

Design of a chatbot in a mobile application for managing payments and controlling activities in a fast school organization

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ABSTRACT

The fast school (FS) educational organization, like many contemporary educational institutions, faces challenges in efficient payment management and rigorous control of activities. Technology, particularly through mobile applications, has shown to be a potential solution to these problems, allowing institutions to stay at the forefront and provide optimized services to their educational community. Therefore, this research work focuses on how a chatbot, integrated into a mobile application, can improve payment management and control of activities in the FS educational organization. Through a detailed study on current trends in educational technology, the design and development of a chatbot adapted to the specific needs of the organization is presented. This chatbot not only facilitates payment processes, offering immediate responses and managing transactions, but also allows for more efficient control of academic and extracurricular activities, improving the experience of its users. In conclusion, the integration of chatbots in mobile applications is presented as a viable and promising solution to face and overcome management challenges in modern educational environments, providing adaptive and user-centered tools that enhance the operational efficiency of institutions. This work is developed with the Scrum methodology and presents a security gateway validated by a digital token.

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1. INTRODUCTION

Currently, the fast school educational organization (FS) has implemented an online intranet web system since 2017. This system is developed to consult grades, documents and attendance information about the student, and is the intermediary between the computers, the users in the operations area and the proxies. However, after an exhaustive analysis, it was confirmed that the web system does not address the payment process, which has given rise to a problem in the operations area (checkout), generating saturation in the service and lines with delays in attention. Additionally, in the marketing area, a problem was identified related to the lack of complete information to parents about the activities carried out in the organization, which has contributed to a gap in the communication and vision of the institution. Consequently, the currently mentioned problems have resulted in the discontent of the representatives and have created a discrepancy with the vision of the organization.

We present some problems that the Institution suffers from and opportunities to improve:

- Payment management: the current system does not address the payment process, which has generated saturation in the service and delays in care in the operations area.
- Communication with parents: lack of complete information to parents about the activities carried out in the organization, which has contributed to a gap in the communication and vision of the institution.
- Adoption of new technologies: resistance to change and lack of adaptation to new technologies, which makes it difficult to implement innovative solutions such as the use of mobile applications and chatbots.
- Efficiency in communication and operation: need to improve payment management and activity control through technological solutions that allow efficient communication and more agile operation.
- Technology training: it is necessary to train both teachers and students in the effective use of technologies, especially in the academic field, to make the most of the available tools.
- Payment security: guarantee security in online transactions, especially in the payment process, to avoid fraud and ensure the confidentiality of user information.
- Product maintenance: develop a maintenance plan to guarantee the continuity of the product in the face of market changes and user needs.

In this context, it is essential to consider the importance of information and communication technologies (ICT), as established in the research of Guerrero and Matute [1], where the need to adapt to cultural and educational changes is highlighted. Through the effective use of ICT in education. The implementation of a chatbot in the mobile application could be an innovative solution that would not only address the identified problems, but would also be aligned with the evolution of technologies in the educational and operational sphere of the SF organization.

The objective of this research is to design the chatbot into a mobile application for payment management and activity control, in the active FS organization. The development of the research has the following scheme, in section 2 we have a literary review of recent research related to chatbot works. Next, in section 3, the agile scrum methodology was used because it will allow effective management of time and resources, as well as greater flexibility to adapt to changes in client requirements. In section 4 you can view results and discussions, where the impact of productivity, reduction of time and cost, compliance with the objectives, requirements and needs of the interested parties is contemplated. With respect to the discussion, a comparative analysis of the research results related to the work is made. Finally we will see the references of the articles used in this research.

2. LITERATURE REVIEW

This section presents the overview of different previous research works to have a worldview regarding what has been investigated and what remains to be investigated. In recent years, the proliferation of mobile applications has revolutionized the way institutions operate and communicate with their community [2]. For this reason, Barrera, and Ramírez [3] it is defined that an application must be designed to run on smartphones, tablets and other mobile devices, and allows users to perform any type of specific task, including leisure tasks, educational tasks, and access to services likewise [4], emphasizes the importance of mobile devices as essential tools in the educational process. These devices not only offer portability, but also provide a versatile platform for the development and implementation of pedagogical tools. In summary, [5] highlights that the design of an educational mobile application serves to improve communication and interaction in real time between members of educational institutions. This research highlights the potential of mobile applications in educational environments, especially when enriched with additional functionalities such as chatbots. Furthermore, Qaffas [6] indicates that a chatbot has the purpose of facilitating a system for students and this in turn acts as an advisor providing student information. In the case of educational entities, such as the FS organization, the applications can centralize services, offering a unified platform for managing payments and controlling activities.

Consequently, [7] the implementation of a chatbot is carried out to provide academic information at the State University of the South of Manabí. This research shows how a chatbot can be essential in educational environments by providing quick and accurate information to users. Likewise, in the last decade, mobile technologies, including chatbots, have established themselves as essential tools in various areas, including education [2]. These artificial intelligence systems allow real-time interaction, offering support and automatic responses to user concerns. In the educational context, chatbots can facilitate administrative and pedagogical processes, such as payment management and activity control.

Next, [8] payment gateways are considered to play a crucial role in helping merchants, including educational institutions, accept online payments. These not only facilitate transactions, but also provide additional valuable services, such as transaction analysis and anti-fraud tools. Along the same lines, [9]

shows us a guide to the most used gateways in Peru, where the characteristics of the Pago Culqi, Niubiz, Mercado Pago and Izipay gateways are highlighted.

Therefore, Castillo [10] defines that a chatbot is a computer program that can maintain a conversation with an individual without the interaction of a third party, and Lima and Rodríguez [11] agrees that chatbots are computer programs with the ability to converse autonomously through an application with the user. Therefore, the use of chatbots in mobile applications can further enhance online transactions. Chatbots can offer immediate responses to payment queries, guide users through the transaction process, and provide real-time assistance, so the potential of combining chatbots with payment gateways is significant [7].

