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Original Article

Proposal of a Mobile Application : Notification of Certificates of Judicial Deposits

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Abstract *- In the last years, it has been seen how the number of judicial processes in Peru is affected by inefficiency or lack of agility for their attention and due process. Due to the digital transformation that has arisen with the use of IT, it has been necessary to choose to restructure the processes in the judicial systems by prioritizing the activities within each one to adapt to the new context that exists. Thus, given this need, this research arises, which aims to implement a mobile application to optimize the management of notifications in the delivery of judicial deposit certificates in the Judicial Branch. In order to effectively carry out this mobile application, the Mobile-D agile methodology has been chosen, which has 5 phases that start from the exploration phase to the testing phase. In addition, Figma was used as a tool for prototype design. In this way, the objective of improving the notification system for judicial deposits was achieved. After applying expert judgment to 5 specialists, it was obtained that the developed application, according to 5 criteria, had the following percentages of acceptance: design at 65%, the interface at 73.3%, performance at 75%, 95% integration and 91.6%.*

Keywords *- Mobile application, Court deposit, Hierarchy, Judicial process, Notification system.*

1. Introduction

At a global level, one of the recurring problems within the judicial system is notifications due to problems in its administration and logistics due to the accumulation of cases in the judiciary or some errors in the documents of the notifications of the litigants that invalidate the procedure [1].

In Peru, in 2013, the system was created to be able to request virtual judicial deposits, as required according to an administrative resolution [2], the use of this has been gradually increasing. In turn, it is necessary to correctly manage the notifications generated when this process is carried out. The certification implies the participation of both the National bank and the Judicial Power. Still, if the judicial deposits generated per day are a large number, they can be affected and delay the continuity of a trial. That is why a bottleneck and discomfort are caused for those involved to a different degree. Since each of these judicial deposits has a different priority scale, likewise, it depends on the judicial process, which seeks to solve through a trial of the competent authority the solution of the dispute submitted to a decision. [3], which has a greater or lesser impact on its delay for the parties involved in this judicial process.

For this reason, an app is required to be able to manage better the validation of these certificates and not present inconveniences in judicial processes. In this way, the large number of notifications generated by judicial deposits can be managed efficiently by the judiciary with the support of a mobile application, which, as denoted by [4], the context and needs of the user must be taken into account, that is, with a more tailored and non-standard content as required [5], with a series of parameters and/or use of algorithms, to define a hierarchy in this process. Since, as indicated in [6], the services provided by the public sector must be transformed to a perceivable quality as more effective and effective. This is how this notification system may have a positive impact on this procedure, as specified [7] that this system generates a quick response for users.

In this way, the following question arises: To what extent would a mobile application optimize the management of notifications for the delivery of judicial deposit certificates in the judiciary in the year 2022? For that, in this study, the objective is to implement a mobile application to optimize the management of notifications in delivering judicial deposit certificates in the Judicial Branch. Therefore, the Mobile-D methodology will be applied. This is a methodology with agile practices to be able to carry out a project-oriented in the field of mobile development, as mentioned [8]. According to the authors [9], this is based on the XP, Crystal and RUP methodology. Likewise, it has five phases which have a series of activities linked.

This research work is made up as follows: section II presents the Literature Review. Section III defines the methodology that was put into practice and the theory of its stages. Section IV describes the results, section V discussions, and finally, section VI the conclusions.

2. Literature Review

Over the years, different investigations have been presented to find a solution for adequate management of notifications generated by the different applications on a mobile device and other smart devices within the framework of the appearance of the Internet of Things (IoT). The trend of the authors on this fact is the use of middleware to be able to manage a specific context and specific applications on mobile devices to generate a model of user preferences with different methodologies.

In principle, regarding the object of study of notification management, current research shows different points of convergence and divergence. First, the authors of [11,25] focus more on using middleware to control and manage notifications on smart devices. So many [12], [11] make use of the UbiPri middleware, while [25] make use of Atellia II. The difference between the two is that the former can be extended even beyond mobile devices and smartwatches. While Atellia II has only been tested with these 2 types of devices.

On the other hand, using mobile applications was the means by which a context was generated for each user where several jobs [13] y [14] analysed the moment of interruptible. Among all the applications, Prefminer stands out, used by the authors [26], where beyond focusing on this aspect, they also focused on suspending irrelevant notifications. Also, in [16], they provide added value by using an activity recognition API to formulate an interruptible map.

