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Use of design thinking in the creation of an application for the control of diabetes

Uso de desing thinking en la creación de una aplicación para el control de la diabetes

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Abstract

This document is the result of the implementation of the Desing Thinking and Lean Startup methodology in a software development project, carried out by students at the Technological University of Nezahualcóyotl, in order to promote entrepreneurship. Students were guided through each phase of the methodology, with incremental results. It began by determining a real problem, from a real user, later a solution proposal was made, which was implemented, until reaching a real and feasible product. The product developed is a web application for adolescents between the ages of 12 and 17, with diabetes problems and who have no control over the disease, which can exacerbate it. Within the school period several projects were carried out, but this one was taken as an illustrative case and emphasizing that an idea can be turned into a product or service and that it can be marketable. For which the students also made the Business Plan, which will not be presented due to space issues.

Resumen

El presente documento es el resultado la implementación de la metodología Desing Thinking y Lean Startup en un proyecto de desarrollo de software, realizado por alumnos de la Universidad Tecnológica de Nezahualcóyotl, con el fin de promover el emprendimiento. Se guío a los alumnos en cada fase de la metodología, con resultados incrementales. Se inició por determinar una problemática real, de un usuario real, posteriormente se hizo una propuesta de solución, la cual se implementó, hasta llegar a un producto real y factible. El producto desarrollado es una aplicación para adolescentes de edades entre 12 y 17 años, con problemas de diabetes y que no tienen control con la enfermedad, lo que puede agudizar la misma. Dentro del periodo escolar se realizaron varios proyectos, pero se tomó éste como caso ilustrativo y haciendo hincapié, en que una idea se puede convertir en un producto o servicio y que éste, puede ser comercializable. Para lo cual los alumnos también hicieron el Plan de Negocios, el cual no se presentará por cuestión de espacio.

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Introduction

Entrepreneurship is the result of the research and development of an idea, until it becomes a tangible product with the potential to be a business. One methodology that allows the development of this idea in process is called "Design Thinkin", which is linked in an important way to another called "Lean Startup". Together, these two methodologies allow the implementation of ideas into real products through creation, testing and continuous improvement.

This document shows how students from the Universidad Tecnológica de Nezahualcóyotl, through the Desing Thinking methodology, implemented an idea into a real product, which could be launched to the market.

Each stage of the methodology was followed, starting with the generation of ideas resulting from real problems, followed by a specific analysis of the user, in order to better understand the user's needs and experiences.

After correctly identifying the user, ideas were generated and then the chosen options were prototyped in a software called Balsamiq, in order to determine which would be more functional or which could better serve the user.

Manual testing of the application was done, and the user was given the opportunity to try it out and make observations that were corrected. Automated tests were also carried out with Selenium and Test project software.

In the end only two of the required functionalities were implemented due to time constraints (it was done in 3 weeks) and screenshots of the result are shown. It is worth mentioning that several tools were used for the implementation of each stage of the methodology: problem tree, value proposition and benchmarking, in addition to those mentioned above.

Literature review

Different project management methodologies and frameworks have emerged over the years. The Project Management Institute (PMI) states in its guide for project management, PMBok (2017) that a project "is a temporary effort undertaken to create a unique product, service or outcome".

According to Toruño (2019) a project is "an investment of effort and valuable resource in a temporary undertaking to achieve a unique change that produces benefits". When any entity decides to carry out a project, it must necessarily make an investment, which the BBVA bank (2020), in its portal states that: "is a limited amount of money that is made available to third parties, a company or a set of shares, in order to be increased with the profits generated by that business project".

There are different types of projects, i.e. projects can be carried out in all areas. There are economic, financial, social, technological, infrastructural, educational, health, architectural, artistic and even life projects.

For the specific case that concerns us, reference will be made to innovation projects, technological projects (software development) and entrepreneurship projects.

– According to the Oslo manual in Rodriguez (2006), an innovation project is "the set of scientific, technological, financial and commercial activities, which results in: a new product, a new service, a new process, an organisational change (organisational innovation), a change in the market (market innovation)".

– A technological project according to Doval (2006) is "a sequence of stages that aim at the creation, modification and/or realisation of a product, or the organisation and/or planning of a process or a service".

– According to Formichella in Velez and Ortiz (2016), entrepreneurship is the development of a project that pursues a specific economic, political or social goal, among others, and which has certain characteristics, mainly that it has a quota of uncertainty and innovation.

