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Development of a Web System that Allows Detecting Stress in Young People between the Ages of 18 and 23 to Treat them Early

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Abstract—Stress is a disease that goes unnoticed in most cases, currently the world is going through a global pandemic that in many cases has generated an increase of the stress level in the population; however, this disease is a response of the organism to stress factors, such as the work and educational environment, implying that the university population is very prone to suffering stress or already has it, for this reason, the present work is focused on they. Finally, a web system will be developed to a large extent that will allow detecting stress in university students through a form, for which multiple web technologies will be used, in addition to the Scrum methodology. In this way, a website prototype was obtained that meets two objectives, the detection of user stress and ensuring that they obtain the necessary information so that they know the causes and effects of this disease, as well as activities that help them to cope, control and overcome stress; thanks to this present project, the user will be able to know their stress level and knowing the severity of this, they will resort to the necessary professional help, achieving in the future, reducing the stress index in the university population.

Keywords-stress; treatment; website; college population.

I. INTRODUCTION

Every person at some point in their life has experienced stress, and this refers to the response that the body gives after the relationship between the person and their environment, generally in negative or tense situations such as unemployment, illness, death, overload of tasks, love breakup, etc., which generates multiple health problems of different degrees that range from headaches and insomnia to asthma and heart attacks [1].

Keeping in mind the context of a global pandemic that has been going on for more than 2 years, this disease is affecting a large part of the population of Peru. The National Institute of Mental Health (INSM) belonging to the Ministry of Health (MINSA) affirms that 52.2% of the population residing in the city of Lima suffers from stress at moderate to severe levels [2], this is quite an alarming figure considering that according to the 2021 census carried out by the National Institute of Statistics and Informatics (INEI), in Metropolitan Lima there are 4,666,000

peruvians [3], this means that in this city alone there are more than 2,333,000 people who suffer from stress due to Covid-19, the latent uncertainty of being able to get it or concern for the health of family members, in addition to work and academic stress that also are present, however, despite the mentioned number, there are few programs promoted by the State to be able to provide information on the mentioned disease and few Peruvians have sufficient knowledge to know how to detect and treat this disease.

On the other hand, the university student is also prone to stress because there are social stressors such as the university academic environment itself, in addition to the family factor and personal impetus. Regarding academic stress, one of the indications of this is the lack of lighting that makes vision difficult for the university student and creates tensions, another of the most important is the noise that occurs around them, which generates irritability, fatigue and lack of concentration [4].

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For this reason, both its prevention and treatment are necessary, many professionals recommend different actions to manage stress, such as exercising regularly in order to reduce the stress hormone, having a good diet, complying with 7 to 8 hours sleep, among others [5].

Around the world there are many researchers who have sought ways to help the population in the detection of diseases and keeping in mind that stress is not the only disease that is present in the young and adult population, a compilation of research which are related to the detection or monitoring of a disease through the use of technological and electronic means, the most relevant articles will be detailed in the following lines.

First, this research [6] focused on developing a non-invasive method to detect anemia in children in Peru, this group achieved its goal by creating a web system which contains a form, which once completed, offers the possibility of uploading a photo of a nail, that with the help of artificial intelligence implemented on the web an analysis can be carried out using its color and thus achieve a much more precise diagnosis; this work evaluated children from different departments, Puno, Loreto, Pasco, Arequipa and Ucayali being the departments with the highest rate of anemia, thus obtaining an estimate that 50% of Peruvian children do not have a proper diet, thanks to the development of this project a new alternative is obtained to be able to detect this disease in time and reduce this figure, in addition to reducing the blood tests that are normally required in anemia tests.

