

Proposal For A Medical Assistance Prototype That Will Help And Improve Care In Peru

Rosa Perez-Siguas^{#1}, Hernan Matta-Solis^{*2}, Eduardo Matta-Solis^{#3}

^{1,2,3} Faculty of health sciences, Universidad María Auxiliadora, Lima Perú

¹rosa.perez@uma.edu.pe, ²hernan.matta@uma.edu.pe, ³eduardo.matta@uma.edu.pe

Abstract — Nowadays, the use of technologies is developing quickly, helping society and providing us with tools to develop all kinds of research. This article focuses on people who have symptoms, disease, or require a daily checkup. Therefore a prototype of medical assistance was designed since there are different problems such as lack of coordination and a problem of saturation in care for the health sector in which many citizens can not be attended, and do not go to health centers for different factors, including the current pandemic of covid-19 for which they are afraid to perform their checkups for fear of contagion. For the realization of the medical assistance prototype, a set of scientific articles was used where the problem was analyzed in detail. In this research, the development of a mobile application that uses the data and information of the most common symptoms and diseases was proposed in order to provide a diagnosis to users who use this application for free. Through this analysis, it is expected to propose a first prototype of a mobile application so that the cases can speed up the attention in the medical centers with the help of the generated diagnosis. In this work, the objective is to help people who require a daily checkup in order to prevent different diseases as well as to provide medical assistance. The methodology used is Design Thinking, which helped to solve the problem. The result obtained is a prototype of medical assistance that will benefit several people.

Keywords — Attention, Covid-19, Design Thinking, Mobile Application, Prototype, Symptoms.

I. INTRODUCTION

At present, in Peru, we live in a system with an oversaturated management system specifying more in medical consultations by having to go to a doctor in person, and we must make a medical appointment and wait days or weeks for attention. Unfortunately, in this era, where covid-19 has appeared, taking the risk of going out can be an imminent danger. Therefore, we have seen the need to do exhaustive research to develop an intelligent mobile application that can attend the patients' consultations in a precise way, without the need of having a doctor in person [1].

Among the problems we have been going through for years in the health, the sector is a list of problems that have been dragging on for years such as lack of medical assistance, lack of medicines, lack of ethical medical protocols, hospitals in poor condition, corruption, among other incidents [2]. These results provide insight for health managers or ministers who have the responsibility to make correct decisions in a

prompt manner in support of the population to improve the quality of services and the satisfaction needed.

Unfortunately, even though the state is required to have good control, people do not get to be attended in time, and this causes the disease that the patient presented to be aggravated or in the worst case, the patient may die because there may be a possibility that a medical diagnosis can be used for a case that may be malignant for patients with symptoms that are not perceived with bare sight [3]. Possible reasons for this occurrence would be the lack of information and lack of prevention in their health of citizens; therefore, in this study, we will try to give emphasis to this research for subsequent implementation of an application that is adaptable to current events, also explained on an appropriate methodology for implementation in the future [4].

The importance of this research is to be able to use information technologies to provide solutions that may have limitations, but that try to treat mild cases of patients and that these can give a diagnosis through artificial intelligence with specialized Machine Learning techniques to predict different medical diagnoses [5]. Technologies such as mobile web applications are used in various parts of the world to provide solutions to the medical and health field as we can see research that uses web applications or in the case of mobile applications as we can see that shows us an efficient mobile application that tries to communicate with the server and to obtain data of interest to patients [6].

The work has been done with the aim of helping people who need a medical assistant by designing a prototype that can provide a good service to their patients.

The present work is structured as follows: Section II will describe in detail the methodology used for the prototype. Section III will show the case study, Section IV will present the results obtained, and finally, Section V will present the conclusions.

II. METHODOLOGY

The methodology to be used will be Design Thinking because it is oriented to the creation of products, which will help us to make the prototype and thus solving the problems mentioned above in such a way that reduces the



risks and, on the other hand, increases the chances of success [7]. Fig. 1 shows the phases of the Design Thinking methodology.