– Entrepreneurship projects are aimed at creating new innovative products or services to satisfy an existing need in a potential market.

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– For the development of projects and their correct management, a methodology is required, which we define according to (Maida and Pacienzia, 2015) "It is an integrated set of techniques and methods that allows to address in a homogeneous and open way each of the activities of the life cycle of a development project".

– Methodologies in software development or software projects are used among other things to:

– Optimise the process and the software product

– Guide the planning of the project in which it is defined: what to do, how and when it should be done, and who will carry out which activities and in how long?

The methodologies are composed of the following elements:

– Phases, which describe the tasks in each phase.

– Products, also called deliverables, which correspond to the results obtained in each phase.

– Procedures and tools, which are all those support elements necessary to obtain results, e.g. programming languages and databases.

– Evaluation Criteria. Software, like all products, must be evaluated to know if they comply with the required quality, this being understood as the satisfaction of the explicit and implicit needs or requirements of the users. For the evaluation of software quality, there are quality standards such as ISO 9126 or ISO 25000, which help to evaluate software. Not forgetting the testing that must be carried out during and after implementation.

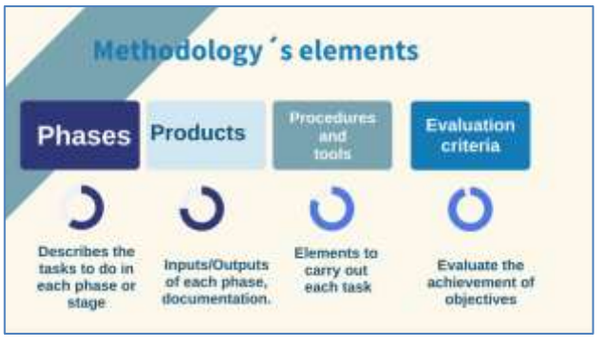

Figure 1 Elements of a Methodology
Source: Own Elaboration

For the purposes of this research, we will classify them as Traditional and Agile methodologies, among which we can mention the most important ones:

1. Classical Methodologies:

These are those that focus their attention on carrying out an exhaustive documentation of the entire project. In this type of methodology it is necessary to establish precise specifications of requirements and data modelling. It is also necessary to follow a work plan, which must be established from the beginning of the project. Within these methodologies we find the Waterfall and Iterative Process methodologies.

Agile methodologies: They involve incremental processes, with frequent deliveries of results, there must be effective communication with the client, they are frameworks that are easy to learn, but sometimes difficult to implement, with the great advantage of allowing changes to the deliverable (product) at the last minute.

Among the agile methodologies (which are rather considered frameworks) are, among others: SCRUM and Kanban.

Below, the way of working in each of the aforementioned methodologies or frameworks is shown graphically. Where:

R= Requirements
D= Design
C= Coding
T= Testing (pruebas)

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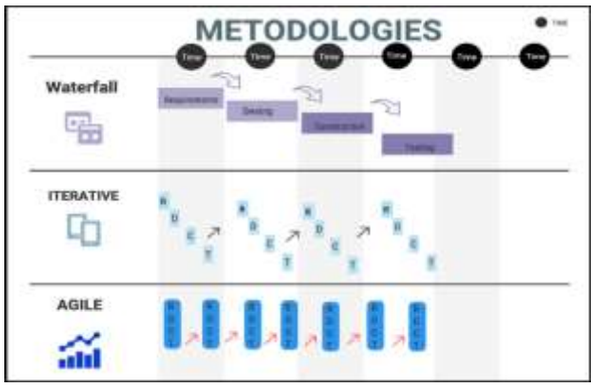

Figure 2 Methodologies
Source: Own Elaboration, based on Garzas, 2018

However, there is another "new" methodology that is currently being implemented in software development, although it was developed in 1970 by Tim Brown, who is recognised as its creator. According to Brown, Desing Thinking is the intersection of people's needs, technical feasibility and business viability (Desing Thinking Online Community 2017).