Similarly, the following contribution [7] describes the creation of a website which allows its users to enter a set of symptoms which will go to an expert system that will detect the disease and thus be able to provide them with true information about it. The expert system, the authors mention, was developed applying the Buchanan methodology and the rules of logic developed in Prolog. This project was tested in the Peruvian population, which mostly searched for the symptoms of Covid-19, in this way they have achieved that the population that uses pages to obtain information about a disease, obtains the necessary knowledge of it and therefore consequently start a medical evaluation as soon as possible, they have also provided a solution to the problem of scarcity of real information on diseases.

On the other hand, the following thesis [8] describes the development of a web system which allows detecting gingivitis at an early stage, this has been possible thanks to image processing. This web system allows its users to upload a photo of the patient's oral cavity, which with the help of digital image processing will be improved, such as removing the color of the teeth and giving higher priority to the color of the gums, after that, the segmentation of the image will be carried out with the purpose of making known the reddest areas of the gum, to finally obtain quantitative attributes that will be evaluated by the dentist on a scale that they have prepared and thus indicate if the patient has gingivitis. After the development of the project, it was tested on several patients at the Dentistry Clinic of the University of Guayaquil, many experts indicated that this system manages to give accurate diagnoses just as a dentist would do, demonstrating its effectiveness.

In Ecuador, a group of researchers have developed an electronic system that allows stress monitoring through vital signs such as body temperature and heart rate; first, a window opens where the person's data is placed, once complete, the save button is pressed and the sensors are placed on the subject in question, the data of these sensors are captured by an Arduino Uno which will digitize the information to be able to store it in the database and to be able to visualize them in the graphical interface this will be possible thanks to the fact that the Arduino is connected to a Raspberry Pi3, once the process is finished the data is processed and it will be displayed in a window the data obtained and the level of stress, which was evaluated on a scale prepared by the authors. With this project, the researchers confirmed that the majority of university students have more stress when they are taking an exam, for this reason it would be recommended that they resort to techniques to manage stress before, during and after the exam [9].

On the other hand, in Spain a mobile application called "Healthy Jeart" has been created that is aimed at the adolescent population between the ages of 7 and 18. This app promotes adolescents to carry out healthy lifestyle habits such as having a good diet, maintain a good physical condition, among others, this will be achieved through a platform game in which they will control Jeart, a nice heart-shaped character, they will have to dodge objects that can affect his health such as snacks, soft drinks, tobacco, drugs, however they can be passed over objects that fill their life bar, in case the player loses, it is possible to revive by answering a timer trial question about health. The creators of Healthy Jeart decided to use the games to reach a much younger audience, since at this stage of their lives it is very beneficial for them to make healthy habits which they will replicate in their adult life, which is why there is a section in Jeart that provides a large number of tips to improve your habits, as well as a forum where players can share tips to help each other and become a healthy community; currently, this app is active and has helped its users to lead a better lifestyle since by proposing a playful way of learning, it manages to teach young people the benefits of having a life with healthy habits [10].

After having reviewed the mentioned investigations, it can be affirmed that with the use of currently available technologies it is possible to create computer systems to be able to diagnose various diseases and even these can give a much more accurate diagnosis if they are electronic systems, because they use other tools such as sensors to be able to capture essential information for the diagnosis of diseases.

University students are exposed to many stressful situations, such as completing assignments, projects, exams, and on multiple occasions they ignore their limits to achieve their mission at the expense of their mental and physical health. The purpose of this research is to develop a web system which allows the user to fill out a form to be able to detect if they are suffering from stress, in addition to indicating the level of this, once the user knows the level of stress, this website will provide information on activities that can help treat this disease, in this way a decrease in the percentage of stress in the Peruvian population that is concentrated in the academic and work environment will be achieved.

For the development of this web system, the agile Scrum methodology will be used, this will allow us to have continuous development and will allow the delivery of value products, with regard to its coding, the Spring Framework will be used, making use of Spring boot, the language java 11 programming, as for the front-end section, bootstrap 5 and Angular typescript will be used, on the database side it will be done under the MySQL Database Management System in addition to Bitbucket as for the repository that will allow us to manage the code and its modifications effectively.

