allow me to recognize tourist sites and provide me with brief information about them.
User	Tourist.
Estimated time	9 days.
Developer	Oscco Carlos and Munoz Roberto.
Acceptance criteria	This option allows the user to get a historical review of the different tourist sites by simply capturing the landscape with the use of the cell phone camera.

Table 3. Second sprint

	Description
User story 1	As the administrator, I want the application to allow the registration of users, in order to give them access to the system.
User	Tourist.
Estimated time	2 days.
Developer	Munoz Roberto.
Acceptance criteria	In order to access the application, it is necessary to know the user, so that he/she can provide some of his/her personal data.
User story 8	As the administrator, I want the application to show a form when logging in for the first time, to obtain a brief information of the user's tourist preference.
User	Tourist.
Estimated time	2 days.
Developer	Oscco Carlos.
Acceptance criteria	In this case the application shows a form of 3 questions with multiple options, in order to know the preference of the users and thus offer more accurate tourist suggestions.
User story 4	As a user, I want the application to provide me with assistance options for my tourist trip.
User	Tourist.
Estimated time	8 days.
Developer	Oscco Carlos and Munoz Roberto.
Acceptance criteria	The application shows a series of options such as lodging, restaurants, stores, among others. This allows tourists to carry out their activities normally, even without knowing the place.

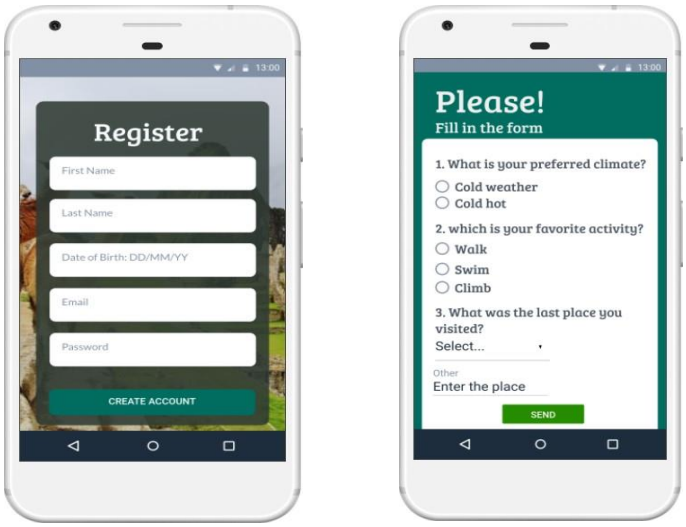
Table 4. Third sprint

	Description
User story 6	As the administrator, I want the application to be able to detect touristic places near the user, in order to provide an alternative suggestion to his destination.
User	Tourist.
Estimated time	5 days.
Developer	Munoz Roberto.
Acceptance criteria	The application will provide a notification that it has detected a nearby tourist site, to keep the user informed during the course of their trip.
User story 7	As a user, I want the application to provide me with information about the tourist place I am going to, in order to have knowledge about my destination.
User	Tourist.
Estimated time	4 days.
Developer	Oscco Carlos and Muñoz Roberto.
Acceptance criteria	This option allows the user to learn more about the tourist destination, such as the activities that can be performed, and the typical food of the place, among other information.
User story 3	As a user, I would like a guide to the application, so that I can get to know its functionality.
User	Tourist.
Estimated time	2 days.
Developer	Oscco Carlos.
Acceptance criteria	It allows the user to learn about the different functions that the application performs, making it easier to use.



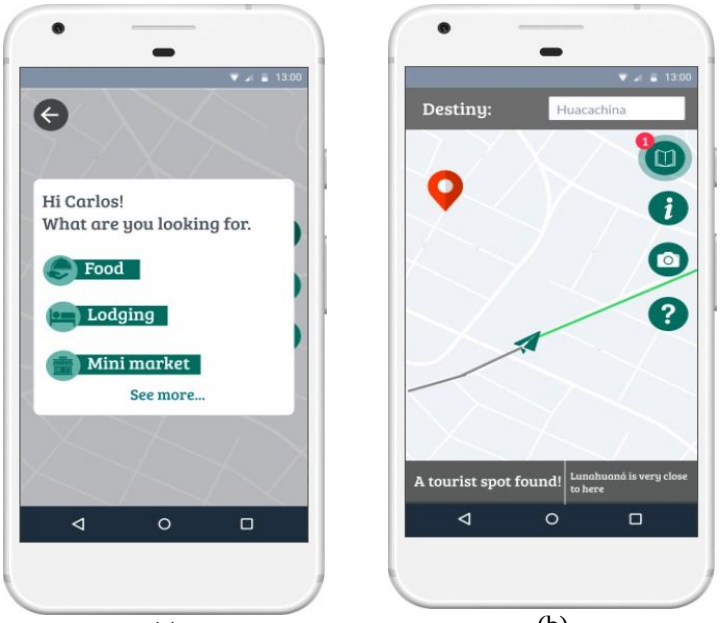
(a) (b)

