Original Article

Design of a Mobile Application for the Control of Pregnant Women

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Abstract - Due to the fact that the health information of pregnant women is extremely complex and delicate because of COVID-19. If adequate measures are not taken, it has to be mentioned that the exposure increases the chances of contagion, making the simple fact of having to receive one of the consultations for the control of gestation becomes very dangerous. The objective of the research is to design a mobile application for the control of pregnant women in times of pandemic in an effective and efficient way and thus decrease the contagion of COVID-19. The methodology used is the incremental model that allowed us to obtain the percentages of the application made. The result obtained is the design of the application for the control of pregnant women to show all the ailments and problems that can occur during pregnancy, from a headache to malfunction of the internal organs. Thanks to the application is already a great help for people's daily routines as these range from simple games to various applications to manage and control in making decisions from home.

Keywords - Covid-19, Gestation, Internal organs, Mobile application, Pregnant women.

1. Introduction

In December 2019, the first case of a mutation of what is known as severe acute respiratory syndrome (SARS-CoV-2) was generated. This new mutation would have the name COVID-19, which would spread rapidly to all parts of the world, generating a global pandemic [1]. The sector most affected by this is pregnant women since they have to be detached from some kind of medical control, be exposed to the contaminated environment, and be in contact with other people who may be infected by this virus [2].

Peru is a country that does not have many deficiencies in health issues; one of the biggest is that it is very fragmented. There are approximately three agencies, the Ministry of Health (MINSA), for low-income people, either people living in poverty or extreme poverty [3]. Social health insurance (EsSalud) is considered for people with more economic resources. Lastly, the Ministry of Health, for people with less economic resources but not less important, the Armed Police Forces, each one has an independent budget and is managed differently. This generates that on many occasions, when one wants to take a measure, have to do it separately, causing a serious problem in communication and decision-making [4].

The woman during pregnancy goes through great internal and external change, which often has repercussions that cause certain complications during this period. The severity of these complications depends largely on the diet she has had [5]. To this, we must add that the main organs are greatly affected because the usual space they have is reduced by the growth of the fetus [6]. With the above, we can realize that this virus is very lethal and pregnant women are not immune to it. In addition, some studies mention that pregnant women affected by COVID-19 are more prone to suffer respiratory diseases and that this also affects the fetus inside them [7]. It was decided to evaluate what would be the best way to implement a system that could reduce the exposure of mothers to the lethal COVID-19 virus; it was seen that the most effective decision would be to implement a mobile application since all families have a Smartphone. Also, the development of this can be done in less time, and it is easier to modify for subsequent system updates and improvements [8].

Apps or mobile applications have become very important in everyday life, either because they are very efficient and easy to use or because they are part of the mobile devices that are carried everywhere [9,28].

It is incredible how many users can be given to cell phones today; they can be from very sophisticated video and photo editors to scientific calculators, all thanks to diverse and varied applications. The objective of the research work is to design a mobile application for the control of pregnant women. Therefore, the application's main use is medicine, in

this case, to keep track of pregnant women and prevent possible transmission of diseases that can cause interruptions in pregnancy [10].

The paper is structured as follows: in part 2, the literature review; in part 3, the methodology. In part 4, the results and discussions, and in part 5, the conclusions.

2. Literature Review

This section reviews the literature on mobile applications for pregnant women who continue to participate in the study and provides the necessary resources to make the study work.

The authors suggest that early detection of the risk of preeclampsia in pregnant women could be attempted. High-quality automated devices to detect the risk of preeclampsia are needed to reduce maternal mortality [9].

In his research, the author [11] says he plans to bring about change with the help of this platform and tools to provide more accurate information about the processes pregnant women go through. The illustrations in the guide will raise awareness about the changes their bodies are going through and the baby inside them. It will also have guided articles that provide valid, simplified, and direct information that, together with the mothers' knowledge, will help them make future decisions. In addition, the pregnant woman will get the information corresponding to her current gestation time without giving importance to her economy.

The author [12] emphasizes that the use of technologies, especially for the mobilization of people, increasingly invades the daily life of personal activities. Its acceptance is remarkable when it comes to health, such as applications to control steps, smart bracelets for sports or continuous or repetitive activities, applications for control, registration and prescription of medicines or remote assistance services for medical care, external or telemedicine entering the era of digital health, online medicine, or social derivations of behavior and medical care still to be investigated. The medical community's concern is remarkable to use new technological applications that allow for mitigating diseases that require treatments supervised by components developed under software, which is the challenge for new proposals.

