

Prototype of Mobile Application Oriented to the Educational Help for Blind People in Peru

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Abstract—The article focuses on the orientation of educational aids for blind people. The prototype was made with the Scrum methodology and the prototype design tool called Balsamiq was used. Its objective is to design Prototypes of mobile application oriented to educational aid for blind people in Peru so that they have a decent and adequate education. The prototype is represented by 4 sprints, the first of user validation, the second of user registration, the third of classes or courses and the last of videoconferencing. In the application, a validation of the existing or new user's data was performed, where the user accesses the courses, he/she takes, so that he/she can choose a class by voice message, choosing to have a videoconference with a teacher. The proposed result for blind people to have a proper education is to optimize the learning process, through a prototype application, for each user or student where they can adapt in their studies, in addition to having blind people to make appropriate decisions in education, in the same way enhance the skills that these people have in education with a prototype of help for blind people designed in a prototype mobile application in Peru.

Keywords—balsamiq, blind people, design prototypes, education, mobile application, Scrum methodology

1 Introduction

In recent years, according to OMS studies, more than 28 million people with visual impairment have been registered worldwide. This is an alarming and worrying figure. All of these people have various limitations or obstacles to carry out their work, and for this they usually use the only tool to move around, which is a cane or a guide dog [1].

There are several cases in different parts of the world, such as South America, where 3 million visually impaired people have been registered in Brazil, and TIC is the only means for them to access different types of information and digital services. Moreover, there is a great absence of education for these vulnerable people, since this disease is a great obstacle for them to have a decent education as any person [2].

Moreover, over the years, various methods have been worked on to diminish this problem, with conventional mobile devices being the most beneficial, as they have been

very helpful, offering better communication with family members through audios, and screen-reading software, for better and safer interaction with the blind [3].

According to studies in the country, 10% of people have some kind of disability, of which 48.3% have visual difficulty [4], as shown in the census conducted in 2017. Therefore, it is stated that the number of blind people up to 2018 is approximately 1,473,928 people with visual disabilities, according to the National Institute of Statistics and Information (INEI) [5].

Moreover, the survey conducted by the INEI for the education sector in 2016 shows that the level of education provided by the population of students 15 years of age and older, there is a large gap between people with disabilities and people without disabilities. In the first group, the highest proportion reaches primary education with 41.4 %, on the other hand, 24.8 % some years of secondary education, 22.3 % did not reach any level of education; since they only had initial studies; and 11.5 % managed to study some year of higher education [6]. On the other hand, among people without disabilities, the group that managed to study some year of secondary education predominates (45%), followed by higher education (31.1%), primary education (20.5%) and 3.4% did not reach any level of education or only with pre-school studies [7]. Education is a fundamental right that every person should receive, but there are many limitations when trying to achieve a better quality of education, especially for people who suffer from some kind of visual impairment, since they are often deprived of studying in a public or private institution due to lack of economic resources or a shortage of books adapted to the Braille system [8].

Because the visual disability in people is a factor that limits the duties and tasks, taking into account their education and their way of life, because these blind people do not have a complete education, causing the prevention of access to various platforms that any student needs, such as books, magazines, texts, etc. [9]. This aspect makes it difficult for the blind student to have a clear and better communication with the teacher of the school, so that the student lives possible situations of discrimination, and therefore through the prototype of educational assistance, generate a great change to the education of Peru, and thus demonstrate how a blind person can overcome their disability [10].

This work is very important, since a prototype of educational aid was made, to support blind people, through applications, that can minimize this problem, which keeps truncated the education of blind people, who cannot have a decent and normal education like any human being, because there are no adequate means for this to happen.

As well as those application of intelligent telephones of tactile use, which help by means of the attention and support for disabled people increasing the interaction with intelligent tools, and consequently it has been increased more cases of favored people who have learned more by means of the interaction with prototypes and applications [11]. Therefore, the prototype ensures good results, and consequently encourages more people with the same problem, and helps them to improve their way of life.

The objective of this article is to make a prototype application of educational assistance for blind people in Peru. And as a result, to reduce the various cases of blind people who have not been able to finish school due to their disability. And with this, to

demonstrate that a disability is not an obstacle to having a dignified education like any normal person.

Section 2 shows the methodology with prototype applications of educational aids for blind people. Section 3 shows the case study for the development of our prototype. In section 4 he deals with the results and discussions that blind people like. Finally, in section 5 of conclusions shows deal with the conclusions obtained.