II. METHODOLOGY

It is very important to mention the main factors that have been taken into account to develop this project, before proceeding to mention the technologies that will be used for the development of this project, it is valid to affirm that the form is oriented to the university population that is between 18 and 23 years old, the main purpose is to create a new alternative that helps university students to be able to detect if they suffer from stress, let's remember that this group of future professionals are subjected to a large number of stressors at the university, when carrying out assignments, developing projects, preparing presentations, studying for exams, in addition to the stress generated by the work environment for that group that decides to work and study at the same time; however, the form can be completed by the young and adult population, in the future the goal is for the entire Peruvian population to be able to use this web system and thus create a new alternative to detect and treat stress on time.

Secondly, in order to maintain order when working, the use of the agile Scrum methodology for the development of the project was considered appropriate due to the large number of benefits that it generates in software development, such as will allow the developing a high-quality product, continually delivering useful breakthroughs at the end of each sprint, monitoring team performance, and facilitating the implementation of changes that are necessary for quality software development [11].

In the following lines, the technologies that will be used will be mentioned according to their purpose:

A. Software to design prototypes

The Balsamiq tool will be used to structure the front models or screens and code quickly. This application is used to recreate prototypes related to the web or desktop application that will be made [12].

B. Coding Tools

The IDEs that will help us facilitate standard coding are the followings:

1) Spring Tools: It is an IDE for developing enterprise applications based on Spring Framework and Boot, lightweight for other types of environment [13].

2) Visual Studio Code: IDE that will help facilitate coding in Angular CLI, it is more easy to download plugins to have an accelerated coding.

3) MySql Workbench: It is a database engine that will help us to easily access data and data modeling, it is more to perform stored processes and also the use of DDL and DML [14].

4) Bitbucket: It is a repository service where the project will be hosted to have a control of directories at the time of coding [15].

In addition, Table I contains the user stories that have been agreed, these allow establishing the characteristics and functions that will be implemented in the web system.

TABLE I. REQUIREMENTS

Num.	User stories
1	I, as a user, want the web system to have multiple choice questions to make it easier to answer them.
2	As a user, I want there to be an option that allows me to send the result of the form to my email so that I can review it carefully later.
3	As a user, I want that the process to create an account have little data so that I can create an account quickly.
4	As a user, I want the questions in the form to be clear so that I can solve the form without problems.
5	As a user, I want to provide me with information in order to reduce the level of stress.
6	As a user, I want the form to have letters large enough so that I don't have problems reading the questions.
7	As a user I want to be able to change my answers in case I change my mind on any of them before submitting the form.
8	As a user, I want to be able to access the page by cellphone to be able to solve it even if I don't have a computer nearby.

On the other hand, to explain the process that the web system will follow, a flowchart was developed which is shown in Figure 1, the process begins when the user accesses the Login in which he must enter the user and his password, in the situation that the user does not have an account, he must create one, entering the required data, once the user logs in, the main page containing the

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purpose of this web system will be displayed, the user will press a button to evaluate their stress level and will direct him to a form where all the questions necessary to detect stress will be displayed, once answered, press the next button, the system will check that all the questions are answered and the level of stress that the user has will be displayed, at the same time that the answers are stored in the MySQL database, information will finally be displayed that can help control this disease, as well as links of interest to the user, finishing the process.
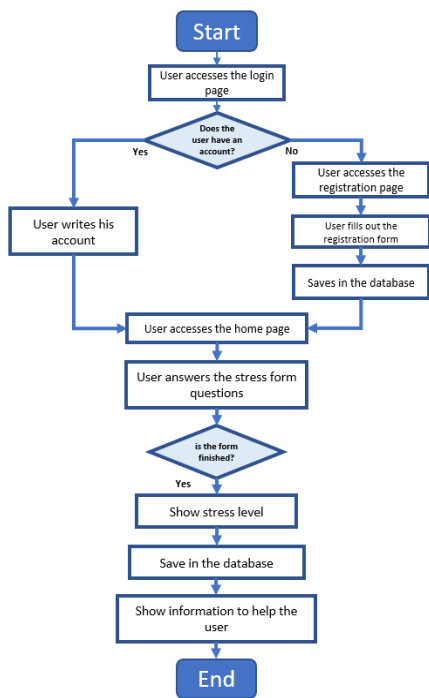
Figure 1.   Flowchart

