

Mobile application of Medical diagnosis with the Implementation of Artificial Intelligence in Metropolitan Lima

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Abstract — *The objective is to avoid a greater number of infections, diagnosing patients through a mobile application that will solve and avoid the crowds of people outside the medical centers, The operation used was XP since we have the established weeks and processes to follow stages, which There are 4, planning, design, coding and testing, balsamiq was used for the prototypes, with the help of AI and “Android” mobile application; The statistical data obtained comes from the Peruvian medical college, which provides us with exact data on how the situation is in our society and we can apply it to solve the problem.*

Keywords — *Artificial intelligence, Component: mobile app, Medical diagnosis.*

I. INTRODUCTION

At present, what we are going through around the world due to the pandemic [1], we as a society have been hit hard, since we were not used to remaining in a state of emergency and for this we must be in our houses to avoid potential dangers, which with the help of AI avoids leaving the homes [2], which can work through a care App [3] that can diagnose different diseases according to algorithms that help to make of decisions which the system learns according to its use to have greater benefits such as reducing cost and time [4].

In these times there are various agile methodologies which help to develop projects by making them simpler such as the Kanban and scrum method [5], so that they are more complex during the development phase, Google also launched the design methodology [6], which is focuses on designing solutions to be tested in prototypes; but as a study of this paper, the most successful XP method of software development, greater control of the project and the best effective and efficient implementation was chosen [7].

Regarding the case study, we applied the XP methodology in our project with a duration of 17 weeks that consist of stages or user stories that can satisfy the needs of our users, which will be shown in table 1; It all encompasses 4 planning,

design, coding and testing processes; For this, a Balsamiq tool was used

to develop the prototyping, also with the use of technologies such as AI and Mobile Application with the help of the “Android” development platform; obtaining statistical results from the medical college of Peru.

The objective is to be able to avoid a greater number of infections, that there are no more deaths in our society and avoiding crowding of people in posts, clinics and hospitals, which with the App any symptoms, discomfort or mishap, go to the App and can visualize what they may suffer at those times, thus avoiding leaving their homes and forming long lines outside health centers, putting their lives and others at risk.

In section 1 we talk about the introduction that shows how our project is structured, the problem, the objectives; section 2 the methodology on which the project is based, its processes; in section 3 the tools we have used to facilitate the development of the project; section 4 is the case study where everything about the methodology, processes and tools are put to the test; section 5 is our result on the case study and the discussions about the methodology that was used and finally our references.

II. METHODOLOGY

For the development and implementation of this mobile application we will use one of the best agile methodologies, which was created by Kent Beck at DaimlerChrysler [8] which will allow us to work in a more orderly way and will facilitate the development of this APP.

A. Extreme Programming (XP)

Extreme Programming (XP) arises with the purpose of reducing costs, this agile methodology helps companies to have a better control of the organization, where it will facilitate simplicity and agility in projects; which proposes a feedback between the client and the development team, having a higher success rate and adapting to any type of change, as can be seen in figure 1.



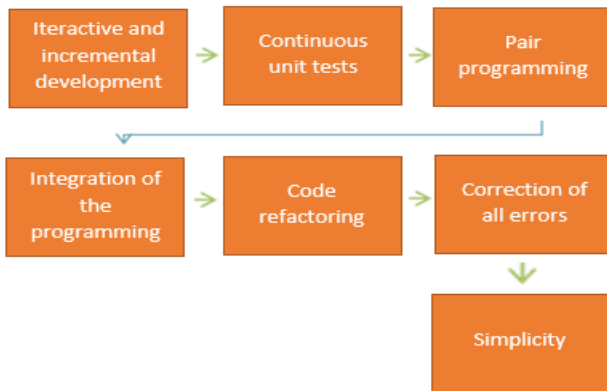


Figure 1: Features of the XP Methodology

B. Process XP

An XP project is successful when the customer selects the business value to implement based on the team's ability to measure the functionality it can deliver over time.

The complete XP development process where it starts from planning, design, coding and testing to launch [9], as can be seen in figure 2.