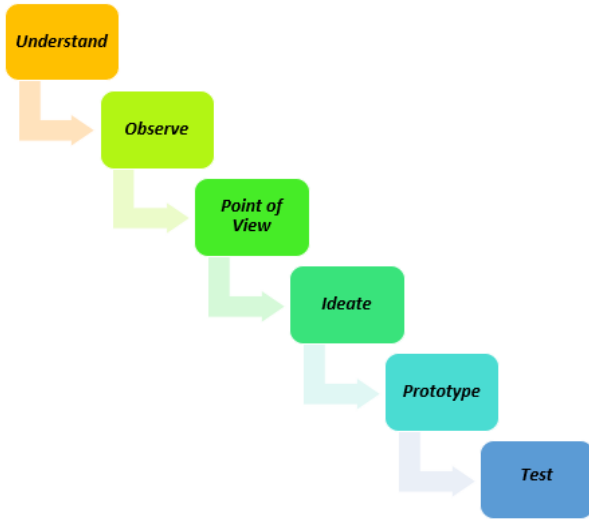


Fig. 1 Phases of the methodology

A. Understand

In the first stage, the information about the problem to be solved was collected and analyzed in-depth in order to understand the existing needs.

B. Observe

In the second stage, all the information is processed based on the needs requested by the person through extensive research.

C. Point of View

In the third stage, the first and second phases mentioned above were analyzed and compiled in order to obtain a clear direction and point of view.

D. Ideate

In the fourth stage, we have a clear picture and a clear idea of the existing problem.

E. Prototype

In the fifth stage, we design the prototype that is converted with the idea, the main requirement of this stage is to convert the idea into a prototype.

F. Test

The sixth and final stage is a detailed evaluation of the patient's requirements in order to provide safe and quality care.

III. CASE STUDY

A. Understand

Information of the health centers, this section is based on the analysis of the lack of information of the health centers of the Peruvian state for the attention of patients as it can be demonstrated in the following subsections; this can be

explained due to lack of information and due to lack of prevention in their healthcare.

- Due to lack of information

The main problem that exists in the health centers is the collapse of patient care, the huge waiting lines that form outside the centers from very early hours in order to be attended since in public hospitals there is at least a limit of care per day depending on the specialties.

EXPECTED LEVEL PATIENTS - PARTIENS SERVED

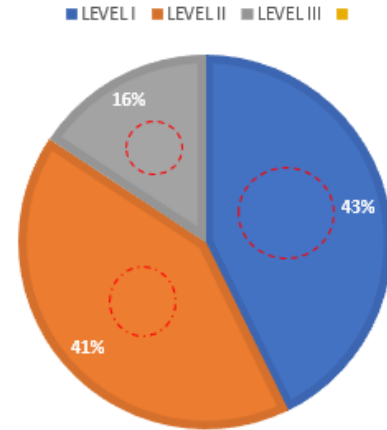


Fig. 2 Level data on the basis of medical care 2019

There are categories of health facilities by the level of care according to the MINISTERIAL RESOLUTION N° 546-2011-MINSA [8]. There are 3 levels of care, each with different degrees of complexity:

a) First level

Main activities developed include health promotion, risk prevention, health damage control, timely diagnosis, and treatment.

b) Second level

It complements the comprehensive care provided at the previous level by adding a higher degree of specialization in terms of human resources and technology, and it also provides access to emergency and urgent care.

c) Third level

It is the one with the greatest specialization and resolution capacity in terms of technology and human resources directed to the solution of the health needs referred to in the previous levels, and urgent or emergency care. Therefore, based on this information, patients should be directed to the corresponding health centers. For example, if a person wants to treat a cold, they should attend a facility that corresponds to the first level, even if the person lives near a third level health center, although it is not an obligation that this person has to comply with this small concept, it should be done, so that third level facilities do not collapse with the attention of

their patients and can attend the patients who need it most, due to the urgency or emergency that they present [9]. As an example of the number of patients, we can see Fig. 2 where it shows the levels of health care, the estimated number of patients to be attended, and the difference of how it is being attended under data extracted from 2019 with respect to the National Institute of Statistics and Informatics (INEI by its Spanish acronym). In it, we can appreciate that at all levels there is a large range of waiting something that really makes inefficient in the current situation that is happening in the country and we can appreciate it more in the first level where a million and a half patients only a number of nine hundred and thirty thousand patients will be attended in the best way and others will have to do to an indeterminate wait. The purpose of this application is to help facilitate this task, referring patients according to the symptoms they present towards the corresponding health centers [9].