Regarding the methodology, two aspects are evidenced to be able to generate rules in the reception of notifications. On the one hand, both [11] and [26] don't use a machine-learning algorithm. First, [11] proposes a flowchart based on criteria such as type of environment, user profile, delivery time and priority. Second, the authors [26] consider the titles of each of the notifications and thus generate association rules in support of the user. Finally, [13] It uses 3 categories of preferences that are personalized when you start the installation of your mobile application.

On the other hand, the use of algorithms related to machine learning is seen in the vast majority of research. Among these stands out [17] that in its Healthy Mind (HM) application, it made use of these algorithms to predict the probability that a user would respond. Also, [14] used them specifically to modify the intervals and content of notifications. Finally, it is worth mentioning the comparison made in [12], where they are not only focused on an algorithm, but through statistical tests, they made a comparison of these to choose the most appropriate for their decision module in the management of notifications.

Web push notifications, which are used to send notifications to stand-alone applications running on mobile devices in the background [18], are another solution measure the authors of the latter mentioned explaining to us [14]. Both of them deal with how the notification management system can be used for sending to multiple devices. Where it only [18] goes beyond implementing it on an Android system and covers the Tizen operating system. Likewise, it provides added value by handling it with the explanation of a specific architecture, unlike [14], that only uses the JOOL Health application Besides, [27], It uses its own software. It relies on Google and Apple cloud services.

The security in these environments of sending data to an external server or managing it locally on the same mobile device is an aspect that can generate some mistrust. The HM application, at work [17], just needs the same data to learn and build an interruptible model between the context of each user on the same device. Then there are applications like [20] where in the first instance, they process the data collected locally, but then it is uploaded from time to time to the server.

For the different works, the data collected from the participation of people, but also from artificial data, were evaluated. This last method is not very common. However, in [12], they use it to be able to train their algorithm. On the contrary, the study that showed the largest sample for evaluating its results was [20], where they surveyed 130 people. Only 34 were women, which demonstrated the low participation of women in the research. However, this is not the only work that has little participation from this sector, which leaves the results obtained somewhat scattered.

Likewise, when performing an analysis of the results, a relationship was found between [12,25] and [14] by the use of a statistical test in the achievement of objectives. Thus, on the one hand, there is the use of the Friedman test in research [12] and [25]. In this first one, it uses it to be able to compare its classification algorithms, and that results in the J48 being the most suitable. While the second study uses this test to detect breakpoints in physical activity. On the other hand, the chis-quare test is used in the work [14] to analyse data in the JOOL Health app.

In addition, the results focused on the notifications that users preferred to receive or reject. In this line, Prefminer, at work [26], was able to identify around 60% of these types of notifications. While Priser [11] was only able to filter relevant messages from the operating system in its tests, in this regard, it was effective in its filters. In this sense of irrelevant notifications, the number of clicks made by the user that will

generate more or less comfort also plays an important role. The authors of [18] they were able to reduce this aspect of the hand with their flow control module. On the other hand, it is also relevant that the users themselves can understand what rules govern managing their notifications. Under this aspect, [13] With an average of 4.4 out of a maximum score of 5, the participants in this study consider the time to choose their preferences acceptable.

According to what was analysed, the commitment of users to the applications and the notifications they generate are evaluated in detail both in [17] and [20]. Both agree in their results that the longer a notification is received, the less likely it is to be opened. Even in [17], they uninstalled the app for a lot of their participants after a couple of days.

The conclusions reached by some authors refer to the points of interruption with respect to the location of the users. On the one hand, those who agree that this is relevant. In this sense, [26] they indicate that each person's preferences are not subject to the activity and time of arrival but to the content of the information and where it is located. Likewise, these specific references to the place where someone has improved the effectiveness of Attelia II [25]. Similarly, the rate of occurrence for authors of [16] in the delivery of notifications was subject to geographic location. However, at work, [17] concludes that this aspect may not always encourage a better response compared to sending notifications clearly at the right times.

Likewise, the treatment of the content of the notifications is, for other authors, the critical point. First, [11] indicates that each of these must be treated individually according to their characteristics. In the same way, [14] suggests that the information will work best for someone understanding the topic.

On the other hand, the use of algorithms is of the utmost importance for the correct identification, as indicated by the authors of [12], [18] that for their component that makes the decision in the delivery of notifications, they make use of it and denoted a high performance.

Thus, the authors [13], [20] point out that they should improve their preference settings due to the low levels of participation in their evaluations that did not reach their goal of a complete notification management system.