In summary, [5] present an innovative design for an educational mobile application that seeks to optimize communication and interaction in real time between members of educational institutions. Furthermore, [12] indicates that, to ensure effective adoption of mobile applications, it is crucial to consider aspects such as ease of use, perceived usefulness, and usage intention. Therefore, both studies are particularly relevant to the research in question, since they provide insights on how to design and develop mobile applications that focus on improving communication and management in the educational field.

Despite the obvious benefits, the incorporation of chatbots and mobile applications in educational entities faces obstacles. Adaptation to new technologies can be slow, especially in organizations that have operated under traditional paradigms for a long time [2]. On the other hand, [13] tells us that the technological gap between teachers and students is small, since currently teachers are in constant training in technology; However, students use technology, but not for academic purposes (usually for recreational purposes). For this reason, an appropriate integration process must be considered through training for new application developments.

In relation to the development of the application, [14] a chatbot was proposed to assist users in maintaining their catalog of mobile applications. Although the approach is not exclusively educational, it illustrates how chatbots can be used to offer support on mobile devices. In short, to implement a chatbot in a mobile application, it is essential to understand the different types of applications available. There are native, hybrid and HTML 5 Web applications. Each one has its own advantages and limitations that can influence the user experience and the functionality of the chatbot [2].

The current panorama shows a void in which there has not been an adoption of chatbots and mobile applications in the educational field. Therefore, this new tool will not only improve administrative management, such as payments and activity control, but it can also enrich the educational experience by providing immediate responses and supporting decision making. For the FS organization, the integration of a chatbot in a mobile application could represent a significant advance in the management and administration of its educational and administrative processes.

3. METHOD

Cadavid *et al.* [15] indicate that agile methodologies were born as a reaction to traditional methodologies in order to reduce bureaucracy in software development. Likewise, they detail that the traditional methodology is predictive, process-oriented, rigid process, conceived as a project, little communication with the client, delivery of software at the end of development and extensive documentation; On the other hand, the agile methodology is adaptive, people-oriented, flexible process, a project is subdivided into several smaller projects, constant communication with the client, constant software deliveries and little documentation. At this point, after reviewing agile methodologies such as Scrum, XP, Crystal, ASD, DSDM and FDD; They focused on Scrum which targets project management and XP focuses on development practices.

Consequently, Montero *et al.* [16] states that agile development methodologies are intended for teams where their members are less than ten members. The availability of the client is also necessary, since their feedback is needed on a continuous basis. On the other hand, traditional methodologies present resistance to change, that is, they are not flexible. Along these lines, he suggests using Scrum or XP as an agile methodology; according to the context of the software development project considering human resources, time, user availability and changes in deliverables. Consequently, Goñi *et al.* [17] uses the agile SCRUM method for application development, since it has an iterative and incremental approach, delivering a minimum viable product in a short period of time. Likewise, they conclude that the agile SCRUM methodology helps to replan content and identify problems early.

Also, Lasa *et al.* [18] chose the agile Scrum methodology, adapting to the framework and the composition of his team. The team is characterized by being multifunctional, with each member contributing various skills and capabilities. This choice is supported by the efficiency and adaptability that Scrum offers by allowing the assignment of tasks and responsibilities in a flexible manner. In short, they observed that the team members demonstrated versatility by being able to play different roles according to the needs of the project, which strengthens the decision to implement Scrum as a work methodology.

Along the same lines, significant results have been obtained with this SCRUM methodology in the implementation of systems, as mentioned in the work of Ramírez *et al.* [19], which focused on the development of a virtual store. Another example of a successful application of this methodology is research related to the monitoring of people affected by COVID-19 using an application [20]. Also, there is the development of a desktop application focused on the design of an optimization algorithm for binary classification which had a satisfactory result with said methodology [21]. Finally, it is worth highlighting another relevant work that focuses on electronic commerce and the promotion of the purchase and sale of products online, which is achieved through the implementation of a mobile application in a Peruvian Company [22]. These examples demonstrate the versatility and effectiveness of SCRUM in different systems and application development contexts.

For all these reasons and advantages highlighted by the cited authors, the agile SCRUM method is established as the preferred choice for the development of software applications. This methodology not only offers flexibility and adaptability, but also focuses on delivering value to the customer continuously and effectively. Therefore, based on the SBOK [23], we proceed to mention the phases of Scrum applied to the development of our research: Initiation phase, planning and estimation, implementation, review and retrospective and launch. Likewise, in [24] the development scheme applying SCRUM is visualized, which presents the sequence of methodological steps that must be followed to be able to apply it efficiently, see Figure 1.

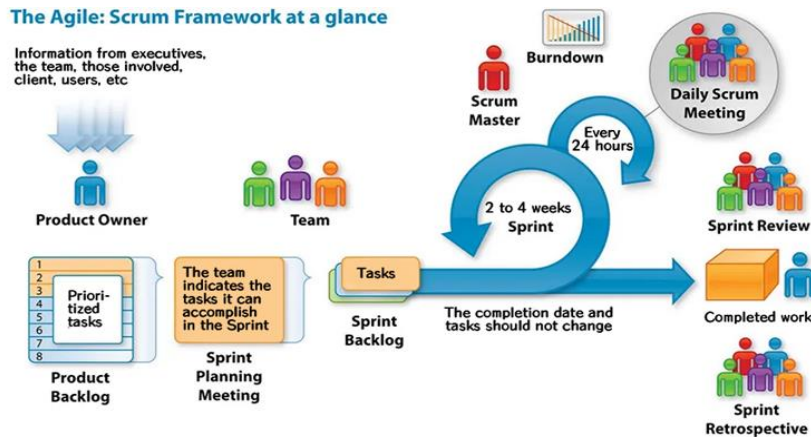


Figure 1. Scrum life cycle

3.1. Development of the methodology

3.1.1. Star phases

A. Roles

The members of the team of this research are designated to fulfill the roles according to their skills and abilities. Likewise, the authors consider teamwork as one of the advantages that Scrum presents, where the commitment of each member to help each other is considered. to solve problems that may arise in the development of its activities, can be seen in Figure 2.