2 Methodology

The methodology used to create the application prototype of educational aids for the blind in Peru was scrum.

2.1 Agile Scrum methodology

With the Scrum methodology, the different functionalities and objectives are organized to achieve the development of the prototype.

The Scrum process involves a Scrum Master, the Product Owner and the Scrum Team. In the realization of this prototype, the main role of the Scrum Masters is to eliminate impediments [12]. The Scrum team is multifunctional as it is composed of developers, testers and other experts from various fields, which are required in the development of the final prototype, which will be versatile and innovative and must meet the satisfaction of the customer. The methodology was used organizing ideas in Sprint.

So, a sprint is the method which are worked for the assignment of the tasks to be worked, so it would last from 1 to 3 weeks. The objective of each sprint is to deliver a potentially unviable product. Mainly we must identify the Scrum processes [13].

Backlog product. Through this stage we will be able to indicate the various requirements of the functionalities that the mobile application prototype will need in order to identify the needs and find a solution soon. In addition, it tells us that we must work with a list of requirements determined by the owner of the product and are also called user stories. Moreover, it tells us that we must work with a list of requirements determined by the owner of the product and are also called user stories [14].

- As a user, I need to register an account through voice audio to be able to enter the application.
- As a user, I need to enter the application correctly, to be able to visualize the courses and workshops.
- As a user, I need to listen to the instructions of the application in order to perform the desired action.

Sprint backlog. At this stage we will be able to identify the various tasks, and those resources that we will need for the realization of the product. And we will work a documentation of all the increments [15].

- Increase 1: Main start, this increment shows the main part of the application which if we have a user, we enter with voice audio or otherwise we must register with voice audio.
- Increase 2: New user, in this increase we will have to register through a voice audio to be able to use the application.
- Increase 3: Choose the action or task, in this increase we will be able to visualize and listen to the tasks, questions, stories, etc. that we want to choose.
- Increase 4: Activities Calendar, in this increase we will be able to visualize and listen to the activities that are programmed in the calendar.

Sprint planning meeting. In this stage are check if the project was developed correctly as planned, through various meetings, in which are discuss the progress, the problems that have arisen, and what intend to do to solve these problems and how we intend to advance in the mobile application prototype. It is divided into sprint delays followed by sprint planning which includes methods to get a Sprint done [16].

Sprint execution. In this stage detail the time that will be assigned in the creation of our software prototype, and with it we will have to work according to the time that the project will be executed.

Sprint retrospective. Through this stage are present the finished Sprint, which indicate the requirements that the client assigned for the realization of our educational software prototype for the blind in Peru. Emphasizing that through the agile Scrum methodology there a better organization of the project's objectives, following the steps correctly to be able to work on it [17]. In Figure 1, shows the process of the Scrum Methodology, withwhich we will work for the realization of the educational aid prototype, through the different steps of the methodology.



Fig. 1. Process of the Scrum methodology [18]

2.2 Tools

The tools we will use to create the prototype of the mobile application for blind people in Peru are

Android studio. Android is an open-source operating system for mobiles. Android has been designed to allow users to create different applications taking advantage of the different features and utilities of their phones. The idea is that you can create all kinds of applications using all the functions of the phone you want, and combining them as you want. Since it is an open-source operating system, all applications created with Android can be shared with other users who also use it [19].

Firestore. Firestore is a web application platform created by Google, whose main function is the development and creation of high-quality apps in a fast and secure way, in order to increase the user base and earn more money. It also supports developers in the creation of high-quality applications [20].

Balsamiq. It makes prototyping easy and simple by having an interface for mobile applications and websites, with this tool a prototype will be made to know how a blind person does his classes [21].

In this section the prototypes for visually impaired people will be created, since the application will have a built-in audio, which will be in charge of indicating to the students at what moment they must speak to register or enter the application, through an audio indicating their data and password, then those activities, courses, cards, questionnaires that will be worked on will be shown, so the students will have the facility to choose the courses or activities through a single voice audio. They will also be able to enter the lecture videos with the help of the audio of the application to the chosen class, and through it demonstrate the interaction between teacher-student and student-teacher, finally the student will say the keyword to pause and / or exit the application.

3 Case Study

This section details the steps involved in the case study of the prototype application.

3.1 Startup stage

This stage is classified according to the identification of requirements and user stories.