Figure 2: Extreme XP Programming Methodology

a) Planning

This process consists of cost estimates, the main priorities of the difficulties of the project are taken into account, this step is carried out every two weeks for greater precision and to have the most exact costs and transparent information.

b) Design

In this phase we will use the Balsamiq tool that will allow us to design the appearance of the mobile application in a more detailed way, allowing us to design a user-friendly interface. In addition, with this we facilitate development at the time of coding because we will have the design already established.

c) Coding

The coding is done in teams since with them it brings an advantage of producing better code for the programming of the software. As new strategies are undertaken in these, the most used without a doubt is technology, the development of the Android app.

d) Tests

For our test plan of this integrating project it is to test the app with the users for their benefit; According to the client's requirements, if our project is successful, it would be launched to the market to help in the health sector.

C. Technological Tools

For the fulfillment of this project we will have different technological tools that will allow the development in a more effective way and thus be able to successfully complete our mobile application with all the functions and characteristics that said application will have.

D. Artificial Intelligence

Nowadays, Artificial Intelligence (AI) is being implemented more and more in our social environment since we find it in many other things in our society, which in this project we want to carry out the development and implementation of an app, with which With this app, the patient knows what they have through the symptoms they present, the app will have algorithms which, according to what they select, will search for and discard certain diseases they present [10].

E. Mobile App

When we talk about mobile applications, we refer to programs designed to run on phones, tablets, and other mobile devices, allowing the user to perform different activities, access services depending on the function that said application was developed, as shown in figure 3.



Figure 3: Android dominates more than 70% in Peru

The most used operating system in Latin America is Android. Once we have decided on our operating system, we will use different tools that will allow us to develop said application:

System Requirements: Have a good computer with the

appropriate requirements that can support the entire manufacturing process.

- **Android Studio:** It is a development platform for an app which we will use to carry out our project.
- **SDK:** The SDK (software development kit) is a tool that we will use to support our application.
- **API Wit.ai:** For our application we will use an API that focuses on natural language processing and speech recognition. For this we will use this library that has an API that can be used in Bots, Mobile Applications, and Robots.
- **SQL Server 2019:** We will use this system to manage a database and are related.
- **Machine Learning:** We will implement it so that for each use of our app there is unlimited learning new things from new data [11], as shown in figure 4.

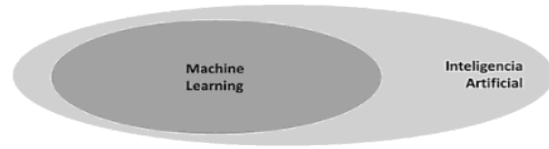


Figure 4: Machine Learning as a subset of Artificial Intelligence

III. CASE STUDY

A. Planning

To carry out this project, we will have different stages where fractions of the application will be carried out and developed, which will have a maximum time for completion. These stages or user stories are assets to be the functions or characteristics of our system that you must have to satisfy our users who will use our system.

This system will have 11 User Stories with a duration of 17 weeks that will allow the development of said stories, then follow-up of the user stories in table 1.

Table 1: User Stories

N.º	User Stories	Duration
H1	As a user I want the application to have a friendly interface for better interaction.	1 week.
H2	As a user I want a search engine to be able to enter my symptoms.	3 weeks.
H3	As a user I want the search engine to allow me to enter multiple symptoms for a better diagnosis.	1 week.
H4	As a user I want the search engine to work with voice recognition for better handling.	1 week.
H5	As a user I want the search engine to be accurate for a better diagnosis.	2 weeks.
H6	As a developer I want the search engine to be fast and accurate.	1 week.
H7	As a user I want the results shown to have a percentage of how accurate it is in order to see the similarity of the symptoms.	1 week.
H8	As a user I want the results to work with speech synthesis for people with disabilities.	2 weeks.
H9	As a user, I want you to show me detailed information about the diagnosis.	1 week.

H10	As a user I want the system to show me specialized or closest medical centers	1 week.
H11	As a developer I want the system to be constantly learning for better diagnostics	2 weeks.