A more complete concept of Desing Thinking is established by Huertas (2018) and mentions that "it is a flexible methodology that allows the development of projects and business models based on real needs and with a User Xperience (UX) orientation". This methodology is based on the following premises, which are the basis for the success of the project under development:

– The user (User Xperience) is the main actor.
– It should focus on satisfying real needs
– Its objective is to deliver a product that improves the user's life.
– It should not tell, it should show the product, even if only graphically.
– It should not anticipate the results

Desing Thinking consists of the following phases in which tools can be used for better development:

Phase 1

Empathise. It consists of understanding the user's behaviour with respect to a real problem; in other words, a project or business model is proposed based on a real need and, above all, oriented towards improving the user's quality of life. This phase is supported by tools such as: Problem Tree, Mind Map and Observation, among others.

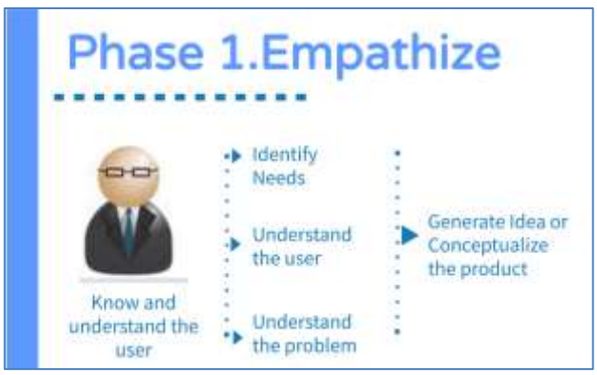

Figure 3 Phase 1. Empathise
Source: Own Elaboration

Phase 2

Define. The result of this phase is to understand the user's need, to be very clear about what they want and need, to determine how the product or service improves their quality of life and to visually demonstrate the user's need. Some tools to better understand this stage are: Infographics and empathy mapping among others.

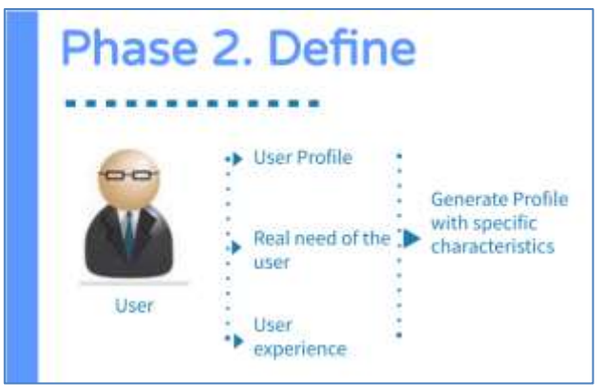

Figure 4 Phase 2. Define
Source: Own Elaboration

Phase 3

Ideate. In this phase the creative stage begins, after understanding the user. It is in this stage where alternatives are created, possible solutions are imagined and components are devised. The recommended tools in this stage are: the value proposition and Benchmarking.

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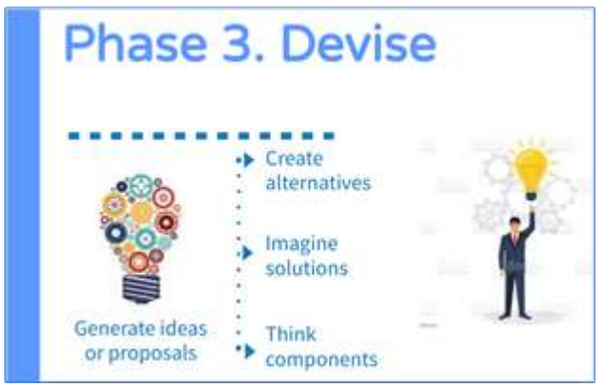

Figure 5 Phase 3. Devise
Source: Own Elaboration

Phase 4

Prototyping. In this stage the product is modelled and prototypes are generated, which can be in second or third dimension, always focused on the user's needs and aimed at improving the user's quality of life. The prototypes must be testable in order to select the best option. Among the tools recommended for prototyping are: Storyboard and Mockups.

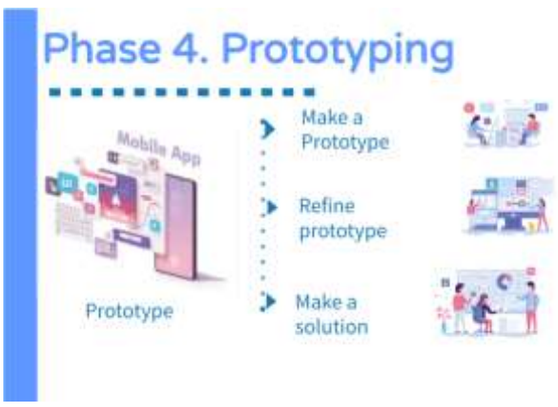

Figure 6 Phase 4. Prototyping
Source: Own Elaboration

Phase 5

Testing. This phase consists of testing the prototypes developed, to determine which are functional and thus choose the best prototypes for implementation in the next stage: Implementation.