Identification of requirements. In identifying the requirements, the different functions that the mobile application was presented in an orderly manner, and highlight that, with this, different blind students can benefit, as shown in Table 1.

Table 1. Requirements

Requirements
The application must allow to show a start in which it will ask the user, the username and the respective password.
The application must have a main menu in which the option to register a new user will be given, in which the different tasks will be shown.
The application should have a main menu, in which the various tasks are displayed.

Identification of user stories. In the identification of the user stories, make known each point of operation of the user in this case that is the student so you can provide with all the functionality of the mobile application, as shown in Table 2.

Table 2. User history

User History	
As a user I want to enter the application through a login so I can see the various options offered by the application menu	
As a user I want to enter a class and/or workshop in order to attend the activity that is scheduled.	
As a user I want to enter an audio-conference in order to have knowledge about the teacher's classes.	

In the estimation table are focus on the different items, each of which will have its respective priority according to the importance it has in the process of creating the application. And so can have clear information on how the application is progressing for blind people and thus be able to get closer to the goal set out above, as shown in Table 3.

Table 3. Estimate

Nº	Item	Priority	Estimate
1	As a User I want to access the application through a	High	2
2	As a user I want to access the menu option to view and hear the areas to be	High	4
3	As a user I want to be able to access the virtual evaluation option in order to identify the correct answers to the questions of the stories and/or workshops that the application will give me	High	13
4	As a user I want to be able to access the virtual evaluation option, in order to identify the correct answers to the questions of the stories and/or workshops that the application will give me	High	12
5	As a user I want to access the option calendar of activities, to be able to have in clear those activities that will be carried out in the next	Medium	10
6	As a user I want to access the audio-conference option, to be able to participate and give my opinion about the topic	Medium	8

3.2 Planning stage

In this planning stage, the proposed objectives was addressed, through the poker estimation, taking into account the user stories and thus adequately obtain the sprint in each execution, and thus be able to have a better progress of how and why the mobile application is being made, as shown in Table 4.

Table 4. Poker estimation

Item	To Do	In Progress	Done
Design	H1	H3 H2	
Development		H4	
	H5		H6

3.3 Development stage

This section explains the use case, in which it deals with the different situation times of each of the sprints that work on for the creation of the prototype.

Sprint execution

- a) **Sprint 1: Main Home.** - First, in order to enter the application, through a voice audio, the application will ask the blind user the user's name and then the respective password, for which the blind user will answer through a voice audio so they can enter their respective account; as shown in Figure 2.

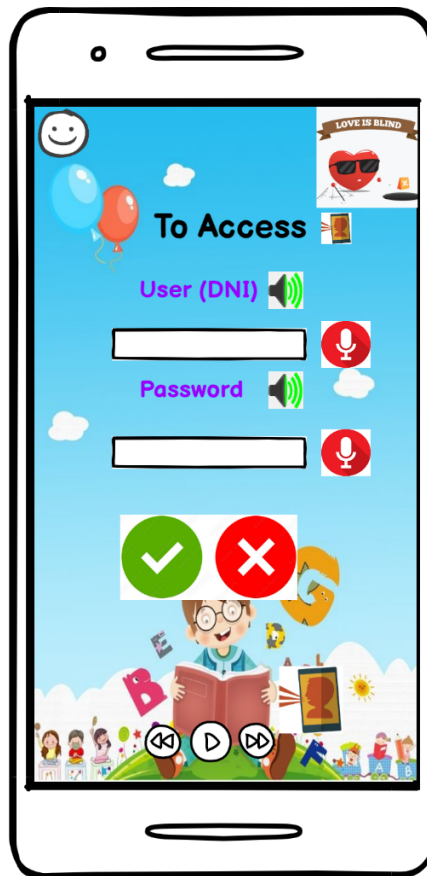


Fig. 2. Main home of the mobile application

- b) **Sprint 2: New user.** - To register with a new account in the application, first the data is given through a voice audio, where the name, surname, age, etc. and the respective school where the new user is, where he/she studies, whether private or state school (see Figure 3).