Figure 3. Protoype (a) user story 2 and (b) user story 5



(a) (b)

Figure 4. Register (a) user story 1 and (b) user story 8



(a) (b)

Figure 5. Design (a) user story 4 and (b) user story 6

(a) (b)

Figure 6. User story (a) user story 7 and (b) user story 3

2.2.3. Review and Retrospective

This phase is performed at the end of each sprint, which consists of presenting the developed tasks to the product owner, scrum master, and sometimes the customer. In addition, new requirements could be determined, which increase the value of the project. For this case, the analysis of 3 diagrams was performed, which determine the feasibility status of each deliverable (sprint) of the project. As a burn up chart, this diagram represents the progress of the user stories through the weeks, indicating that the Y-axis represents the story points and the X-axis represents the weeks. Similarly, Figure 7 shows the number of story points per week, in order to reach the upper limit that represents the total number of story points.

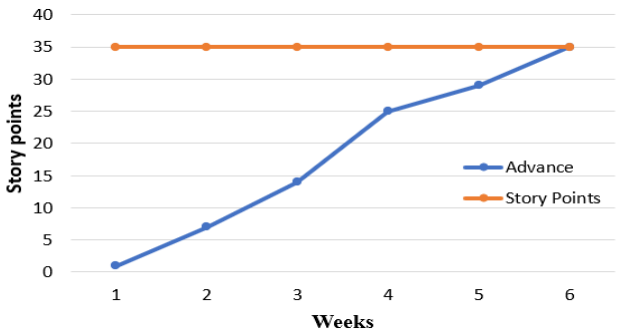


Figure 7. Burn up diagram and history points

3. RESULTS AND DISCUSSION

This section shows the results of the prototypes of each of the user stories, which have been divided and grouped by sprints. Also, as discussions, the usability tests of the user stories and the degree of acceptance in each of them are shown. First of all, we will talk about the prototypes, the present research work aims to use artificial intelligence to meet the needs of tourists in their travels. Also, we know that currently there are a lot of mobile applications, oriented to tourism, which provide you with the basic features for a trip, such as proposed accommodations, nearby restaurants, and showing the current location [13]. However, this mobile application makes use of new information technology (IT) [25] such as image recognition, search accuracy, and suggestions of nearby tourist sites. This allows it to be more outstanding than other mobile applications and to be more useful for tourist trips. Thus, 8 prototypes were made that were grouped by sprint and that better describe the usability of this application.

3.1. Satisfaction surveys

For this section, we will show the usability tests by sprints. The importance of performing these tests allows us to mitigate errors based on the use and degree of acceptance of the application. Also, to carry out the tests it was necessary for the participation of a total of 20 people external to the project; where 10 people are nationals and the other 10 people are foreigners. This was carried out with a cell phone, which contains the functionalities of each user story, having direct communication with the external user and providing information about the actions to be performed in the application. In addition, some parameters were established to determine the result of difficulty, which are: “very easy”, “easy”, “neutral”, “hard” and “very hard”; and the result of acceptance, was “yes it complies” and “fails”.

3.1.1. Sprint 1

In this first sprint, the result of the difficulty in using the application was that 13 people found it “very easy”, 3 people found it “easy”, none found it “neutral”, 2 people found it “hard” and 2 people found it “very hard”. For better detail, it is shown in Figure 8. Also, the result of acceptance of the application is obtained; where 94% of people think that it complies with its functionalities and 6% of people think the opposite. These results are shown in Figure 9.

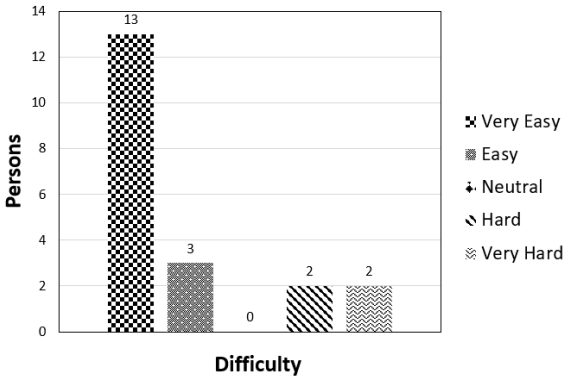


Figure 8. Sprint 1 difficulty

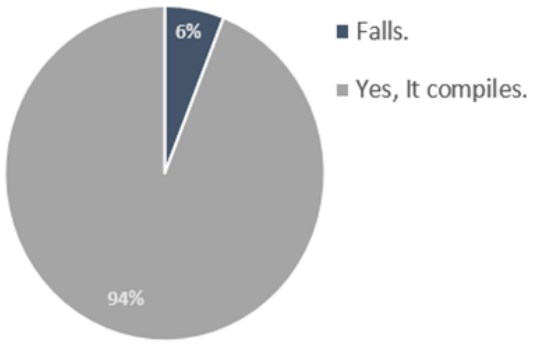


Figure 9. Sprint 1 acceptance

3.1.2. Sprint 2

In this sprint, the result of the difficulty in using the application was that 5 people found it "very easy", 10 people found it "easy", 2 people found it "neutral", 2 people found it "hard" and 1 person found it "very hard". For a better detail, it is shown in Figure 10. Also, the result of acceptance of the application is obtained; where 87% of people think that it complies with its functionalities and 13% of people think the opposite. These results are shown in Figure 11.