B. Observe

Observation - lack of prevention in health, another of the most common problems is that people do not take the necessary precautions regarding their health. When they have any discomfort, they expect it to cure themselves or self-medicate without having any knowledge about what they are ingesting or applying. Also, it happens that they do not have time to go to the medical center due to lack of time, either because their work or studies do not allow them to do so. Another case would be the lack of money needed to go for medical consultation; although there is free insurance to solve the economic problem, there would be a problem of the collapse of care due to the number of people who come to the establishment.

Fig. 3 shows the most common reasons why people do not go to medical centers for a consultation, extracted from the website [10]. In it, we can see that in the brown bar with 41.2%, they did not attend because it was not necessary, followed by the green bar graph with 31.6%, where they indicated that they used home remedies or self-prescribed. In the red graph, 18.1% indicated that it was due to lack of time because the appointments in public health insurance are scheduled at the available times. In the orange graph, we can see that 14.4% were due to mistreatment, lack of trust, and delay. The blue bar graph with 11.4% identifies lack of money, and finally, the purple graph with a percentage of 3.8% identifies that it was due to distance. Therefore, we can see that there are several reasons why several patients do not want to go to be cured [11].

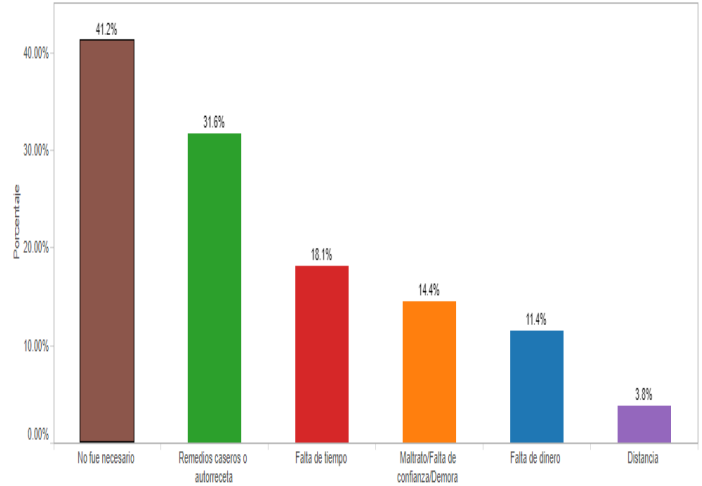


Fig. 3 Percentage of non-consultation to health services

- *Covid-19, also known as Coronavirus*

Fig. 4 and Fig. 5, extracted from the global data of covid-19, shows the increase of covid-19 infected in Peru, the number of deaths up to April 2021, in which we can see that it is one of the reasons why patients no longer want to resort to on-site medical care due to the danger of contagion [12].

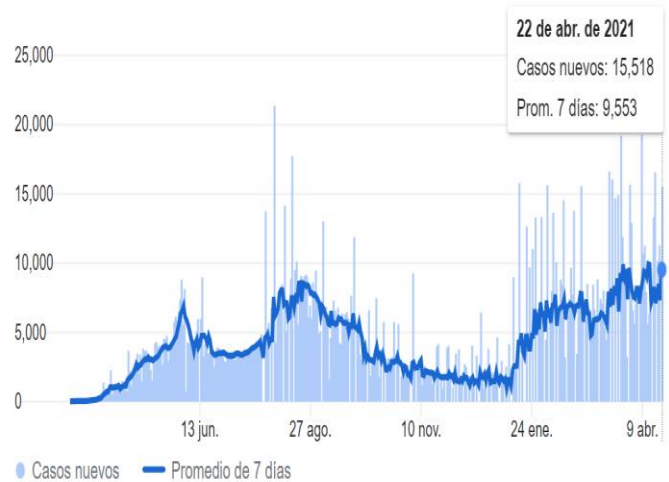


Fig. 4 Statistics on the increase in coronavirus infections from the beginning of the pandemic to the present.

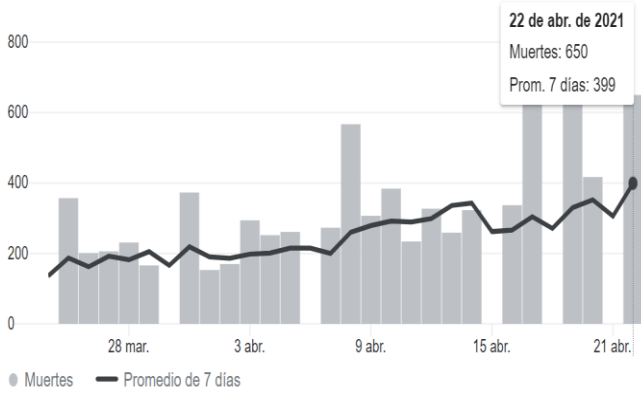


Fig. 5 Statistics of increase of deaths in the last 30 days compared to April 2021.