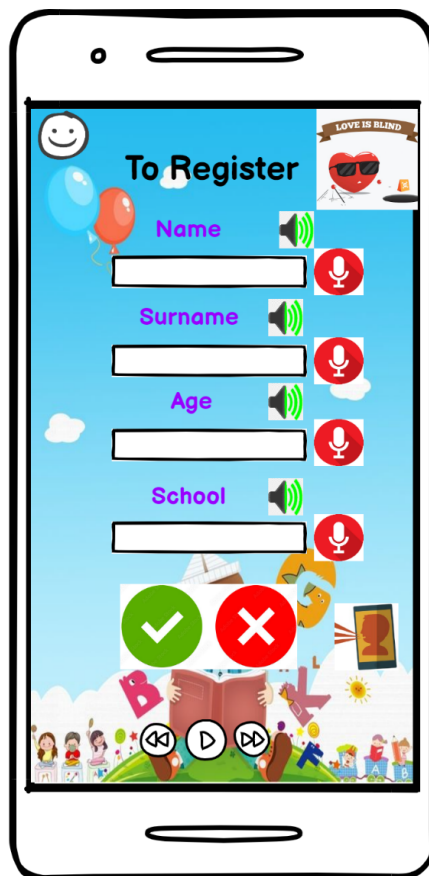


Fig. 3. New user sample for the mobile application

- c) **Sprint 3:** Choose the action or task. - In this part through a voice audio, the application will ask for the action to be offered, including educational tasks, questions and stories from the different courses, which will help them to stimulate their learning through explicit audios, etc. as shown in Figure 4.



Fig. 4. Main menu of the mobile application

- d) **Sprint 4:** Calendar of Activities. - To listen to the activities scheduled in the calendar of the different courses, the application will communicate to the user the different activities scheduled in the coming days and weeks, as well as various educational tasks and lectures through voice audio (see Figure 5).



Fig. 5. Sample of the audio conference that the user chose

Sprint retrospective. - The last phase is the completion of all the sprints with the requirements that were delivered at the beginning of the project, since at this stage, the design and the correct functioning of the application was evaluated, culminating together with its functionality what had been proposed at the beginning. Table 5 shows the characteristics and functionalities of Sprint 1, detailing the action of the new user in the mobile application.

Table 5. Sprint 1

Sprint 1	
User History:	As a user I want to enter the application through a login so I can see the various options offered by the menu.
Ordered:	Jhony Huayllani
N° Item:	1
Estimated Time:	2 days
User:	Student

Criteria for Acceptance:	voice and audio mail and/or id and password * Audio that allows to enter or specify data.
User History:	As a user I want to enter a class and/or workshop in order to attend the activity that is scheduled.
Ordered:	Jhony Huayllani
N° Item:	2
Estimated Time:	4 days
User:	Student
Criteria For Acceptance	Panel of their courses.

In Table 6, details the characteristics and functionalities of Sprint2, detailing the action of the blind in video conferences.

Table 6. Sprint 2

Sprint 2	
User History:	As a user I want to enter a video conference in order to have knowledge about the teacher's classes.
Ordered:	Jean Pierre Saldaña
N° Item:	3
Estimated Time:	2 days
User:	Student
Criteria for Acceptance:	voice and audio of a class. that allows you to enter or specify data.
User History:	As a user I want to return to the main calendar to be able to listen to the various classes and/or workshops that are scheduled.
Ordered:	Jean Pierre Saldaña
N° Item:	4
Estimated Time:	5 days
User:	Student
Criteria For Acceptance	panel of their video conference courses

In Table 7, details the characteristics and functionalities of Sprint 3, detailing the action of the user's questions and answerstowards the application.

Table 7. Sprint 3

Sprint 3	
User History:	As a user I want to finish the videoconference in order to ask questions and give answers to
Ordered:	the application
N° Item:	Jean Pierre Saldaña, Jhony Huayllani
Estimated Time:	5
User:	7 days
Criteria for Acceptance:	Student

4 Results and discussions

4.1 About the case study

By having an application for blind people in the country [22], it supports in a formidable way, because these people can get ahead even with difficulties they have, on the other hand, can appreciate that it was a help, to be able to reach each use of virtual platform sample, with audios and different modes of selection of the sessions to perform [23]. The result obtained by the authors [21] is that it allowed the satisfaction of people with said visual disability since with the help of instructions they could be guided to carry out different activities such as searching for routes among others.

In addition, it must be emphasized that in the country there are few entities that can provide educational support to these blind people, further increasing the risk that more blind people will not be able to finish their studies in an adequate manner. In order to minimize this situation, an application is needed that can stop this lack of education for blind people [24]. It has been demonstrated that through interactions with software and mobile applications, visually impaired people are more likely to learn educationally. Moreover, thanks to the in-depth research on blind people with a lack of education, were able to emphasize and prove that many blind students, despite having the resources to be able to study, do not study because of their disability [25]. Unlike other departments in our country, it is the capital city that has the highest percentage of blind students who do not study, since schools often reject them, or sometimes parents cannot make their children's education a higher priority.