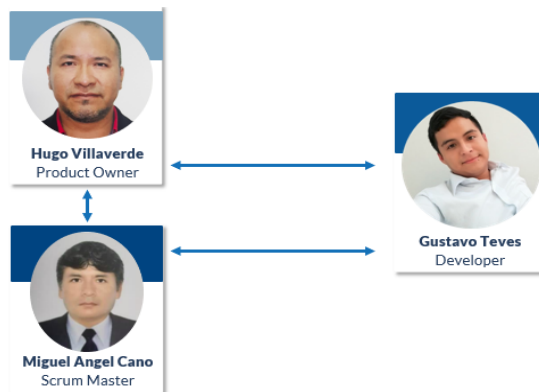


Figure 2. Scrum team diagram

B. Epics

The epics written by the product owner to be developed in this research are detailed, it is a key role in the agile methodology, he serves as a key facilitator in the agile development of the product, who is responsible for representing the interests of the client and the business, as well as as well as ensuring that the development team is focused on creating value for the end user, within the characteristics it has; Product vision, prioritization, decision making, etc. see Table 1.

Table 1. Project epics

Epic ID	AS (ROLE)	Epics – business requirement	
		Quiero	Para
EPIC01	Fast School operations manager	I want the parent to have access to pay the student's pensions from their mobile phone.	To reduce congestion times at the checkouts of our stores.
EPIC02	Fast School marketing manager	I want the parent to be informed of the activities carried out in the educational organization from their mobile phone.	To reduce by 100% the information flyers used in the educational organization.

C. Product backlog prioritized

The prioritized product backlog is described, which contains the user stories that were obtained from the epics, they have also been prioritized with the MoSCoW method [25]. This list is prioritized according to its value to the client and to the overall success of the project, it is flexible and adaptable, transparent, collaborative, among other characteristics, in addition to estimating the effort for each user story, the HU05 together with [26] is used the planning poker technique see Table 2.

Table 2. Backlog prioritization

ID	User story	Product backlog prioritized				Poker planning estimation
		Prioritization			Wont	
		Must	Should	Could		
HU01	Security access	X				20
HU02	Student list	X				20
HU03	Payment list	X				13
HU04	Make payment	X				20
HU05	Initial image of the application			X		13
HU06	Global position	X				20
HU07	Activities list		X			8
HU08	Integrate chatbot	X				20

3.2. Planning and estimation phase

3.2.1. User stories

At this point we proceed to describe in detail the user stories used for the development of this research. It is essential in the development of agile software, since it helps to maintain the focus on the user's needs, facilitates collaboration between the development and stakeholders and enables the delivery of value incrementally and continuously. Among the characteristics that are developed are: user-centered requirements definition, customer value, and effort estimation as shown in Table 3 to Table 10.

Table 3. User story 1

User story	
ID: HU01	Name: security access Dependence: does not apply
I WANT	User history detail I want the representative to be able to enter the mobile application with the username and password of the educational organization's web intranet.
FOR	So that the agent's data does not present identity theft and is approved in the web and mobile system.
	Criteria of acceptance
	1. The user to be entered in the mobile application corresponds to a DNI (national identity document), therefore, only numbers should be allowed to be entered for this field.
	2. The password must be displayed hidden; this means that for each character " * " must be displayed. Also, the password field should only allow a length of 8 to 16 characters.
	3. I want a button to be displayed with the text "Start Session" that allows us to validate if the data entered in the username and password are correct. If so, it should lead to the View listing students.
	4. I want a connection error to be generated or if the data entered is not correct, an error message to be displayed in a pop-up.

Table 4. User story 2

User story		
ID: HU02	Name: student list	Dependence: HU01
User history detail		
I WANT	When I enter the mobile application with the correct credentials, I want the parent to see the list of students under his/her care.	
FOR	So you can view the details for each student you are responsible for.	
Criteria of acceptance		
<ol style="list-style-type: none"> 1. I want the Fast School educational organization logo to be displayed. 2. I want the image of the representative to be displayed in the upper central part in a circular shape. 3. I want the sex of the proxy to be validated so that the message "welcome" or "welcome" is displayed according to the sex of the proxy, this message must be concatenated with the name of the proxy. 4. When listing the students, I want their ID, name, grade and section to be displayed for each of them. 5. I want the image to be displayed for each student in a circular shape. 6. When I press the back button, I want a pop-up to appear with the message "Are you sure you want to log out?" with the following options: <ul style="list-style-type: none"> • Yes: the mobile application must be closed. • No: you must remain in the current View. 		

Table 5. User story 3

User story		
ID: HU03	Name: payment list	Dependence: HU02
User history detail		
I WANT	I want the agent to view a list of payments made and pending payments through the mobile application.	
FOR	So that you can have a record of payments made and payments to be made.	
Criteria of acceptance		
<ol style="list-style-type: none"> 1. I want a View to be shown with the payment details when selecting a student in the View listing students. 2. I want the agent to not be able to make the payment for the current month if he has debts in previous months. 3. I want the pension statuses to be displayed in the View payment details with the following details: <ul style="list-style-type: none"> • Pensions paid should be shown in green. • Pensions that have not been realized must be shown in gray with the exception of the pension with the oldest date, which must be shown in red. 4. I want a pop-up to be displayed with information about the pending payment, which should show the description, amount and expiration date. This pop-up will only be shown for the pension that has debt with the oldest date. 5. I want that after viewing the pop-up there is a "continue" button that is activated and allows you to enter the Cards View to proceed to make the payment. 6. I want an image and a message with the following detail to be displayed at the top centered: <ul style="list-style-type: none"> • If you have no debts, you should see a reference image and the message "Congratulations! Your payments are up to date. • If you have debts, you should see a referring image and the message "Remember! You have pending payments." 		