This stage allows to analyse the responses of the users with respect to the tested prototypes and which one had more impact or better meets their expectations. Some recommended tools for testing are: TestProject and Selenium.

Figure 7 Phase 5. Testing
Source: Own Elaboration

Phase 6

Implement. After having done all the necessary tests on the prototypes, the one that is most usable for the user and meets their requirements must be chosen. In other words, the product or service must be implemented and made available to the user.

These are the six stages of the Design Thinking methodology, but it is very important to mention that it is totally linked to the Lean Startup methodology (as shown in figure 8). Because it is in this methodology where the development of the project (product or service) is done to later go to the market for its sale.

Figure 8 Desing Thinking & Lean Startup
Source: Own elaboration, based on Herrera

For the purposes of this paper, a startup is understood as an emerging company that seeks to undertake a new business within a potential market. According to Hernández (2017) "a startup will be oriented towards the development and/or use of technology, looking for market niches that create ideas".

The Lean Startup methodology is an iterative process based on four phases: Create, Build, Measure and Learn. This is stated by Ries (2012) in his book "The Lean Startup Method", where he mentions that "the fundamental activity of a startup is to turn ideas into products, measure how consumers respond and learn when to pivot or persevere". He also mentions that the success of a startup is based on its ability to understand the feedback it receives from the user.

Ries establishes the so-called "Information Feedback Loop, based on the three elements of the methodology: Create-Measure-Learn, as shown in the figure below.

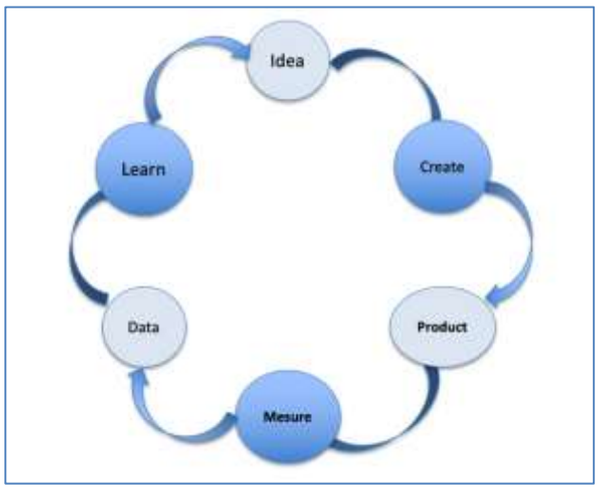

Figure 9 Information Feedback Loop
Source: Own elaboration, taken from Ries (2012)

As can be seen in Figure 8, Lean Startup is an intermediate process of Desing Thinking. In other words, both methodologies complement each other in order for a venture to achieve success in a better way.

Methodology

General objective

To develop a web application for diabetes control in young people from 12 to 17 years of age based on the application of the Dising Thinking methodology.

Specific Objectives

1. Define the problems presented by the probable user and his profile considering demographic and psychographic characteristics.
2. To detect the main competition through benchmarking, making a comparative analysis between companies that offer a similar product.
3. Design the application and its prototype, carrying out the necessary tests to evaluate its functioning.

Type of research

In order to carry out this project, documentary research was used to support the theoretical basis for the development of this project. Exploratory research was also applied to define the user profile and the competition through benchmarking.

Desing Thinking Method

The process of Desing Thinking (empathise, define, ideate, prototype, test, implement) was followed and implemented as detailed below.

Through the aforementioned methodology, the results obtained in each of its phases are shown. Until achieving a product based on a real need, for a real user.

Results and discussion

According to Velez and Ortiz, entrepreneurship projects are "The implementation of an idea into something tangible", that is why in the Unviersidad Tecnológica de Nezahualcóyotl, in the new program of studies of the Software Development Engineering Career, there is the subject "Methodologies for Software Development", in which they are taught the different types of projects and methodologies for their realisation.

The application of the Desing Thinking methodology in software development is detailed below.

Phase 1. Empathise. This consists of understanding the user's behaviour with respect to a real problem. For this phase, the problem tree tool was used, which consists of determining a real problem and identifying the causes and consequences, as shown in the following image.