C. Point of View

This application will allow monitoring the user's health by providing advice and/or treatments based on a diagnosis that the application will determine based on the answers given by the user about their symptoms, also providing them with the individual information they will need for a possible meeting with their actual doctor. This application will be designed for people with no medical experience. Additionally, the application will list all the health centers closest to the user, the distance will be measured with the help of the GPS of their mobile device and will direct the user to the respective center of their choice with the help of Google Maps, which will be integrated into the application.

D. Ideate

Once the use of an analysis of the Peruvian situation has been made, we can identify that for the development of an efficient mobile application, it is necessary to use a methodology that adapts to constant changes such as Design Thinking; therefore, in this case, we can state that the ideal is the use of the Design Thinking methodology.

E. Prototype

In this stage, the prototypes will be created, and the application will be developed using the programming languages and resources already mentioned in the first stage. The mobile application will be developed to be compatible with cell phones with Android and IOS operating systems, so it was decided to create a hybrid application using a framework called IONIC [13], which will help us achieve this goal; this framework allows us to work using Javascript, HTML, and CSS, at the end the framework will be responsible for compiling the files we have worked and generate new files to upload our application to the respective application stores platforms (PlayStore and AppStore). In the back-end, we will work with a framework called Laravel, as it provides us the facilities at the moment of developing and creating REST API services to be able to connect with the application and manipulate the information stored in the

database. The database to be used will be MySQL because this database is open source, easy to configure, and is mostly used for web development environments [14].

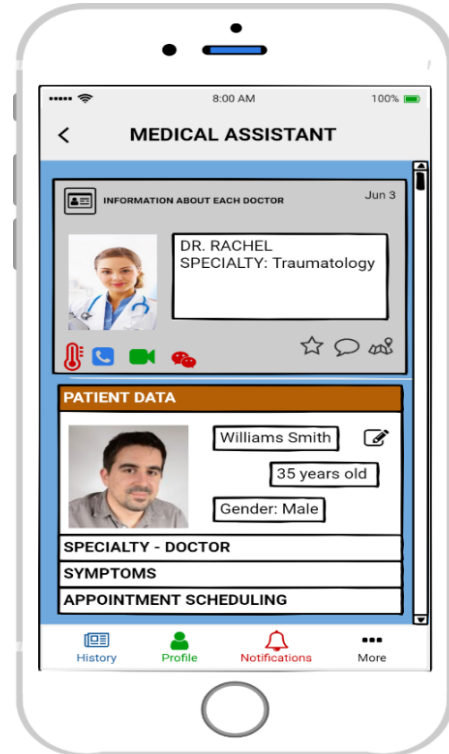


Fig. 6 Prototype medical assistant

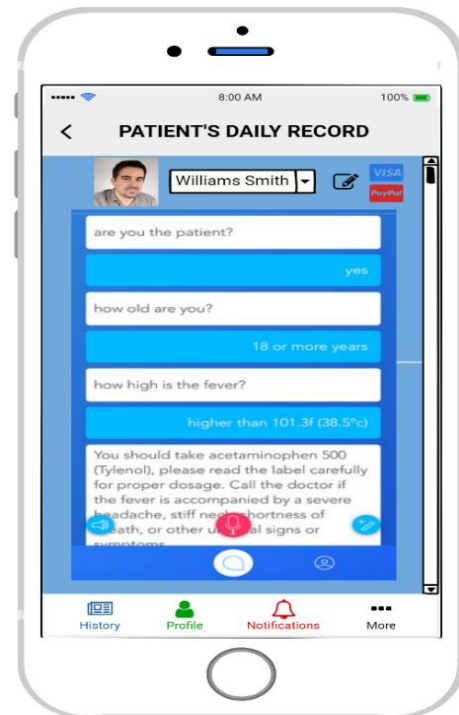


Fig. 7 Patient's Daily Record

Fig. 6 shows the result of the prototype as the first interface, the required specialty, and information of each doctor is chosen, which can be communicated by call, video call, or also by a medical assistant via text message. In addition to this, the data of each registered patient is observed, Fig. 7 shows the second interface where the patient, after being registered, provides their information according to weight, height, allergies, among other things, and for this, they communicate with a medical assistant who will obtain all the data required by each patient, as well as payments are made via credit or debit card to facilitate the person to have a good service especially quality.