B. Design

The design of any application is one of the most important phases in the project since with this we try to make it more user-friendly, improving the interface and achieving a better experience for our users. In this phase we will cover the user history H1 as shown in planning table 1 as shown in the table, it will last 1 week where two main screens will be designed:

a) Splash

It will be the first screen where the logo of our application will be displayed, it will be displayed for a few seconds then it will redirect us to the next screen that will be the search engine, as shown in figure 5.

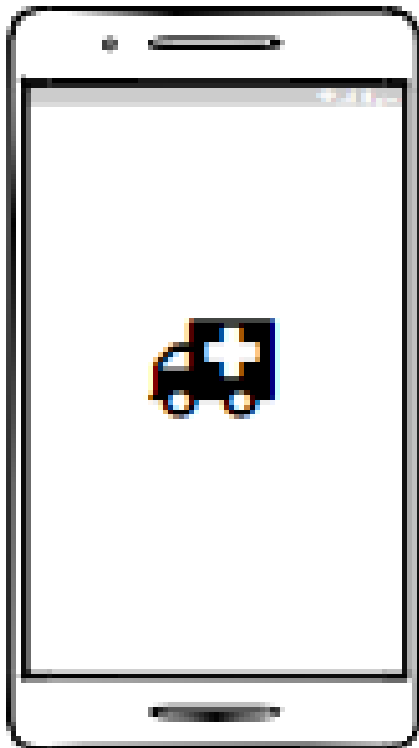


Figure 5: Splash

b) Search Engine

The Search engine will be the main screen and the most important one for our system since it will be where the user can enter their symptoms with which they will be diagnosed. The design will be simple and easy to use so that all users can use it since this application will be aimed at people of all ages, as shown in figure 6.

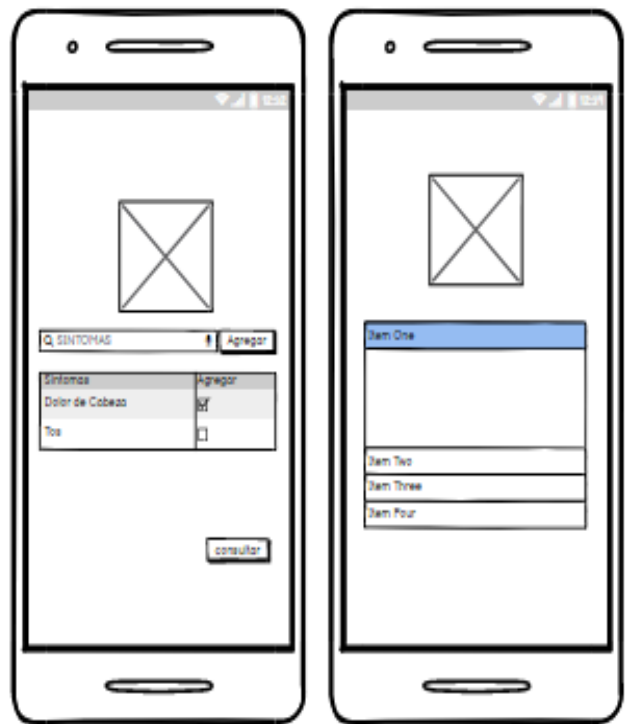


Figure 6: Search Engine

c) Outcome

For this screen, like the others, it will have a simple design for better handling. This shows in detail all the information collected about the diagnosis that shows as a result after entering all its symptoms, so that the user can understand their diagnosis in better detail and take preventive measures, as we can see in Figure 7.

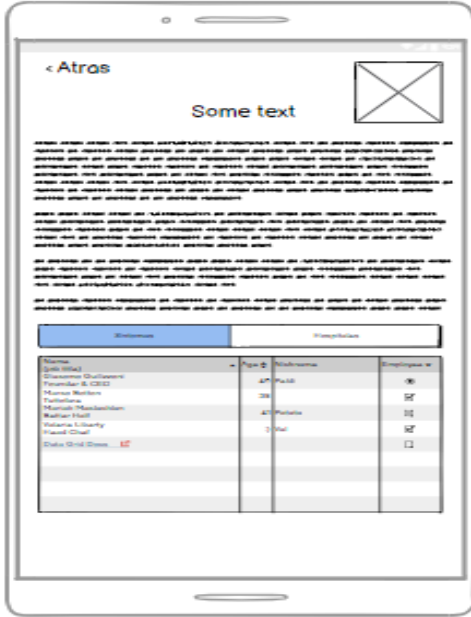


Figure 7: Diagnosis result

C. Coding

In this phase, we will begin with the development of the user stories that were detailed in table 1, which are H2 to H11, these stories are mainly focused on the search engine and the implementation of Artificial Intelligence in our system. The application will be a means of communication between a server which will be in charge of carrying out all the diagnoses and giving a response to the mobile device as shown in figure 8.