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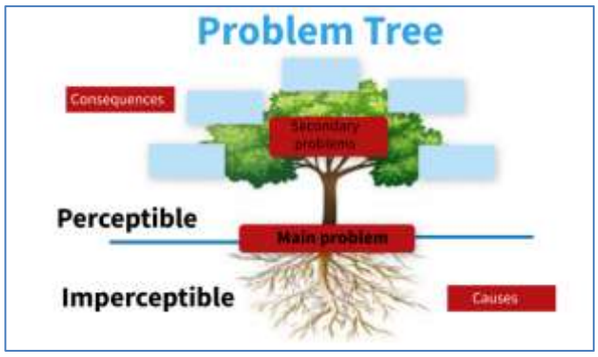

Figure 10 Problem Tree

The students made their tree with the problem: Diabetes. The result of their analysis is shown below.

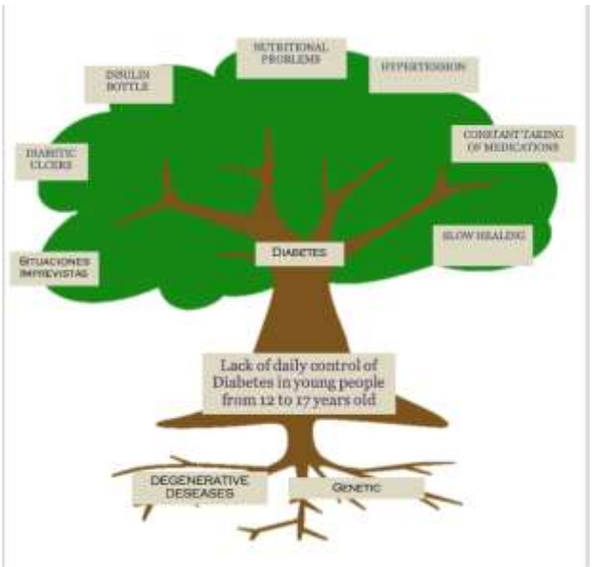

Figure 11 Problem tree: Diabetes
Source: Ayala, 2022

The real problem they established was related to diabetes, taking as the main reference point the control that a patient with this condition, specifically a minor, should have.

Phase 2. Define. In this phase, as mentioned above, it is necessary to establish the user profile. The better the definition, the better the approximation to their needs. The user profile is shown below.

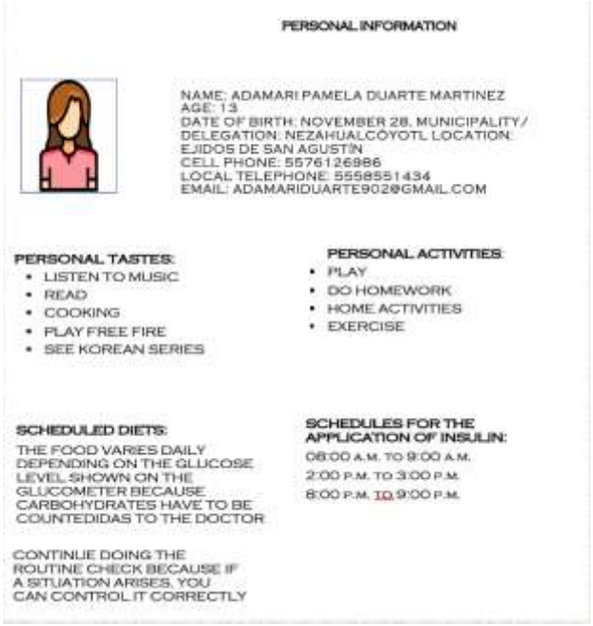

Figure 12 User Profile

Phase 3. Devising. In this phase the students began to devise applications that could solve the problem of the lack of control over medication and routines that an adolescent with diabetes must follow.

Two tools were used in this phase: Value proposition and Benchmarking. Both tools are presented below.

The value proposition is a tool that consists of two parts, the first is aimed at getting to know the client and their real needs or problems.

Its objective is to generate Business Models, profitable products or services that improve people's lives. It starts by defining the problem (in the customer part) and moves on to the proposed solution, in the product/service part, and closes again in the customer section (see image below).