To understand in depth the way in which this process will be carried out, it will be divided into two sections: "Login" and "Stress level evaluation".

A.   Login

To start the process, it is necessary to log in, the first thing we need is to create a user for this we will use a user entity that will have the attributes of name, surname, ID, occupation and email of the person. Following this, the GET and SET methods of the attributes are performed to obtain the entered values, they will also be useful if you want to modify them in the future. After that we proceed to create the constructors that will serve to save the record information in the database with the help of a stored process to insert, this will have the attributes of the user entity, in this way the record of the form fields. When all this is done, the user will be able to complete the login form where the user entity fields will be, each field will be required, so the field can't be empty and it will also have a mail validator so that it has a correct structure at the moment to register the data of the person,

in addition to create a method that allows us to verify if the credentials entered by the user at the time of login are registered in the database.

B.   Stress Level Evaluation

Once the user has logged in, he will be redirected to the main page of the web system and will be able to access the form to evaluate his stress level, for this the GET and SET methods will be used to obtain the answers given by the user in each question, a constructor will also be used which will allow us to store the set of answers, with this information a method will be used which will allow us to obtain the score obtained by the client and indicate the level of stress they are suffering, to finally save all this information in the database with a stored process created specifically for this task, once this is done, the level of stress suffered by the user will be displayed along with links of interest and help information to mitigate the disease.

On the other hand, Figure 2 shows the architecture model that will contain the web application. Our database that has been selected is MySql, in it we will store both the information of the user accounts and their form answers. Within the Backend approach, we will use Spring Boot as a tool that will work hand in hand with connection REST APIs to manipulate project data, APIs in abbreviated terms are only the communication between software or applications and REST is a software architecture manageable in various languages that the data will be returned through a JSON [16], now for this project to be efficient and secure we will work with tokens managed by JWT. As for the frontend, we will work with the Angular framework for the style format, angular material and Bootstrap, as for its functionality, HTML, Typescript will be used, for the programming language open JDK 11 will be used since it is more accessible to programmers and his great libraries Spring Boot was chosen because it allows easy access to data, allows you to create MVC and REST applications, because it provides a large number of dependencies that will greatly reduce project coding.
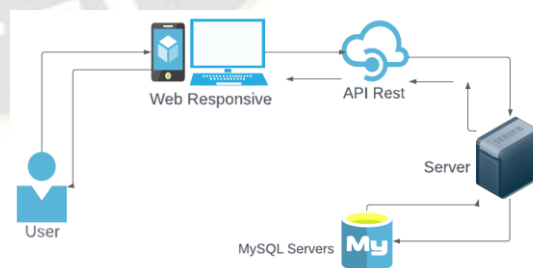

Figure 2.   Web System Architecture

In more detail, a Bit Bucket repository will be used, which will serve to share the progress that is being made through the use of certain commands, for example, "git pull" to download and update changes, "git add" to add what has been done and also, "git push" to upload the worked code, in this way a more

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orderly way of working is achieved with respect to the updates that the members implement.

In order for users to access the website, it must have a space on the Internet, this will be achieved through hosting, which must meet certain characteristics to be chosen, such as having the necessary space to store the website, having stability so that it is not saturated if a large number of people are simultaneously connected to the website, a good bandwidth that allows the sending of information to be carried out quickly and that it has the necessary support in the event that events occur unexpected; After analyzing the aforementioned characteristics, it was considered that 000webhost is the ideal hosting for the website that has been developed.