IV. RESULTS AND DISCUSSION

A. About the Case Study

For the case study, the prototype design was carried out in order that patients can perform their medical checkups and if necessary they can schedule an appointment by contacting the doctor so that there is no longer any inconvenience, thanks to this it can facilitate the person to perform their activities hence the application is designed to continue to have the excellent performance to the user using the medical assistant. One of the tools used for the design of prototypes was the software Balsamiq Mockups that allowed to design effectively. This program has several advantages. For example, Balsamiq works like any usual application, in which you can move from one side to another and save mockups in a document [15] in order to realize the mobile application in such a way to have an ideal prototype for the user.

Fig. 8 shows a flowchart that begins with the first step and then leads to the internal or external consultation that is required and then passes through a check to verify the consultation in detail of each process performed after analysis is performed; the next step is to provide the diagnostic information to then be taken to a condition if it requires therapies or medications and finally a report of the data obtained is printed.

B. About the Methodology

It is a methodology for creating new and innovative ideas that focus its effectiveness on understanding and offering a solution to people's real needs. It starts the way product designers work. It has 6 stages, such as empathizing, defining, devising, giving the point of view, prototyping, and finally evaluating; all phases must be carried out in an orderly manner to achieve good results. Moreover, the Design Thinking methodology helps a lot to solve the problems found.

a) Advantages

Among the positive results of using the design thinking methodology is the rapid resolution of any problems that may occur. This is why the customer is at the center of the construction process in a certain way. It is clear that the development process overcomes the problems by providing guidance on the skills and tools needed to solve both problems. It should be noted that this methodology is focused on the specific problem and therefore solves the real problems we face in society as well as being a potential user-centered process. Another benefit is that the approach in this direction adapts to new solutions and services to meet the needs of the patient and thus obtain optimal results [16].

b) Disadvantages

The disadvantage of the Design Thinking methodology is that it cannot be used for every type of process, and it is a fundamental change to the organization in which it must be well specified for the application of the methodology.

c) Comparison

Design thinking is ideal for discovering opportunities and thus being able to identify problems thoroughly and from there to propose solutions and build empathetic relationships with users, while Design Sprint is constituted by methodological processes that focus on solving problems in a specific way within a clearly well-defined scope, it is focused on solving problems in a specific time range, that is, concrete problems with a well-defined scope already delimited. These two methodologies coincide in solving the problems that exist, but the way of employing the methodology involves different processes [17].