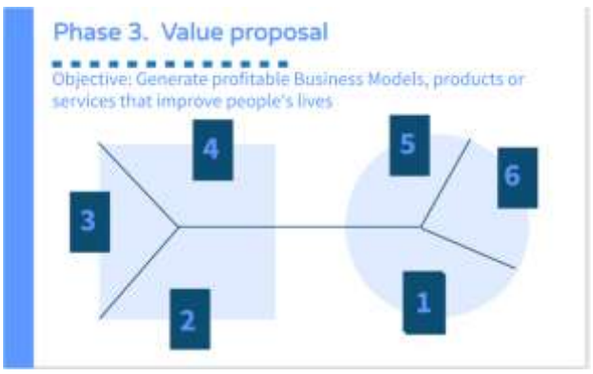

Figure 13 Value Proposition. Elements

The value proposition of the project is presented below

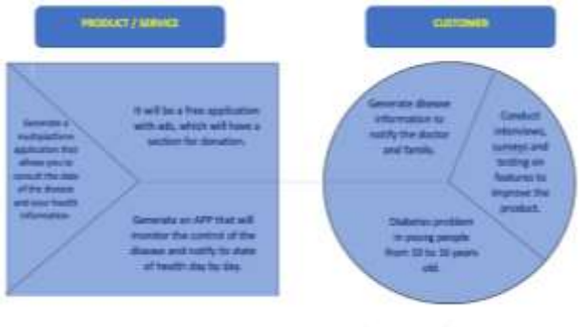

Figure 14 Example of Value Proposition
Source: Ayala (2020)

Another tool used in this phase is Benchmarking (Cárdenas 2006), which consists of the evaluation of products, services and processes between organisations, whereby one of them analyses how another or others perform a specific function in order to equal or improve it. It is a tool used to determine the advantages and disadvantages of competitors and to establish parameters or metrics in the development of similar products, with the aim of improving them. A part of the Benchmarking analysis carried out by the students is shown in the following image:

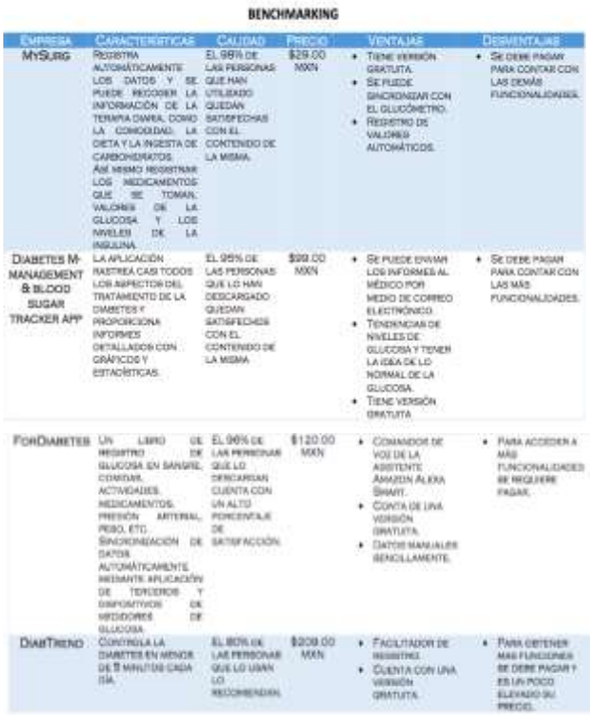

Figure 15 Benchmarking

Phase 4. Prototyping. In this stage the product is modelled, for which the students made the Mockups, in a software called Balsamiq. In order not to extend the document, only some screens will be integrated.

It was prototyped for both a web application and a mobile one, to later evaluate and decide which one the user considered more practical or easier to use.

2. Web application

The application is presented below for use on a computer or tablet.

Figure 16 Login

Figure 17 Medication Schedule

Figure 18 Glucose Recording

Figure 19 Suggested diet

Mobile application. According to Florido (2013) "It is software that uses a mobile device as a tool for communication, management, sale of services-products aimed at providing the user with the needs that he/she demands automatically and interactively".

Figure 20 Logging in

Figure 21 Registration

Figure 22 Glucose recording

Figure 22 Medication Schedule

Figure 24 Suggested diet

Phase 5. Testing. This phase consists of testing the application, in order to detect errors. The tests were carried out manually and automatically. The latter was done with Test Project software. Here are some screenshots.

We started in Test Project and we indicated the type of project to be evaluated, as shown in the following image.