Regarding IDEs, we will work with an upload part and a download part with git commands that help to speed up and make the process more intuitive for the team members who will be the developers. It is important to note that the Spring Tools Suite 4 IDE was used to code the backend and Visual Studio Code regarding the frontend. On the other hand, it is necessary to install OpenJDK 11, which is similar to Oracle's jdk to be able to code, as well as the most up-to-date version of the angular cli framework, Node JS and TS, in addition to this, the installation of the Lombook library that helps in the code reduction together with JPA, then everything will be restarted and the project will be created from scratch.

Regarding the structure of backend packages, a nomenclature will be used, specifically entity - repository - rest, as the coding is carried out, other directories will be created, the codes will be clearly in English to continue with the standard. The connections to the database will be from an application.properties file, that is where the configuration of both the database and the JPA standard will be.

For the frontend side, you will have to run this command "npm install -g @angular/cli", this will be done to install the angular framework to start with a new ng project new angular-project-system and then carry out the designs that at the time were reflected in Balsamiq as a proposal. The link between frontend and backend will be from the REST API that Angular itself will have to send the data in JSON and the backend will have to respond in the same chain of information. The upload of updates in the backend and frontend code that are being made will be possible thanks to the git commands which are compatible with BitBucket.

In the previous paragraphs, technical aspects of the development and operation of the website have been described, however, in order for it to fulfill the objective of being able to detect stress, it is necessary to have a form, for this reason it has been decided to use an adaptation of the Perceived Stress Scale [17], this is a form of fourteen questions that have five alternatives each: never (0 points), almost never (1 point), occasionally (2 points), often (3 points), very often (4 points).

The perceived stress index will be found by adding the scores of the questions, it should be noted that questions 4, 5, 6, 7, 9, 10 and 13 have the scores inverted or, in any case, the values of those questions can be subtracted, all the questions will allow obtaining the stress index suffered by a person expressed in a numerical value, the logic to follow being that the higher the score obtained, the higher the stress index. Below, Table II shows the fourteen questions of the Perceived Stress Scale.

TABLE II.   PERCEIVED STRESS SCALE

Num.	Stress related questions
1	How often have you been affected by something that has happened unexpectedly?
2	How often have you felt unable to control the important things in your life?
3	How often have you felt nervous or stressed?
4	How often have you successfully handled life's little problems?
5	How often have you felt that you have effectively coped with major changes that have been occurring in your life?
6	How often have you been confident about your ability to handle your personal problems?
7	How often have you felt that things are going well for you?
8	How often have you felt like you couldn't handle all the things you had to do?
9	How often have you been able to control the difficulties in your life?
10	How often have you felt like you had everything under control?
11	How often have you been angry because things that have happened to you were out of your control?
12	How often have you thought about the things you still have to do?
13	How often have you been able to control the way you spend your time?
14	How often have you felt that difficulties are piling up so much that you cannot overcome them?

Note. This table shows the questions that will be used in the form to detect stress levels [17].

III. RESULTS AND DISCUSSIONS

A.   About the survey

In order to find out the approval of this project by the target population, a form was prepared where 50 people (29 men and 21 women) shared their opinion regarding what was proposed. In the following lines an analysis of the 8 questions formulated in said form will be given.