Table 6. User story 4

User story		
ID: HU04	Name: make payments	Dependence: HU03
User history detail		
I WANT	I want the representative to be able to pay the student's pensions through the mobile application.	
FOR	To control the saturation of the service in the operations area (Cash)	
Criteria of acceptance		
<ol style="list-style-type: none"> 1. I want the description, total and payment due date to be displayed at the top of the View. 2. I want the View to display the fields to enter the card data and data required to make the payment on the CULQI gateway. 3. I want payment to be made with debit or credit cards such as Visa, MasterCard, American Express or Diners Club. 4. I want the representative to give their consent to use their debit or credit card, selecting a check with the message "I accept the use of my card." When selecting this check, the "Confirm payment" button must be activated. 5. I want that when the "Confirm payment" button is active and selected, the payment is made and at the end of the process a message is displayed in a pop-up. If the payment process is correct, "Successful operation" should be displayed, otherwise a message with the error description should be displayed. 		

Table 7. User story 5

User story		
ID: HU05	Name: initial image of the application	Dependence: does not apply
User history detail		
I WANT	I want when entering the mobile application to show a preview animation where the representative enters their credentials	
FOR	To ensure that the mobile application identifies with the image of the educational organization	
Criteria of acceptance		
<ol style="list-style-type: none"> 1. I want an animation with the Fast School logo to be displayed when I load the mobile application. Its duration must be 5 seconds. The animation must be validated by the digital marketing area. 2. I want the orange color associated with RGB #ff5722 to predominate. 		

Table 8. User story 6

User story		
ID: HU06	Name: global position	Dependence: HU02
User history detail		
I WANT FOR	I want the parent to view a menu with options for each student in charge So that the agent's interaction is more fluid and easier to understand	
Criteria of acceptance		
1. I want the logo of the educational organization to be displayed in the upper left part of the view. Additionally, I want the student's photo to be displayed in the top center.		
2. I want you to be able to select "payments" or "activities" in the options menu. Having said that, you must proceed:		
<ul style="list-style-type: none"> • If "payments" is selected, the View listing payments must be displayed. • If "activities" is selected, the View listing activities should be displayed. 		

Table 9. User story 7

User story		
ID: HU07	Name: activities list	Dependence: HU06
User history detail		
I WANT FOR	I want the representative to be able to view the list of activities carried out by the educational organization. So that you are updated with the information at the time you are available to access the mobile application.	
Criteria of acceptance		
1. All activities carried out in the educational organization must be listed.		
2. I want the image of each published activity to be shown in the View, and I also want it to be able to see its details when selecting an activity.		

Table 10. User story 8

User story		
ID: HU08	Name: integrate chatbot	Dependence: HU03 y HU07
User history detail		
I WANT FOR	I want a chatbot option to be displayed when entering the mobile application. To ensure that the representative can have the option to make payments and consult activities from a chatbot.	
Criteria of acceptance		
1. I want a chatbot icon to be displayed when I load the mobile application in the global position.		
2. I want when I click on the chatbot icon to show me a chat where the representative can interact to make the payment and consult the student's activities.		

3.3. Implementation phase

3.3.1. Update log impediments

Table 11 describes the obstacles that arose in the productivity of the Scrum Team, we must mention that it is important to update the impediment log in Scrum to guarantee transparency and efficient problem resolution during the development of the project. Here are some key points about this practice; identification of impediments, record of impediments, follow-up meetings, among other considerations. It can be seen in Table 11.

Table 11. Updated log ingredients

ID	Impediments of updated log
LOG01	The team did not have availability from Monday to Friday during the 9:00 a.m. schedule. to 6:00 p.m. Therefore, to maintain constant progress within the project, meetings are held virtually.
LOG02	Intermittency in the test environment of the CULQI payment gateway.
LOG03	Resource team has basic knowledge of the tools used in the investigation.

3.3.2. Daily standup

In the Daily Standup, brief daily meetings were held with a time-box of 15 minutes. In this meeting, each team member gave answers to the following three questions.

- What have I done since the last meeting?
- What do I plan to do before the next meeting?
- What impediments or obstacles (if any) am I currently facing?

These three questions were asked verbally, and it was possible to have a clear understanding of the current work situation.

3.4. Review and retrospective phase

The Scrum Team demonstrates the sprint deliverables to the product owner and relevant stakeholders during a sprint review meeting. The purpose of this meeting is to achieve the approval and acceptance of the product owner regarding the product or service, in greater detail it is seen in Table 12. Additionally, this meeting provides an opportunity to receive feedback and adjust the product as necessary to better align it with customer expectations.

Table 12. Sprint of the project

Sprint	ID HU	Name HU	Estimate
1	HU01	Security access	7 days
	HU02	Student list	
	HU03	Payment list	
	HU04	Make payments	
2	HU05	Global position	7 days
	HU06	Activities list	
3	HU07	Initial image of the application	7 days
	HU08	Integrate chatbot	

In Figure 3 you can see the development of the architecture of the mobile application, as well as the use of design patterns, libraries, and payment gateways. This technological representation will contribute to improving the usability and functionality of the application. In addition, it facilitates the integration of new features and future scalability of the system.