The author [13] begins by mentioning that within the catalog of applications that exist within smartphones, the most popular are the distracting ones, whether they are games or streaming apps. However, within all this sea of apps, the author mentions and wants to make one dedicated to controlling postpartum pregnant women and how to carry their emotional and psychological state. In many cases, the trauma that the mother goes through at the time of giving birth and how this can affect the future on it is not made known.

The authors [14], in their research paper, propose a mobile application to help women who perform prenatal care in a public health unit to receive better training in pregnancy education. In addition, the application should allow better mapping of pregnancy and centralization of data to analyze the use of public funds better and identify the need for public authorities to act on the given application.

The author [15] also notes that pregnant women consistently endanger their lives by skipping physical activity and losing consciousness. It is also believed that pregnant women who rarely participate in physical activity and awareness programs risk the life of their unborn child.

The authors [16] note that the new app produced in this study is to encourage pregnant women to participate in physical activity and is based on research and input from physicists, therapists, IT professionals, and pregnant women can inform the development of a mobile health app usable for pregnant women.

In conclusion, a literature review of the different research works was carried out since each author has different methodologies and objectives. Therefore, the literature review will help to achieve the proposed objective.

3. Methodology

As a methodology, the Incremental Model was applied (see Figure 1). This model gives partial results of the final product; that is, it gives increments, and for each increment, an application will be obtained in a certain percentage already done; the percentage will be determined by the number of increments in which the project will be divided [17]. In this way, it will be possible to see progressively how the project is advancing or if there has been any kind of delay since, if it were to occur, delivery of the increment in which the delay was generated would also suffer a delay [18].

3.1. Communication
At the beginning of the project, create a list of functional requirements and group them in the number of increments that we believe are necessary for the project [19]. The grouping mode will be guided by the need that each increment should provide a functional result.

3.2. Planning
After grouping them define the order of priority since by joining them in that order, obtain an improved product each time.

3.3. Modeling
In order to carry out the modelling, it was necessary to test which designs would be the most appropriate, for which images were more friendly, and which environments better captured the attention of the users and also with which they felt more comfortable to interact [20].
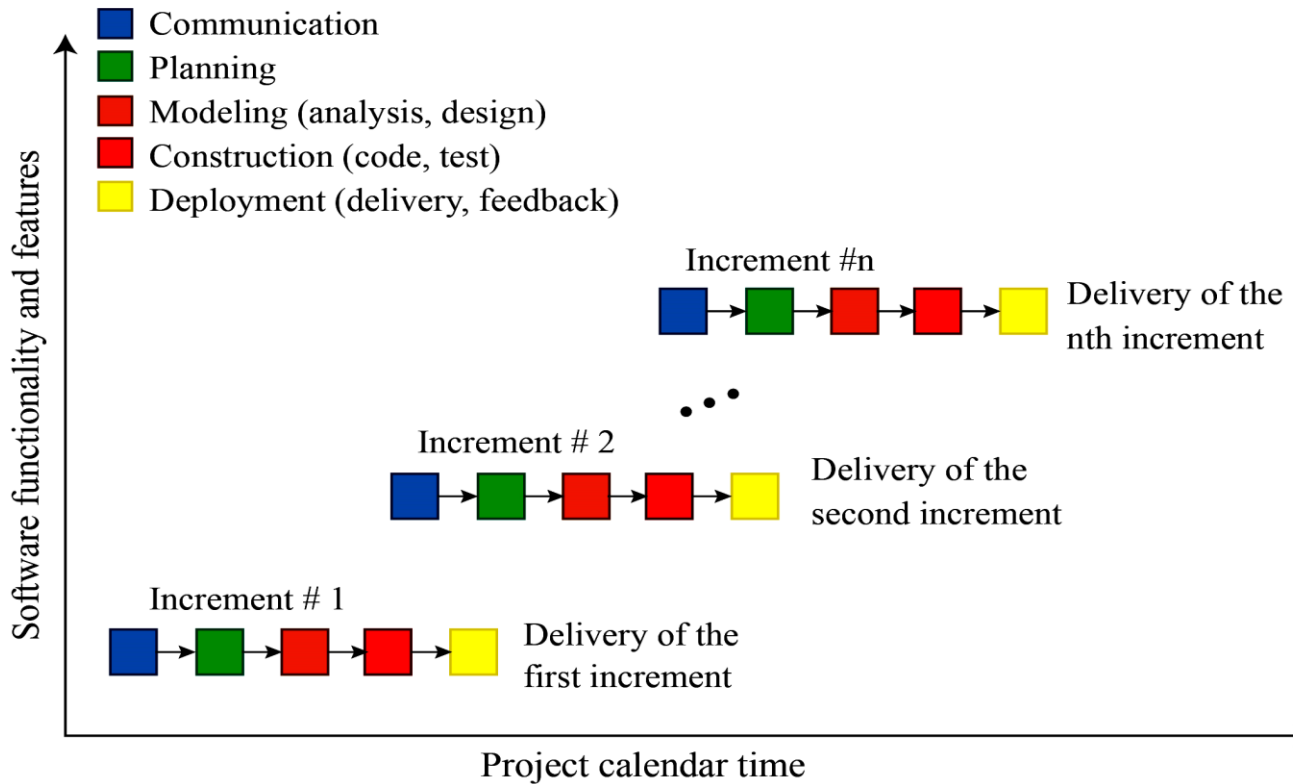
Fig. 1 Incremental model