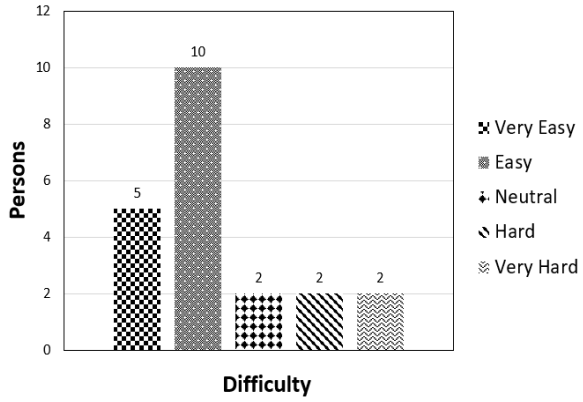


Figure 10. Sprint 2 difficulty diagram

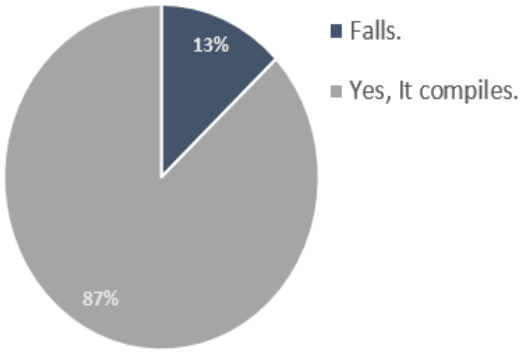


Figure 11. Sprint 2 acceptance diagram

3.1.3. Sprint 3

In this last sprint, the result of the difficulty in using the application was that 3 people found it "very easy", 11 people found it "easy", 1 person found it "neutral", 3 people found it "hard" and 2 people found it "very hard". For better detail, it is shown in Figure 12. Also, the result of acceptance of the application is obtained; where 60% of people think that it complies with its functionalities and 40% of people think the opposite. These results are shown in Figure 13.

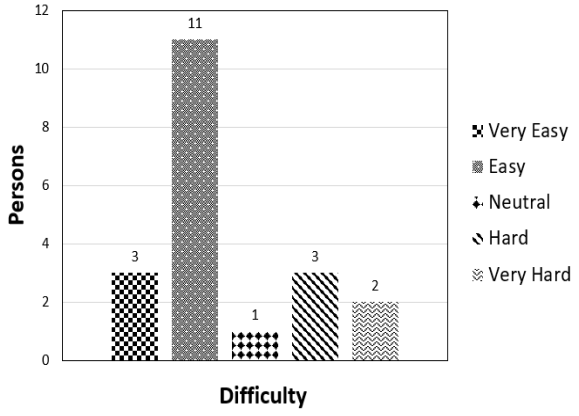


Figure 12. Sprint 3 difficulty

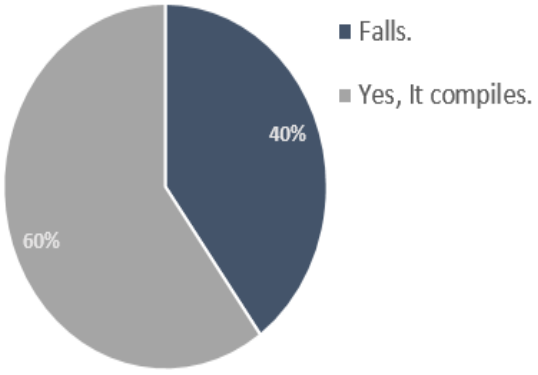


Figure 13. Sprint 3 acceptance

4. CONCLUSION

In conclusion, the implementation of a mobile application to benefit the tourism sector, which has been severely affected by COVID-19, was successfully carried out. The main objective was to create a virtual tour guide to travel around Peru in order to get to know new places and learn about their history. Likewise, this application benefits people who have an economic income through tourism, since they can obtain a greater number of visitors with the suggestions offered by the application. On the other hand, the successful implementation of the application was developed under the scrum methodology, which allowed a joint development, was precise in the times of each sprint and was adaptable to the user's changes. In addition, as future work, it is estimated that this article will be improved based on the functionalities that allow greater

interaction with the user, implementing new technological tools such as artificial intelligence, machine learning, and deep learning, among others that allow its improvement.

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