Inteligencia Artificial



Figure 8: Communication between the App and Artificial Intelligence

The application will work mainly from small algorithms which will communicate with a server as already mentioned above, with this we achieve better performance, we improve the processing capacity since all the work will be done by the server and we make our application compatible with many more devices since you will not need large resources for the application to work correctly since we know that not all the population has modern devices that support these types of applications.

One of the main algorithms that the search engine will work with is a really simple one which will capture all the symptoms that the user types which will be accumulating once concluded, it will connect to the server sent the data which will make the corresponding queries finding matches which will return two possible results in case it is not found, it will save the symptoms so that the system continues in constant growth and at the same time it will send a message that a diagnosis was not found but if it found matches it will return all the information about the diagnosis. This is how the algorithm shown in Figure 9 would work, which is the search engine.

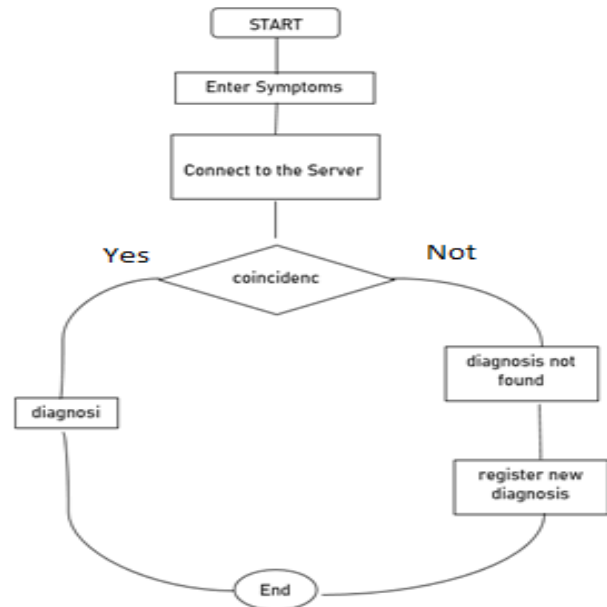


Figure 9: Search engine algorithm

D. Tests

In the testing phase it will be the most important part of the entire development since in this the operation of the application will be verified in different situations which will allow us to see how the application behaves, if it really complies with what was planned and if all user stories were successfully concluded. With this we can see the errors that it has and solve them before the application is released for end users; One of the tests that will be carried out is the functionalities test where the previously designed ones for the App will be reviewed. The non-functional requirements test will also be carried out where the availability, security, usability and performance of the application will be verified. To achieve these tests we will make use of different Tools that are on the market, these allow us to carry out autonomous and massive tests allowing us to verify the system from a static point of view, that is, it allows us to analyze our software without executing it through the source code of these Tools. They are: Bugzilla Testopia, FitNesse, Ap. Test Manager, among others.

IV. RESULTS AND DISCUSSIONS

A. About case study

The results of observations according to the medical college of Peru, we have the characteristics of the doctors who are skilled at the regional level, according to each region, geographic distribution and family health insurance, as we see in figures 10 and 11.

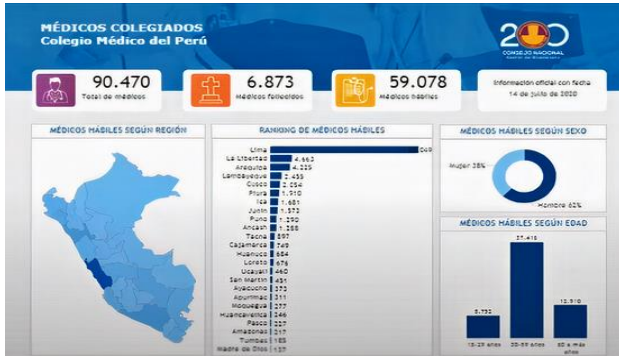


Figure 10: Geographical Distribution of Physicians

In Lima there are more doctors by a lot of advantage, then it is followed by the departments of La Libertad, Arequipa with an approximate of 4000 doctors, Lambayeque, Cusco with 2000, Piura, Ica, Junín with 1000 and the other departments are in decline.