In short, a greater application of systems is identified that is installed on a mobile device and can manage notifications both with an algorithm and by criteria that the user understands. In this way, the field of IoT is also considered relevant, which is approached to a lesser extent due to its high level of complexity for formulating an architecture that can address all the inconveniences that may arise. In addition, there is an absence in the specific field of a scenario for managing mobile applications clearly focused on a work environment, where an application must only manage notifications that arrive within its schedule. In this sense, the works address beyond this specific context. Finally, it is worth mentioning the lack of orientation of the work towards a legal environment in the field of efficient management through client-server architectures that mobile applications can provide for a simplified but optimal solution.

3. Methodology

The materials and methods section should contain sufficient detail to repeat all procedures. It may be divided into headed subsections if several methods are described.

3.1. Phase 1: Exploration

In the exploration phase, the plan that will become the mobile application will be developed. Likewise, the concepts to which it is subject for its development will be developed. In addition, the scope that will cover and the functionalities that will arrive are established. Recommended font sizes are shown in Table 1.

3.2. Phase 2: Initialization

All the resources required to develop the application will be prepared in the initiation. In the same way, the planning for the following phases will be carried out with their respective physical, technical and human requirements with which each of these plans that each stage of the project contains will be implemented.

3.3. Phase 3: Production

In this phase, the implementation of the modules is carried out to develop each of the functionalities of the application, adhering to the requirements initially raised. As well as unit tests with their respective user interfaces for higher quality

3.4. Phase 4: Stabilization

The last actions are carried out to integrate all the previously developed functionalities to guarantee that the entire application works correctly to have it finished.

3.5. Phase 5: Testing

The objective for this phase is to have a stable version of the entire application available by carrying out tests that verify compliance with the requirements initially set. Finally, the faults found by the integration are eliminated.

3.5.1. Development of the Methodology
Phase 1: Exploration
a) Establishment of Stakeholders

Among the interested parties were both lawyers with experience in this judicial process as well as the researchers of this research work.

Fig. 1 Mobile - D Phases

b) Scope Definition

The present work was developed in 4 stages for the implementation of this application, with which it will be possible to have a prototype based on patterns and metrics so that it can have a correct operation. The time in its development was anticipated to be 15 weeks. In addition, there was a budget of s / 3457.6 for its development.

c) Project Establishment

The features covered for the following investigation were grouped into releases. Table 1 summarizes these functionalities in four versions.

Table 1. Mobile app releases

Release	Functionality
1	Check-in. Log in. Sign off.
2	List judicial deposits. Filter by state
3	Receive notification. Accept/Reject judicial deposit. Manage notifications

3.5.2. Phase 2: Initialization

Development resources

The following technologies specified in Table 2 were used to develop the following application.

Table 2. Means

Technology	Reason
Android Studio	Code Development and Testing
SQLite	Database Manager
Figma	Development of mockups

Stage Planning

The following stages of the application development are defined in Table 3.

Table 3. Stages of development

Technology	Reason
Analysis	Collection of information for application development
Design	Make mockups for the application interface.
Develop	Development Coding of functionalities
Testing	Evaluation of functionalities and their integration

3.5.3. Phase 3: Production

According to the defined releases and the functions the application would cover, the following designs were developed to be produced using the aforementioned tools. The screens corresponding to Release 1 were designed in this way. Both the login and registration screens are shown in Figue 2 and Figue 3. According to release 2, there is also a list of judicial deposits, as shown in Figure 4. Finally, as indicated in release 3, there are the following screens of Figure 5, Figure 6 and Figure 7 for the adjustment of the types of judicial deposits, their approval or rejection and the notification that would reach the officer.

3.5.4. Phase 4: Stabilization

An analysis of the functionalities of each release was carried out in which it was verified that all of them are stable for their correct integration. In this way, this was achieved through a main menu, as shown in Figure 8.

3.5.5. Phase 5: Testing

The tests were carried out as the releases were created through unit tests of each functionality with 90% coverage. Then, during the last week, there was a final test with all the functionalities integrated in the stabilization stage. In the first place, the users had to test the application's login with some provided codes and verify that there were no problems. Secondly, the correct opening of the pdfs of model notification certificates and their change of status was verified. Finally, we proceeded to test that the notification priority settings are operating according to the settings of each user.