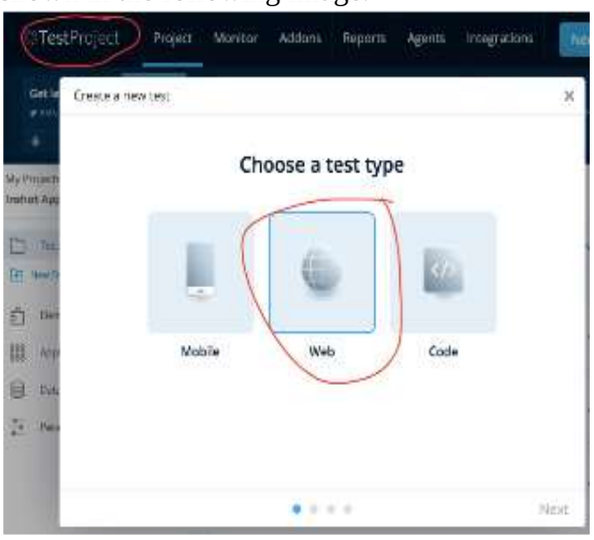

Figure 25 TestProject - web application evaluation

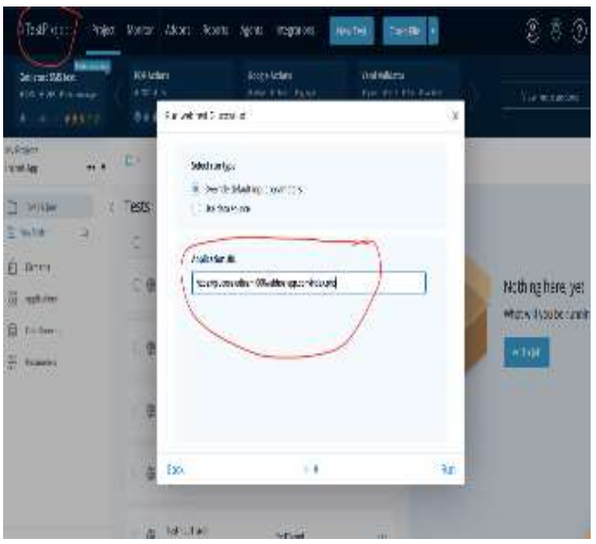

Figure 26 Enter URL

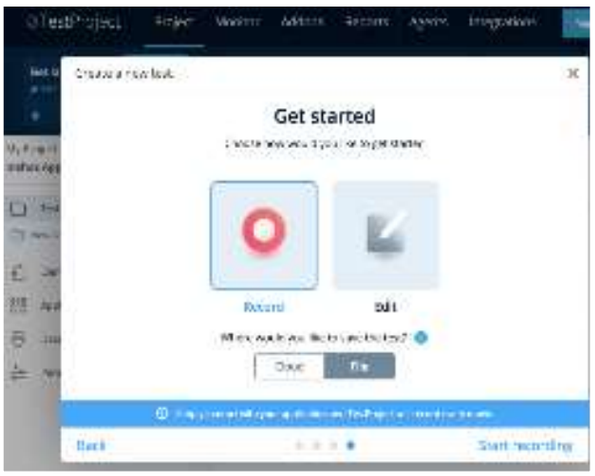

Figure 27 Test recording starts

Figure 28 Application login from test

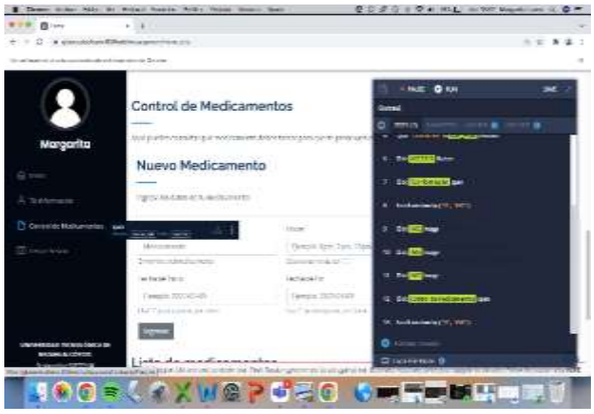

Figure 29 User data. Inside test

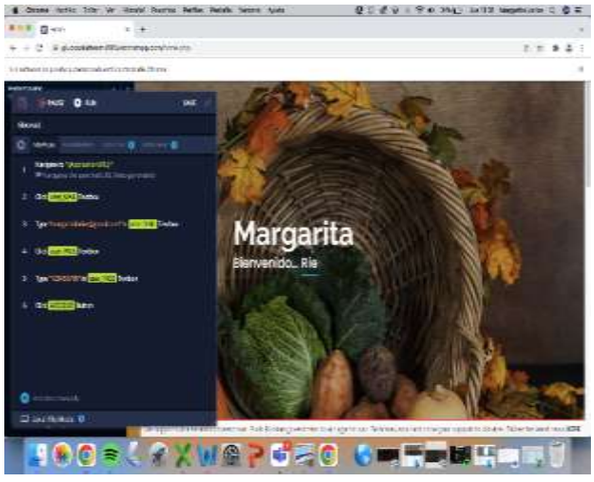

Figure 30 User data. Inside test

Figure 31 Test Report

Phase 6. Implement. This phase consists of uploading the project to a server and executing it from any browser. Some screens of the application's functionality are shown below.

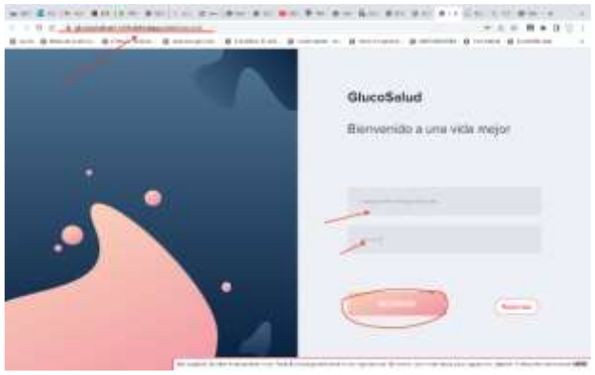

Figure 32 Web application login

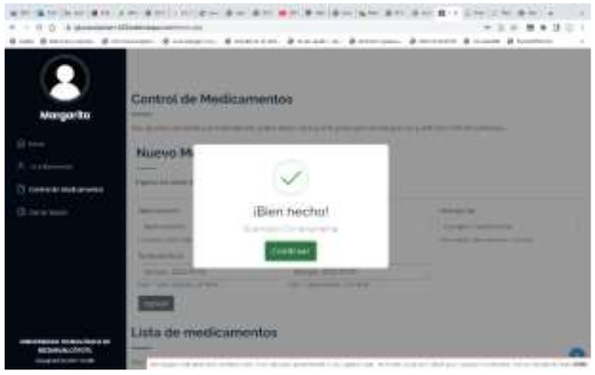

Figure 35 Home page

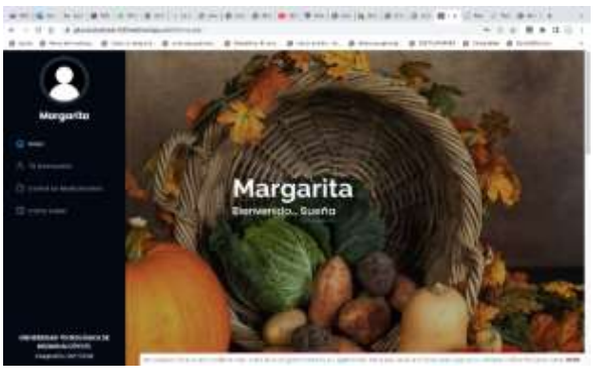

Figure 36 Registration of medicines

Figure 37 List of medicines

Conclusions

Methodologies are a great support for the development of projects, some are very robust and others are light, but all of them have the same objective: to create functional and marketable products or services.

The methodologies mentioned in this document are not totally new, but they are starting to be implemented in IT areas, which helps students to generate projects in a "faster" way, since they already know the traditional methodologies and rely on them for a better development. The students had the ability to develop projects that can be implemented as a startup and that are feasible to commercialise.

Six similar projects were developed, which cannot all be shown due to space limitations, but others were developed, such as: a mobile application for children with language problems and another to provide physical therapy to young people with limb problems due to some kind of accident.

It is worth mentioning that the users are real, as are the problems. For example, in the case of Diabetes, the user taken to develop the idea was the sister of one of the members of the team; and for physical therapy, the user was the brother of a member of another team who, in recent months, had a motorbike accident. This is an important requirement of the Desing Thinking methodology.

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