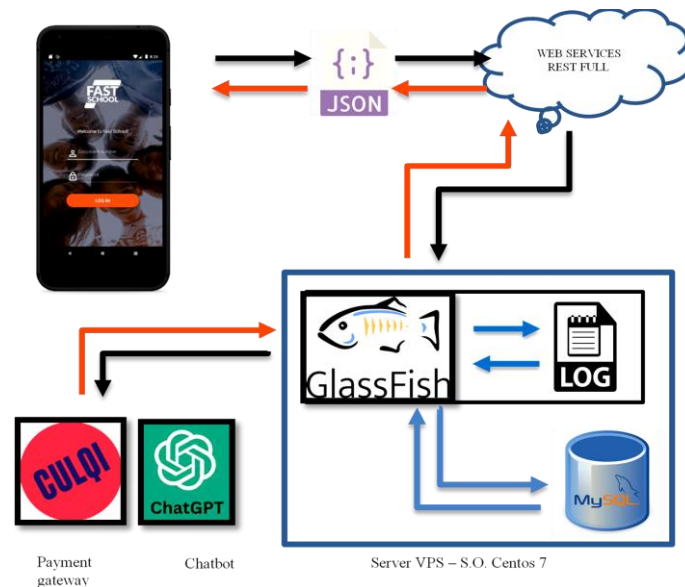


Figure 3. Application architecture

I must consider that the following technologies are used in the proposed architecture:

- A. For the development of the mobile application
 - Singleton Pattern. It is a pattern that allows you to restrict the creation of objects belonging to a class. Therefore, it will be used in the development of the mobile application in order to create a context object and to initialize Fresco.
 - Retrofit. It is developed by the esquare team with the purpose of converting the HTTP API into a Java interface. Likewise, it is recommended by Android Developer for the development of the JETPACK architecture. Therefore, it will be used in the mobile application to manage requests or consumption to web services.
 - Fresco. It is used and developed by Facebook, which is why it aligns with the use of current libraries for the project. It will be responsible for loading and viewing images in the mobile application.

- Culqui. It is a payment gateway that seeks to simplify payments, providing support for fraud control and access to pay with debit or credit cards (Visa, MasterCard, American Express or Diners Club). You will be responsible for making online payments in the mobile application.
 - ChatGPT. It is an API to integrate the chatbot within the application in order to send requests and receive responses.
- B. For the development of web services rest full
- MVC architecture pattern (model – view – controller). Separates the data and business logic of an application from its representation and the module in charge of managing events and communications. Therefore, it was proposed to develop the web service with MVC.
 - JDBC. The JDBC API will be used to connect the web service with the MySQL database.
 - Log4j. The library developed in Java will be used with the purpose of generating a trace for each transaction at runtime within the web service.
 - JSON. It was proposed that the services performed return a JSON format, since less time is needed to structure it and its transmission, and the processing is much faster than XML.
 - Trace log in the VPS server log. A trace log will be created in order to have the INPUT and OUTPUT data towards the Culqi provider identified in case of possible incidents.
 - Security with Token authorization. To access and consult the services developed in the web services, they must have an authorization token, which will only be generated when the user enters the mobile application and from the Login screen consumes the “validarApoderado” service with the correct ID and password.
- C. For implementation on a VPS server
- MySQL database. A cloud database will be used with the purpose of replicating the Trilce database, since the systems area provided us with the tables that will be used in the development of the project.
 - GlassFish Server. It will be used to display the WAR generated from the web services, and it is also configured to record the trace log with the current time. Figure 4 shows us the data model used for this research.

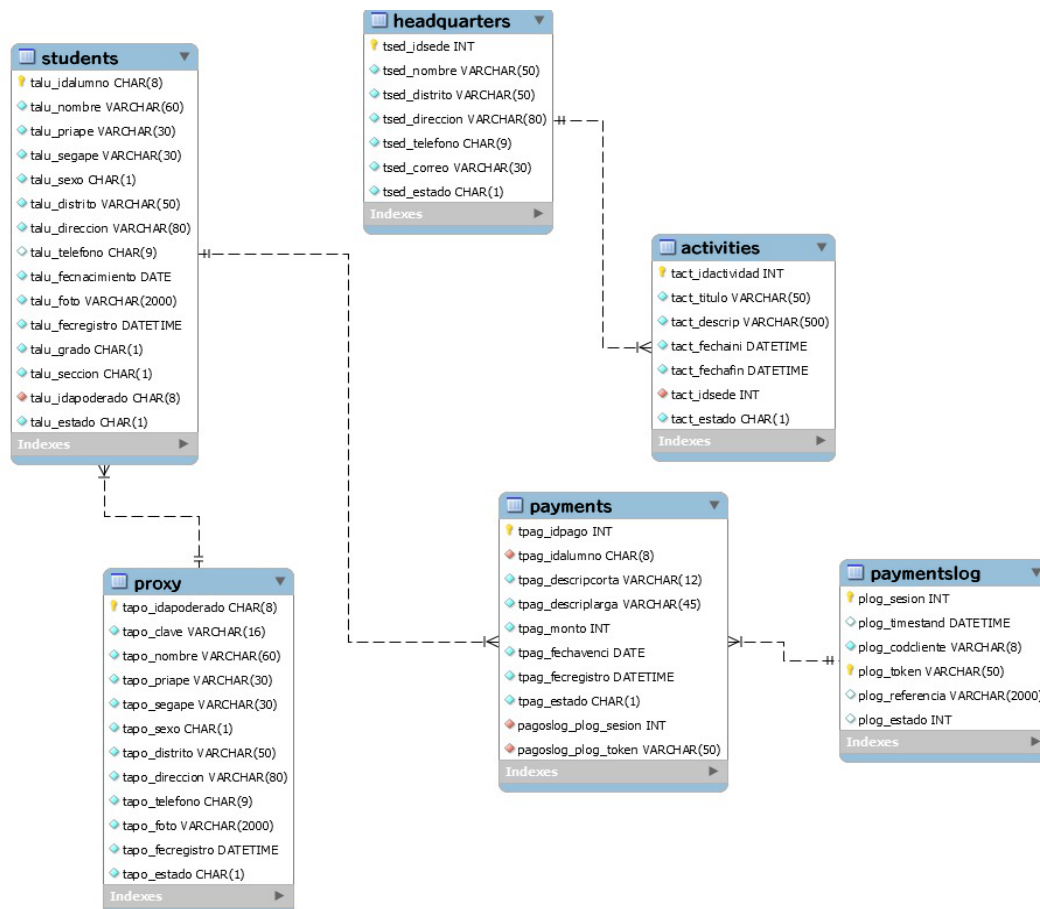


Figure 4. Data model

3.5. Launch phase

3.5.1. Restrospective

In the retrospective meeting, we discussed how things went during the development of all the sprints, which is why the points obtained from the conversation by the Scrum Team, Scrum Master and product owner are mentioned.