Fig. 2 Login

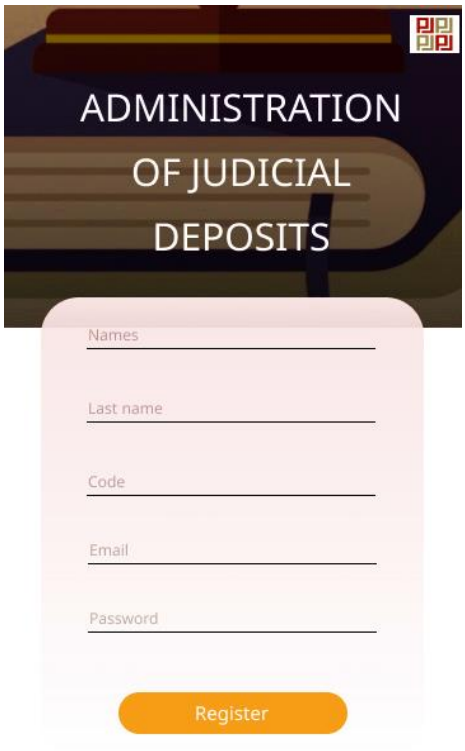

Fig. 3 Register

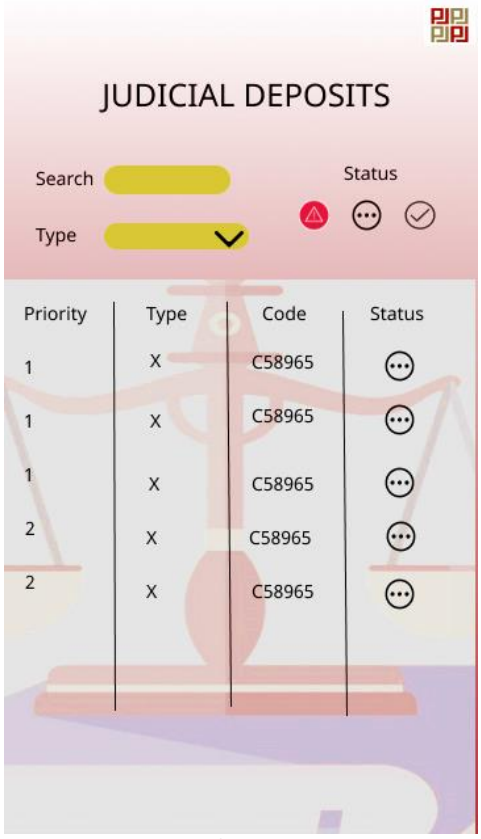

Fig. 4 List of judicial deposits

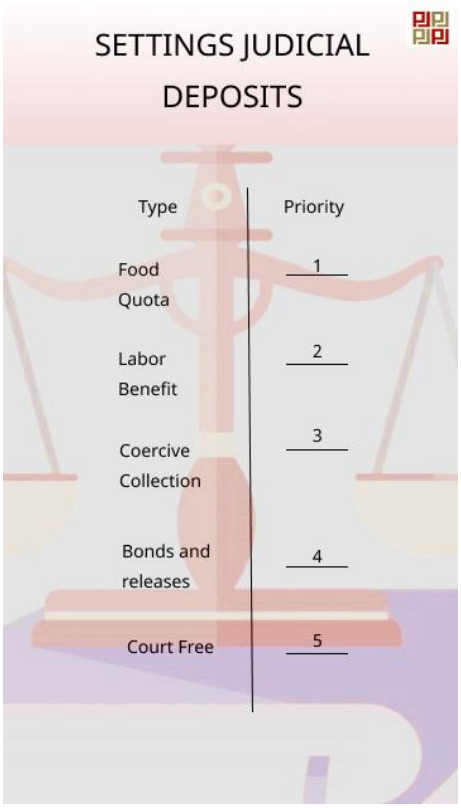

Fig. 5 Priority setting

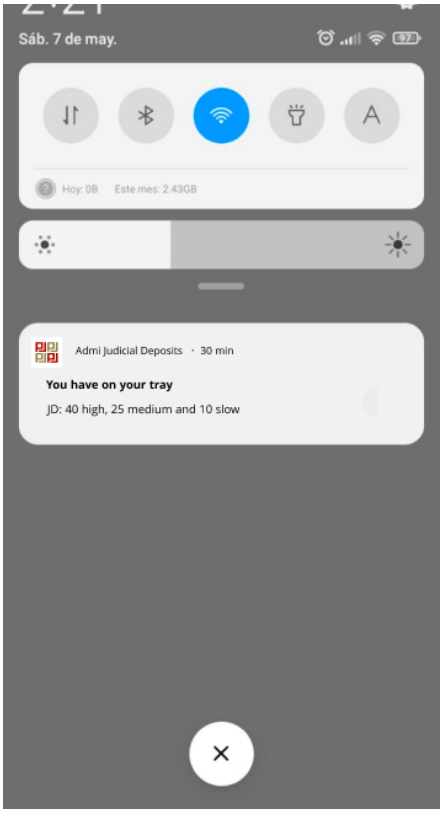

Fig. 7 Notification of new judicial deposits

Fig. 6 Review of judicial deposits

4. Results and Discussion

4.1. Results

4.1.1. About the Prototypes

The results after the design of the prototypes are detailed below. Regarding Figure 2, which details the login, in which there were good opinions due to the corresponding figures that gave a better understanding of the application and the contrasting colors of this screen. Also, it was noted that it was necessary to include a pop-up when the login was unsuccessful—also an extra button to be able to recover the password. Later, during the creation of new users, Figure 3, the following validations were added: the number of characters in names and surnames, the format of the user code necessary for the registration, email format and finally, mandatory values for secure password creation. On the other hand, within the application, it was necessary to assign each one of the screens that were developed in the Stabilization phase; Figure 4, these being clear about the name of the buttons, did not present any inconvenience for their understanding. In the first place, there is a redirection towards the prioritization configuration, Figure 5, in which, through the categories of alimony, labor benefits, dependence on coercive jurisdiction, sureties and releases, and the judicial fee, it was known that they still existed. Other categories, but they were very rare. In this way, through the 5 categories that are required, it was possible to cover the highest priority notifications, and those of less frequency could continue to receive attention in other attention channels that the judiciary

has. Secondly, there is the list of judicial deposits, Figure 4; the list of types of deposits mentioned above allowed a better search.