3.4. Analysis

In this part, the type of increase to be performed will be made. In this case, an analysis has been made for each increase, which depends on the need for each one of them; it should be noted that the work has five increments.

3.5. Design

The design of each of the increments was based on the need for the user to be able to manage and understand the application easily; this will improve the understanding and comprehension of the application.

3.6. Construction

Then develop the increments previously ordered in the previous stages, and tests are carried out to verify if the result obtained works correctly; if not, was have to find the cause of the error and correct it.

3.7. Code

For the operation of each panel to work efficiently, all of them must communicate with one another. The main purpose of this is that all are one, and there is no centralization of data. For this, the Kotlin programming language is very effective and layers of being able to perform it.

3.8. Test

Within this area, the corresponding testing of each increment will be carried out. It should be noted that each increment will undergo one or more of these quality tests before being launched to guarantee the correct operation of the increment.

3.9. Deployment

After validation of the increments, they result in the final product. At this point, each increment should already be linked. Finally, when the final result has been verified and validated, and its functionality agrees with the established ones, it can proceed to delivery [21].

An essential part of being able to develop all these models is the programming language to be used for this. In this case, it will be Kotlin, a very robust and efficient programming language for Android devices [22].

MySQL will be used for the development of the database, mainly because it is Open Source and very easy to handle when it comes to relational databases [23].

Android Studio will be used as a development environment mainly because it offers many facilities to develop Android applications [24].

In order to develop a model of how the final result of the application will be, a very powerful tool called vision will be used, which allows the creation of didactic models to know how the application to be developed will work [25].

4. Results and Discussions

4.1. About the Application

Mobile applications allow one to specify the moods for expert advice, daily articles, medical tips, and interactive 3D models to follow the baby's development and show all the ailments and problems that can occur during pregnancy, from a headache to malfunctioning the internal organs.

Fig. 2 Increment 1 Part. 1/3

As seen in Figure 2, increment 1 has what could be called a Login so that users can enter the application and make their reports.
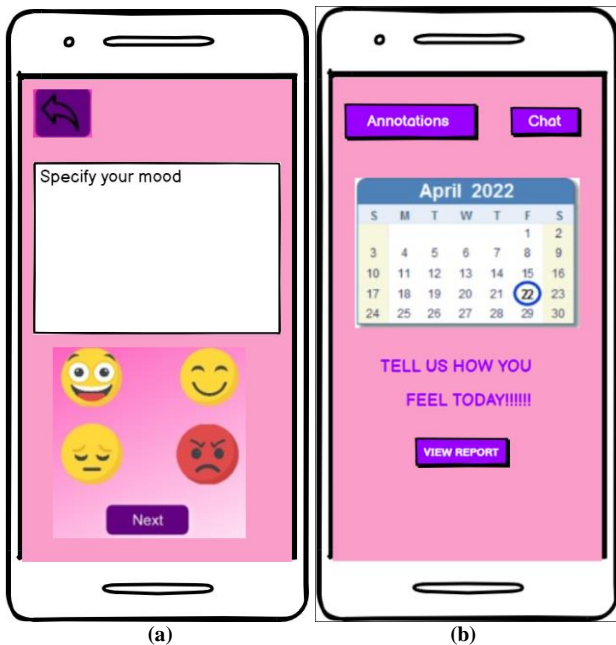
Fig. 3 Mobile application design: (a) Increment 1 Part. 2/3 and (b) Increment 1 Part. 3/3