- We must continue learning about the agile Scrum methodology, using the SBOK with the latest version to be updated, since the agile Scrum methodology allowed us to carry out the project in a short period of time, delivering a product with the client's requirements.
- Digital tools should be used to speed up the development of future projects, such as scrumboard and poker card.
- The work team managed to consolidate efficiently.

Finally, it is noted that the project retrospective meeting concluded satisfactorily.

4. RESULTS AND DISCUSSION

4.1. Results

4.1.1. Design

- Splash: at the beginning there is a “Splash” which is a small and brief startup animation when entering the App, it can be seen in Figure 5, which has a maximum duration of 5 seconds.
- Login : after the “Splash”, if you successfully enter the application, the “Login” screen will be displayed, which shows the option to press “Login”, this being the possible option to enter after entering the ID and password, this description is seen in Figure 6.
- Student list: in Figure 7 you can see the list of students for which each parent is responsible.
- Globla position: Figure 8 shows the menu of options per student.
- Payment list: Figure 9 shows the list of payments per student.
- Card: on this screen you must enter the card number to make the payment of the student pension, the description can be seen in Figure 10.
- Activities: in Figure 11 you can see the list by date of the activities carried out in the educational organization.
- Chatbot: in Figure 12 you can see the interaction of the payment flow through the chatbot.



Figure 5. Prototype home page

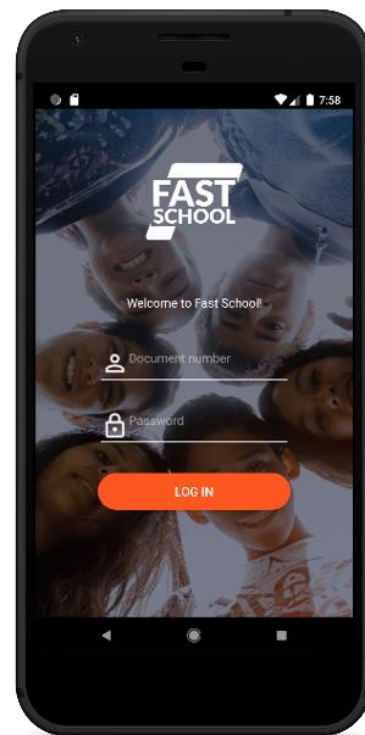


Figure 6. User login

4.1.2. Payment flow

In addition to the implementation of a chatbot in a mobile application and the use of the agile Scrum methodology, another innovative aspect of this project will be the incorporation of robust security measures to protect user information and ensure secure online transactions. A security system based on token authorization will be implemented to access the services developed in the web service. This means that users must authenticate correctly when entering the mobile application and consume the proxy validation service with the correct ID and password to obtain an authorization token. This token will be necessary to access payment and activity control services, ensuring that only authorized users can perform these actions, see Figure 13.