In the same way, it could be considered to have the search for the name of some involved within each of these certificates instead of codes—finally, 2 important prototypes for the application are shown in Figure 6 and Figure 7. First, the person in charge can approve or make an observation where he can read the entire document. This comment will be saved together with the new status for follow-up when it is communicated to the parties involved so that they can raise their observations if necessary. Finally, the prototype of the notifications that would reach the user is divided into high, medium and low. These are considered for the first 2 types of judicial deposits handled for the high level, then the third and fourth would be handled as medium level and finally, the last as low. Thus, this number of each level can vary according to the level of prioritization that each user handles.

Table 4. Expert judgment

Evaluation criteria	Average	Description
Design The size of the fonts and color tones on the screens are adequate.	65%	half
The themes used are appropriate according to their functionality	65%	half
The images used in the application are appropriate.	65%	half
Interface The text used is appropriate for each of the functions of the application	75%	high
The information is specific for quick navigation in the application.	70%	high
There is an appropriate space between the text and the elements that surround it.	75%	high
Performance All screens load correctly without any intermittency.	80%	high
The loading of all judicial deposits is fast.	65%	half
Registration and login are successful.	80%	high
Integration The services involved in the search for deposits by filters are adequate.	90%	very high
All processes are correctly interrelated in the app.	95%	very high
The redirection between screens is correct	100%	very high

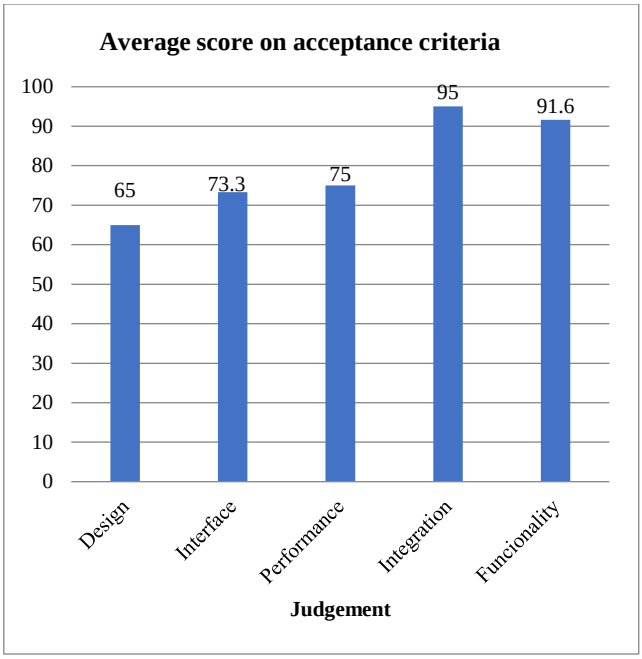

Fig. 8 Average score on acceptance criteria

4.1.2. Validation by Expert Judgments

The application of an expert judgment was chosen, including a criminal law attorney, a UX designer, a UI designer, an app frontend and a backend, which were requested according to 15 points under the following 5 criteria: design, interface, performance, integration and functionality. In this way, it was possible; Next, Table 4 details the same and the average score of the 5 experts.