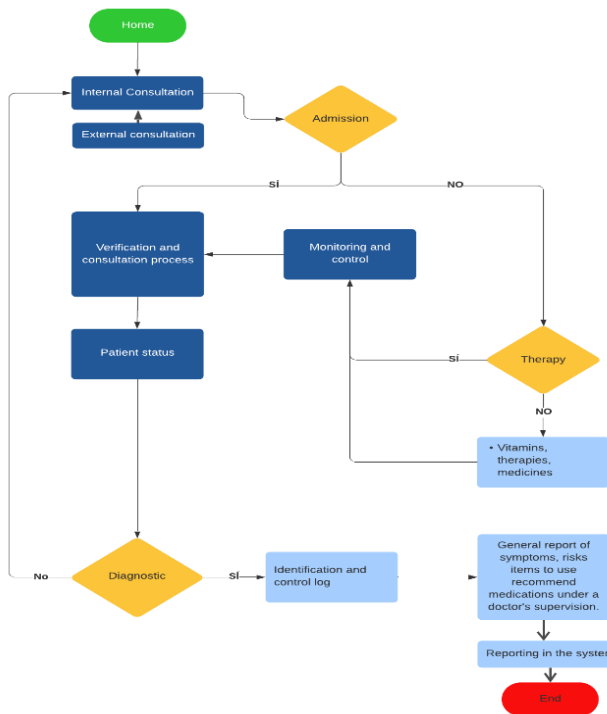


Fig. 8 Flow diagram

V. CONCLUSIONS

Consequently, the design of the medical assistance prototype will help patients who need a diagnosis in a fast and efficient way. The application integrates all the required health information of a person aimed at the different health states in which various results are generated and contacts all health care experts with whom the person is related in any health care situation. It shows unquestionable advantages in health administration and organization, as well as in public health. Therefore the ease of application avoids inconveniences that may arise, such as a quick check-up and diagnosis based on symptoms detecting what occurs to the patient. Likewise, the use of the Design Thinking methodology was fundamental since it is focused on the user and on the problems that may arise, which made possible the development of the prototype design and application. With this prototype of the medical assistant, we intend to implement the software in the future in order to implement it in Peru in such a way to provide quality medical assistance and, most importantly, the safe and reliable manner in which it is easier to diagnose diseases based on the symptoms presented and thus to provide a better quality of care for the benefit of the population.

REFERENCES

- [1] Ram, and E. Jain., Performance Comparison of Hadoop and spark engine., Proc. Int. Conf. IoT Soc. Mobile, Anal. Cloud, I-SMAC (2017) 671–674 doi: 10.1109/I-SMAC.2017.8058263.
- [2] Gomez, L. C., Health status of the Peruvian population. In Health(2019).
- [3] Care in Peru: Resources and Policy., Routledge. 15-52.
- [4] M.Wegmuller,J.P.vonder Weid,P.Oberson and N.Gisin, High-resolution fiber distributed measurements with coherent OFDR, in Proc. ECOC'00, paper 11(3)(2000) 109-125.
- [5] R. E. Sorace, V. S. Reinhardt, and S. A. Vaughn, -High-speed digital-to-RF converter, U.S. Patent 5668842, 20(2) (1997) 300-325.
- [6] FLEX Chip Signal Processor(MC68175/D), Motorola, 15(3) (1996) 250-275.
- [7] PDCA12-70 data sheet, OptoSpeed SA, Mezzovico, Switzerland.
- [8] Brown, T., & Wyatt, J., Design thinking for social innovation. Development Outreach, 12(1) (2010) 29-43.
- [9] J. Padhye, V. Firoiu, and D. Towsley, A stochastic model of TCP Reno congestion avoidance and control, Univ. of Massachusetts, Amherst, MA, CMPSCI Tech. Rep. 8(4) (1999) 99-120.
- [10] Díaz, J. J., & Saldarriaga, V., Encouraging the use of prenatal care through conditional cash transfers: Evidence from JUNTOS in Peru. Health economics, 28(9) (2019) 1099-1113.
- [11] COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University., 2021, [Online]. Available: <https://github.com/CSSEGISandData/COVID-19>
- [12] MINSA., Resolucion Ministerial., in Resolucion Ministerial 546-2011-MINSA, 148 (2011).
- [13] Y. Yang, Y. Zhang, P. Xia, B. Li, and Z. Ren., Mobile Terminal Development Plan of Cross-Platform Mobile Application Service Platform Based on Ionic and Cordova., Proc. - 2017 Int. Conf. Ind. Informatics - Comput. Technol. Intell. Technol. Ind. Inf. Integr. ICIICII (2017) (2018) 100–103 doi: 10.1109/ICIICII.2017.28.
- [14] M. Sendiang, S. Kasenda., A. Polii, and Y. R. Putung, "Optimizing Laravel Authentication Process., Proc. - 2018 Int. Conf. Appl. Sci. Technol. iCAST (2018) 247–251 doi: 10.1109/iCAST1.2018.8751257.
- [15] Eke, N. O., & Salihu, I. A., Design and Implementation of a Mobile Library Management System for Improving Service Delivery., Traektorîa Nauki= Path of Science, 7(4) (2021) 3001-3010.
- [16] Rivero, J. M., Rossi, G., Grigera, J., Luna, E. R., & Navarro, A., From interface mockups to web application models. In International conference on web information systems engineering., (2011) 257-264. Springer, Berlin, Heidelberg.
- [17] González González, E. J., Technological tools in teaching EU: a design thinking proposal., (2021).
- [18] de Sá Araújo, C. M. M., Santos, I. M., Canedo, E. D., & de Araújo, A. P. F., Design Thinking Versus Design Sprint: A Comparative Study. In International Conference on Human-Computer Interaction., (2019) 291-306. Springer, Cham.