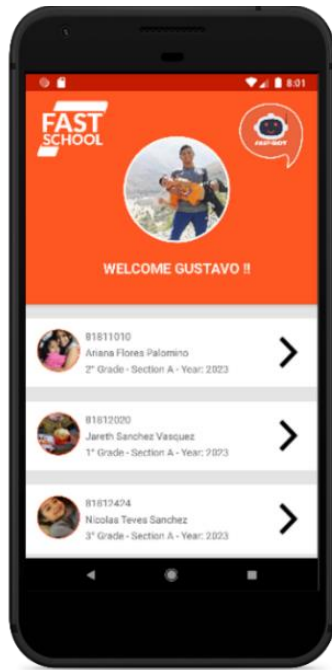


Figure 7. Student list

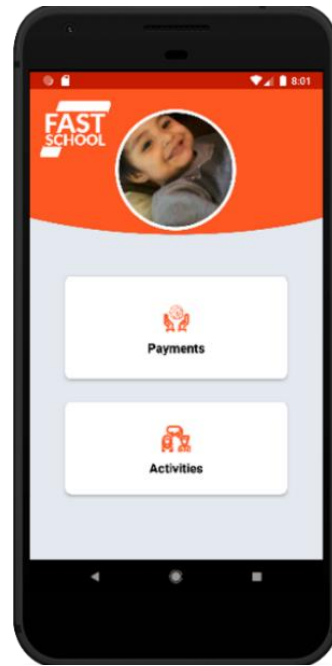


Figure 8. Global position

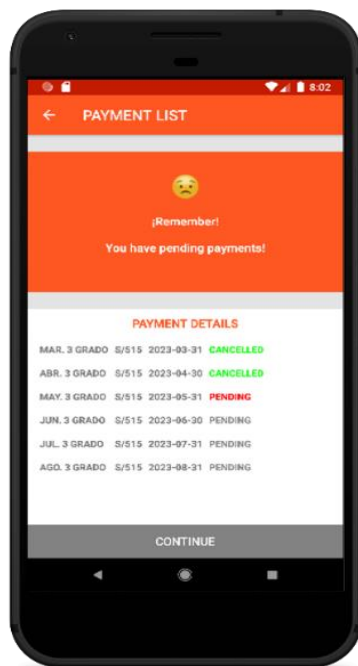


Figure 9. Payment

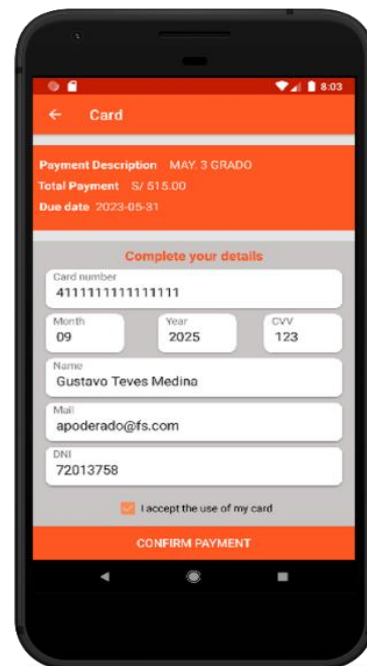


Figure 10. Card

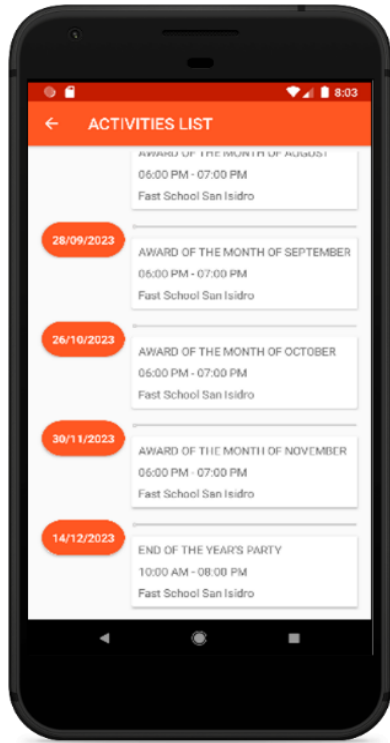


Figure 11. Activities list

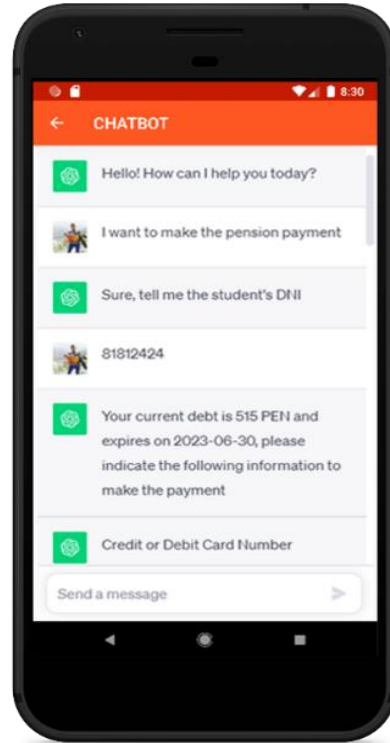


Figure 12. Chatbot

```
1 no usages
2 public class GenerarIonToken {
3
4 @ no usages
5 public static String getSHA256(String token) throws NoSuchAlgorithmException, UnsupportedEncodingException {
6     System.err.println("El token: " + token);
7     MessageDigest md = MessageDigest.getInstance("SHA-256");
8     md.update(token.getBytes(Charset.forName("UTF-8")));
9     StringBuffer sb = new StringBuffer();
10    byte[] ndbytes = md.digest();
11    for (int i = 0; i < ndbytes.length; i++) {
12        sb.append(Integer.toString((ndbytes[i] & 0xFF) + 0x100, 16).substring(1));
13    }
14    return sb.toString();
15 }
16 }
17
```

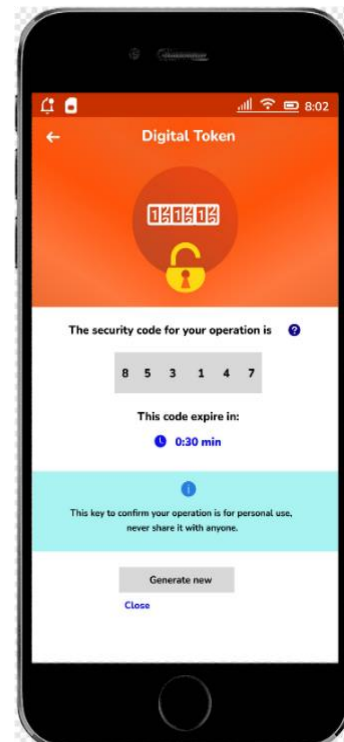


Figure 13. Digital token verification

Additionally, encryption and data protection techniques will be used to ensure the confidentiality and integrity of user information during online transactions. A trace record will be used in the VPS server log to

have the input and output data to the Culqi payment provider identified in the event of possible incidents, which will allow detailed monitoring of transactions and a quick response to any anomaly or attempted fraud. In summary, the implementation of advanced security measures will guarantee the protection of user information and the security of online transactions, which will contribute to generating reliability in the mobile application and improving the user experience, see Figure 14.