Figure 3 (a) is still part of the first increment. Only in this case can we see how the interface will be when entering the system. As a first impression, have a calendar that allows knowing on which day of the gestation period. Figure 3 (b) is the final part of the first increment, which will have as its main function to deliver reports with which the area physicians can know what ailments and problems the patient has.

Fig. 4 Mobile application design: (a) Increment 2 and (b) Increment 3

Fig. 5 Mobile application design: (a) Increment 4 and (b) Increment 5

Table 1. Comparison of the incremental model Cascade model

Incremental model	Cascade model
• Documentation is required, but not too much in the incremental model.	• Detailed documentation is required in the waterfall model.
• There is low quantity risk in the incremental model.	• There are many numerical risks in the waterfall model.
• There is very little latency to run the software in the incremental model.	• It takes a long time to run the software in the waterfall model.
• The incremental model also cannot handle large projects.	• The waterfall model cannot handle large projects.
• Flexible changes in the incremental model are easy.	• It is difficult to change the waterfall model dynamically.
• Testing the model incrementally after each phase iteration.	• Testing is done in the waterfall model after completing the entire coding phase.
• It is possible to go back to the previous step/period in an incremental pattern.	• It is not possible to go back to the previous step/phase in the waterfall pattern.

Figure 4 (a) shows the interface where more information can be added, which details more specifically how the pregnant woman is feeling. Figure 4 (b) shows a graphical report of how the gestation period has been going. It also shows in which parts of the period there have been critical and mild events and gives as a result whether it is going through a good period or if it is a complicated case to manage.

Figure 5 (a) shows how the notifications area will look like, showing alerts of the medication to be taken by the patient, exercise schedules, how her medication is going when she will have to attend. Figure 5 (b) shows the last increment, which will be a direct communication chat with your specialty physician so that, when necessary, you can communicate with him/her to make consultations.

4.2. About the Methodology

For this discussion section, the tables comparing the methodologies are shown. According to the methodology applied in the research work, as shown in Table 1.

In the incremental model, several development cycles are carried out and divided into short modules [26]. In general, the software is produced in an incremental model in the first module and adds a function to the previous one. This model is performed until the system is complete. While the cascade model is sometimes referred to as the linear sequential life cycle model because all of its phases are linear. This model is mainly used for small projects [27].

5. Conclusion

As it could be seen in the implemented prototypes, it was sought to be as attractive and warm as possible, and this seeks to have a simplicity and ease which allows any user to use it intuitively without the need of having to receive a class or having to watch a video tutorial to be able to handle it. The incremental model as a management method for the development of the project, although it is simple, makes things much easier to develop a project which requires something simple, fast, and efficient. While it is true that the incremental model is simple, fast, and effective. Many times, it can easily be ruined by not having good time management, and even worse, if the team communication is not adequate, this could easily end up causing the estimated time to increase and even worse that the increments are not delivered in the established time. The recommendations to have in mind for future work would be to use tools that are useful because although it is true that there are tools that could be of help are not always very useful when performing the work, so it is always good to have several tools in mind which can be adapted to the type of needs that may come to have, have assertive communication between coworkers is also very important, this generates that the development of the work is also much easier. Preferably after each increment, take a brief time, either a meeting or a lunch, to share among colleagues. The type of methodology used in the research work is also of utmost importance, whether it is a methodology or a model. The case of the models does not require much prior preparation, and this is essential because being work for a community will not generate a greater cost for the development of this. What could be implemented in the future for this research work to be able to make connections with a web page mostly? So that doctors can keep better control of patient data since editing data on a smartphone is good but not entirely comfortable, either by the amount of space one have to type or the size of the Smartphone. This would also help patients since some people are not entirely accustomed to using Smartphones and find it much easier to handle them on a computer.

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