In Figure 6, the y-axis represents values in percentages, can see how in the most important cities of the country, a high statistical regime of blind people in the country is shown, because according to reports of the Census, it is shown that most of the blind people reside in the city of Lima with a 38, 29%, followed by the departments of Piura with 5.62%, the department of La Libertad with 5.14%, Arequipa with 4.88%, and the city of Lambayeque with 4.16, while the rest of the departments do not exceed 4% of blind citizens. According to the INEI, the gap is wide in inclusive education [6][7]. However, in the proposed proposal it is possible to reduce the gap, since the use of mobile applications is an alternative to contribute to said education.

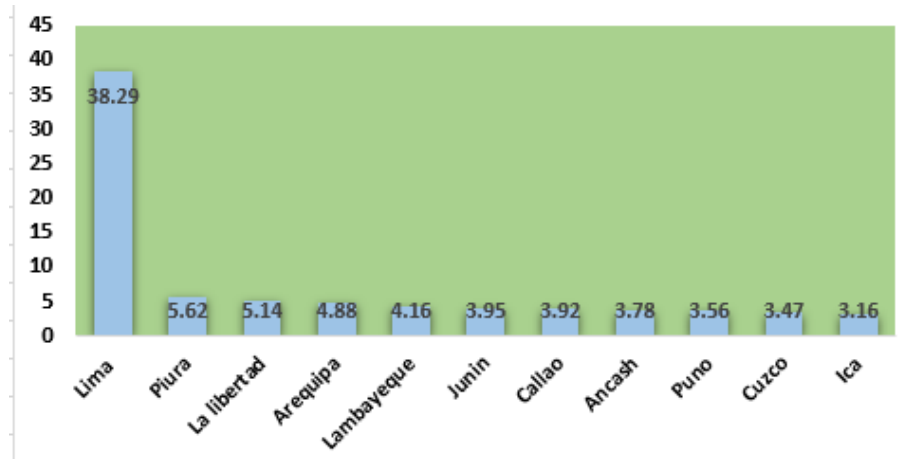


Fig. 6. Statistical graph of the cities with the most blind students

With these results of the Census, can highlight that the city of Lima is the city with the greatest presence of blind people, and at the same time with the greatest absence of blind people without a decent and safe education; coinciding with the author [4], who states that 10% of people have some disability, where 48.3% have visual problems.

It can be said that the growth of inequality in education by parts of blind people will not decrease if the policy of the country under study (Peru) does not have clear rules with financing to train teachers for special education; in this case blind people. In addition, it must be strengthened using emerging technologies for special education. Likewise, the teaching-learning strategy, such as the didactics of teaching, must be exclusive for this type of study.

4.2 About the methodology

Applying the scrum methodology through a staged work environment, which helps to obtain the requirements as well as the user stories, and also raise the sprints with the obtained estimates [26]. In addition, the work team, with the scrum methodology has not taken any steps in the sprints, to reduce the time.

Advantages. Thanks to the Scrum methodology, it was possible to have a better organization of the sprints, through the user stories. The sprints, and these actions, helped to classify the requirements by their value, and thus have a better focus on the project creation process [27].

In addition, through the different stages of Scrum, we were able to have a better understanding of how a project can be organized, using the correct steps to perform requirements, estimations, and so on. And with this, we were able to have a clear sample of how we should achieve the objective, which is the creation of a prototype of a mobile application for educational assistance for blind people in Peru. On the other hand, we were able to recognize the problems that could jeopardize the creation of our prototype, and thus prevent them from affecting our proposed sprints. It was also possible to have

a clear approach of how the actions of the application would be thanks to the execution of the Sprint, which helped to know how the start menu would be, the options that the application would offer, through a prototype that was worked with the Balsamiq tool. On the other hand for the creation of the prototype, as shown in Figure 4, and Figure 5, the actions that the blind user will have with the application are detailed, being this of great help for the user, improving their intellectual and educational facet, and thus prove that thanks to the methodology can have a better concentration of the objectives, encouraging blind users to have a better quality of life, taking into account that Scrum is a methodology that can help to organize the activities to perform the research work.