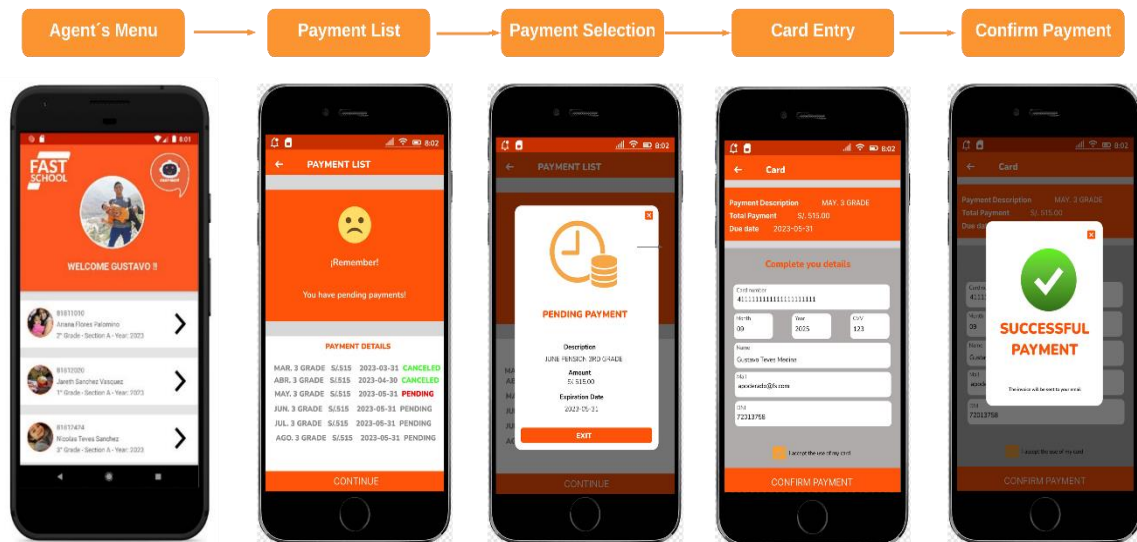


Figure 14. Payment flow

4.1.3. Activity control flow

In the following Figure 15 you can see the activity control that is designed from the global position where you can see the options in the menu, choose the "activities list" option which includes relevant items by dates that can be accessed and see the day's activity in detail. The student menu screen provides quick access to main functions such as payments and activities. Additionally, the newsletter section allows users to get specific details of important events directly from the activity list.

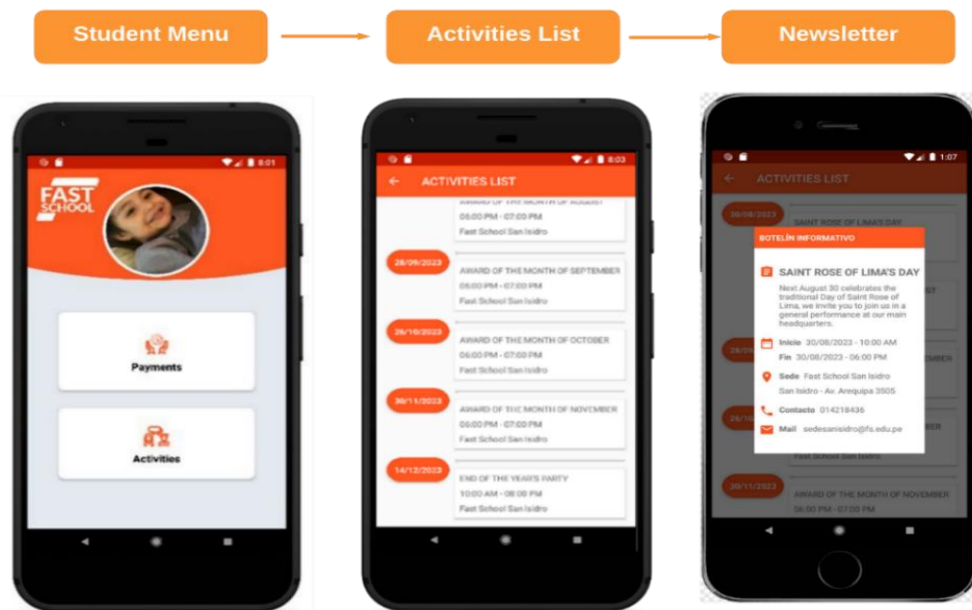


Figure 15. Activity control flow

4.2. Discussion

This application manages the academic development of the student, that is, how their grades are progressing in the courses they are enrolled in, and shows a statistical evaluation that measures academic performance. On the other hand, it manages the payments made according to the level the student is studying. Of the articles reviewed, no applications have been found that provide an integrated solution to clients in the educational field. However, we found in the reviewed literature some advances or attempts to create web pages or applications that provide solutions regarding the monitoring of academic progress and/or payment management in the institution, such as:

Guerrero and Matute [1] highlighted the importance of adapting to cultural and educational changes through the effective use of ICT in education. Similarly Bajaan [27], states that they provided valuable perspectives on improving financial processes in educational institutions, enriching the understanding and application of solutions for payment management. As well as [28], highlighted the challenges associated with overdue loans in educational institutions, providing additional context for the consideration of improvement strategies in payment management.

Gómez and Urbano [29] describe a client portfolio management model using the Committee of Sponsoring Organizations of the Treadway Commission (COSO) methodology. Barrera and Ramírez [3], applications can occur in any area of knowledge, because they facilitate work, optimize processes, monitoring can be carried out. Unlike [4] where it highlights those applications can occur in the educational sector, and it states that educational platforms provide permanent solutions to users (teachers and/or students) managing the evolution of the process in education, in any field or level educational. In article [5] it mentions that there is greater interactivity through chatbots, providing quick and practical solutions by simulating being a tutor and/or counselor through this application. Likewise, highlights the versatility of applications related to education and the massive use of chatbots which provide quick solutions to users, in this way it is perceived that these applications optimize the process in education [6].

5. CONCLUSION

After applying Scrum in this research, it is concluded that the agile Scrum methodology positively influences the increase in the productivity of the software development process in terms of reduction of time and costs, ensuring that the research is carried out within the estimated deadline according to what was planned. Likewise, the iterative and incremental development process proposed by Scrum allows us to conclude with the result of a mobile application called Fast School, which meets the objectives, requirements and initial needs identified by the interested parties. Through the work, a payment gateway was developed to improve communication and efficiency in payment management in the educational institution, in addition, the Fast School application is useful to improve management, organization, control and monitoring in the institution. Likewise, the application shows security in financial transactions because it has a digital token system that is validated by the user and their financial institution for the payment of the educational service.

For future work, it is recommended to develop a maintenance plan that allows the continuity of the product in the face of continuous market changes. Consequently, in the development of the payment service, a tracking log was implemented, which records the flow of payments made by representatives on a daily basis, so it is suggested to generate a backup of the tracking log in case of possible incidents. In the same way, the agile Scrum methodology used in this project could be compared with other traditional or agile methodologies, highlighting the advantages and disadvantages of each approach in the development of mobile applications in the educational field.





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