In this way, according to the average score specified by the experts shown, the average score of the interviewees regarding the 5 criteria was the following percentages of acceptance: design at 65%, the interface at 73.3%, performance at 75%, integration at 95% and functionality at 91.6%, which indicates that there are still certain aspects to improve in terms of design, interface and performance.

As can be seen in Figure 8, it can be seen that the integration, having 95% acceptance, complies with being able to have the necessary modules to adapt the required notification system process. Afterwards, the functionalities are covered with 91.6%, which also determines that they are covered for their purpose. While both the design and interface become improvement points with 65% and 73.3%, respectively. This is because it is the first design regarding the application. Finally, the performance of 75% is another point to improve due to the delay in loading multiple judicial certificates that a user may have.

4.1.3. About the Methodology

The methodology that was worked during the research work was that of Mobile-D. This is one of the agile

methodologies available today; however, in its development, the following findings could be made in its use. In the first place, a comparison can be made with Scrum, which, as detailed [21] it, is a framework used through sprints in a certain cycle of time. This, in turn, is somewhat more granular due to the detail of all the standardized activities. However, while using Mobile-D, the same level of granularity can be performed during the Initialization phase, which establishes a work schedule and the resources which will be used that, to its extent, is not within what is considered by Scrum. The latter focuses on objectives framed in fixed deadlines that would also be controlled in the schedule with a list of the end of each of the activities to be carried out. Secondly, if it is compared with RUP, which is a method that contains agile and traditional practices given how cumbersome it can be due to the 4-phase life cycle that it has, which are the following: inspection, elaboration, construction and transition as precise [21]. It is seen that for the purposes of this project, with few people involved and the short time since its inception, it would not be adequately adapted. In this way, everything planned could be carried out using Mobile-D, which was better adapted to the development of the application due to its specific orientation in this field. RUP and Scrum's characteristics are somewhat adapted and simplified in the phases of the methodology worked on in this mobile application proposal.

4.2. Discussion

Performance is discussed as an aspect of improvement, and the way in which the notifications of other authors described in the literature review are managed. On the one hand, the performance that has been obtained due to the use of push notifications for the administration of judicial deposits works in the background as required by the actors. [18] y [14] for reception by the user. However, it would be [27] who has had better performance results due to using cloud services. Therefore, it would be good also to consider this aspect. Also, both Prefimner [26] and Priser [11], although they carry out a filter of notifications to see which one to eliminate or reject for the field of judicial processes, would not apply. However, its classification system through machine learning could give greater scope to the current prioritization with which it works. Users have not presented discomfort in making their adjustments as it also uses it and gives freedom in its application [13].

Finally, according to the results presented by [17] and [20], They concluded that the time between the reception of the notification and its opening could lead to the due priority not being taken. That is why at work, in addition to classifying judicial deposits by the types that exist and the same user can change the order of priority, through the use of push notifications that show the number of high, medium and low notifications, can generate greater predisposition to serve them.

5. Conclusion

In the research work, it is concluded that the mobile application was achieved in order to optimize the management of notifications in the delivery of certificates of judicial deposits in the Judicial Power. This was achieved with the application of the Mobile D agile methodology in conjunction with the tools for the application's design, development and testing. Regarding the Mobile D methodology, it was essential for the development of the application due to its conception from the beginning to be able to plan the stages and scope of the project. In addition, the phases were in themselves very intuitive and not very complex to develop.

A limitation that arose in the development of the work was the lack of published information or some work directly related to the problem in question. For this reason, it was necessary to resort to external sources from the same institution to have a better scope and give a resolution based on previous studies on notification systems.

In the future, it is expected that this research work can be complemented with integration with machine learning patterns to rank judicial deposit notifications with even greater filters for approval, observation or denial by the judiciary; likewise, a multiplatform system be addressed that can also include other mobile operating systems such as iOS and even a web system that speeds up the current process and serves as a support for mobile applications.

We must mention that a comparison can be made with the SCRUM referential framework because it has important results with respect to web applications, which can be seen [22 - 24].

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