Disadvantages. A disadvantage of Scrum is that in certain cases the steps that are followed for the creation of the sprint are usually shortened, since with it you can have a better organization of the sprints, requirements, user stories, etc. [28].

On the other hand, it should be noted that Scrum has several limitations, if in case one of the team members withdraws, it will not be possible to advance the prototype according to the time that was originally planned.

It should also be noted that if the estimates are not properly prioritized, it will not be possible to have a correct categorization of user actions, as well as requirements that help to make a more orderly creation of the prototype mobile application.

Comparison. On the Scrum side it has been demonstrated that by means of the Sprints you can have a better idea of how the prototypes of the application will look like as well as with the estimates [29].

However, on the side of the user stories in certain cases it is not possible to define on who will be the manager, because it depends on who will have the best criteria to perform the acceptance criteria. In addition, we can say that, through the Requirements, the user's actions with the mobile application could be kept in order.

It should also be noted that other agile methodologies do not usually offer those features that Scrum offers [30], since Scrum has the ability to manage a project in an appropriate manner, raising the ideas and meetings in an orderly and efficient way to achieve the proposed objectives. The strength of the scrum methodology is that it works with products for each sprint, which means that in an interval of 2 to 3 weeks it can be carried out in your case or prototype in its initial part depending on the user's requirement that is carried out by the Product owner. However, the author [13] argues that each scrum stage lasts up to 3 weeks; that will depend on the project and the time each sprint requires. In addition, the methodology is adaptable to change, a characteristic of all agile methodologies. Also, meetings are held for planning, review and retrospective for continuous improvement [31].

It should be noted that Scrum has helped plan and organize various international projects, being one of the most used methodologies worldwide, emphasizing that Scrum stands out from other methodologies, as shown in Figure 7, indicating that Scrum stands out with 52%.

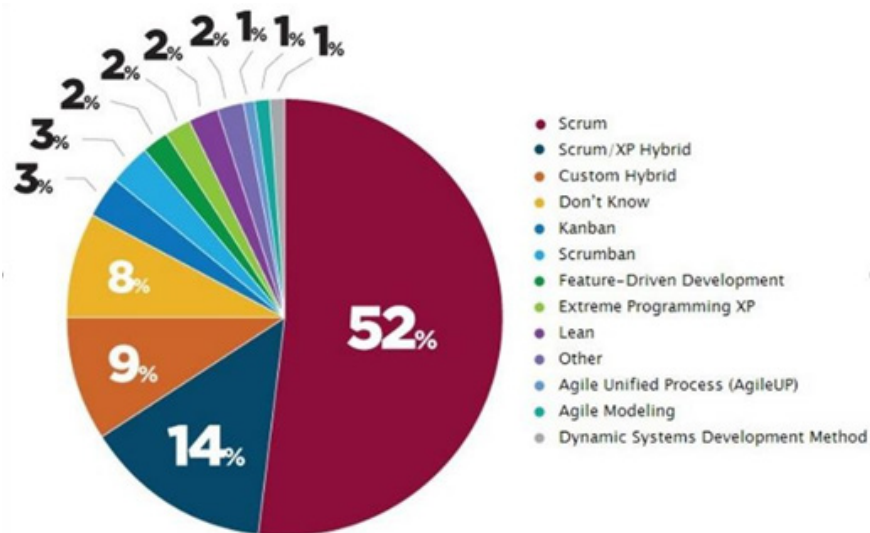


Fig. 7. Statistical chart of the most used methodologies

5 Conclusions

In conclusion, thanks to the Scrum methodology, it was possible to achieve a mobile educational assistance application for the blind, which has had favorable results, since it has reduced the statistical rates of those students who have not been able to complete their studies due to this disability. The methodology used allowed to make the prototypes for its implementation in an adequate way and in this way the students with this disability benefited; thus, minimizing the problem.

Finally, the objective that was raised at the beginning was met, with positive results. This shows that several blind students had a better learning experience through the virtual class with their virtual teacher, through workshops, storytelling and audio conferences, favoring the intellectual side and self-esteem of the students, and with this it was possible to demonstrate that a disability is not an impediment to having a decent education like any other person. As future work, it recognizes that the prototype application should be a reality in the coming years, since technology is currently one of the main resources of education, and thus the prototype application will favor different blind people and/or students [30]. It is suggested in the future that it can be complemented with augmented reality studies, with the use of machine learning, for which the study must be multidisciplinary, with experts in electronics and computer science.

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