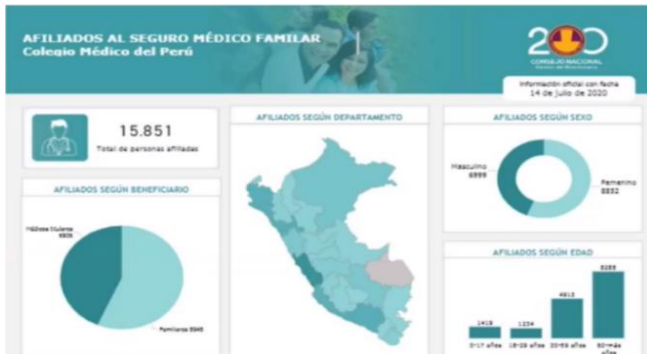


Figure 11: Family Health Insurance Statistics

As well as the number of doctors who have been infected, who are fighting in favor of their health, doctors who are hospitalized and, unfortunately, doctors who died due to the pandemic that we are facing, as seen in figure 12.

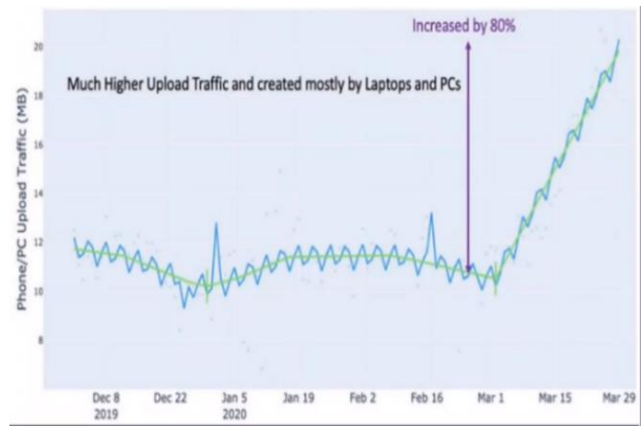


Figure 12: Doctors with covid-19

B. Differences

With this new technological innovation and accepted by our users, we seek satisfaction in our society in the field of health, and that our users seek information necessary for a diagnosis and results; where the increase in technological use helps them to obtain said information through our app that will provide our users with data that can offer them all kinds of answers to their questions, thanks to the use of their mobile phone that has internet, as we see in the figure 13.

Figure 13: Increase in Wifi traffic



The differences are as follows:

- Methodology XP
- The schedules are in pairs
- Its focus is the programming or creation of the product
- Reviews are every 3 weeks
- Customer orders are strictly followed [12]

Scrum Methodology

- The reviews are done every 2 to 4 weeks and are known as sprint
- Focuses more on project management
- Customer-approved tasks can no longer modify

C. About the methodology

Comparison between Xp and Scrum:

- Deliveries are made to the customer in short periods of time
- Allow meetings between all team members
- User history is used as tools

V. CONCLUSIONES

In this research, the use of Wi-Fi traffic can benefit several people in Peru, as shown in the graphs, since with the technology at our hands we can take advantage of even more and have more information; With this mobile App proposal help to have greater control avoiding crowds of people outside medical centers. We conclude that the XP methodology helped us to manage the development of the software, since with the stages established according to its processes, the table of users was obtained and with this we worked satisfying all the needs of the client, providing the best use and understanding of our system. This project provides the solution to the problems that are occurring in society where the application will facilitate and protect us, providing medical diagnoses; Likewise, a topic to be investigated to reinforce the research is teleconsultation since it is a more direct contact with health specialists and would provide much more confidence to patients, keeping them safe, for this, a better quality in the field of care must be achieved telematics.

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