In Figure 3, the question that was considered to find out what amount of the surveyed population that have gone through stressful situations throughout their lives is displayed, as mentioned at first, stress can be caused by many factors and not necessarily the pandemic, although it is good to consider that this has been a trigger for the majority of the population; the results show that 92% of the population, 46 people, have gone through stressful situations, revealing that a large part of the population may suffer from stress.
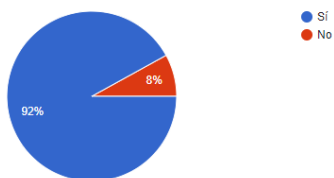
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Figure 3. Measurement of stressful situations of the population

In Figure 4, a question is formulated that allows knowing precisely how often the target population has gone through stressful situations during their university preparation, it is known that the university student is more prone to go through stressful situations, due to the responsibilities that this entails. preparation period; the results obtained show that 3 people considered always, 21 people almost always, 20 people sometimes, 5 people rarely and 1 person never; this indicates that 42% of the population considers that during their university preparation they almost always face stressful situations, while 40% consider that sometimes they go through stressful situations.
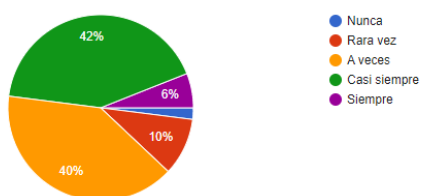
Figure 4. Frequency of stressful situations during university preparation

In Figure 5, the question seeks to know how important it is for the target population to measure their stress levels is formulated, the results indicate that 32 people (60% of the total) consider that is very important to know their stress level, 15 people (30% of the total) consider it slightly important and 4 people unimportant; this indicates that a large part of the population, precisely 92%, shows great interest in measuring their stress because they are aware of the negative effects that this disease brings to their health. On the other hand, 8% do not consider this disease as a threat to their health, this can happen because they may have a low level of stress or lack of information, in all cases it is advisable to provide information to users about the effects of stress on health.
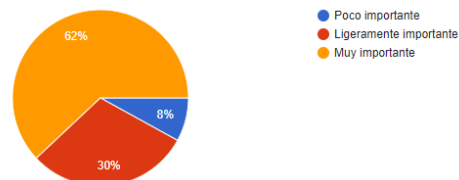

Figure 5. Importance of knowing the level of stress

In Figure 6, the question allows to know how useful it is for the target population to be able to measure their level of stress through the website is shown. The results show that 24 people consider it very useful, 22 people slightly useful and 8 people little useful; this means that 92% of the population would use the website to measure their stress and be able to monitor it through this alternative.
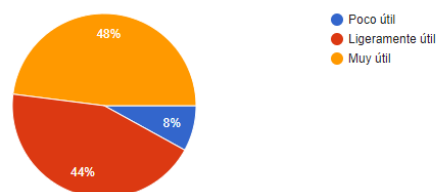

Figure 6. Usefulness of measuring stress via a website

In Figure 7, the question that allows knowing how reliable the final evaluation provided by the form is for the target population is displayed, emphasizing that it has studies that support it; the results obtained indicate that 14 people consider it very reliable, 31 people slightly reliable and 5 people unreliable. The reliability of the user compared to the exposed results greatly influences how recommended the website will be, 62% of the surveyed population indicates that it is slightly reliable, which suggests that if this project is made available to the public, it will be widely accepted due to the confidence that users have in the evaluation made by the website.
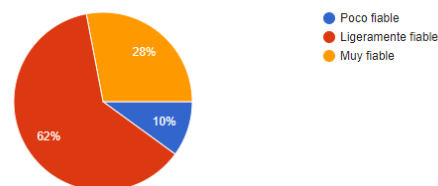

Figure 7. Web form stress test reliability

In Figure 8, the question seeks to know if for the population surveyed, the website is efficient with respect to its objective, for this they were shown a short video where they can visualize the progress of the website that is currently available; the results indicate that 21 people consider it very efficient, 25 people slightly efficient and 8 people not very efficient; This suggests that a large part of the population, 92%, considers that the website meets the proposed objective and can be used as a support tool to detect people's stress level.

Figure 8.   Website efficiency

In Figure 9, the question allows to know if the users consider that the amount of information currently on the website is adequate or if it is necessary to increase more than this is exposed; the results indicate that 26 people want the website to have more information, while 24 people consider that the information is sufficient. Although, the main objective of this project is to measure the user's stress level and approximately half of the surveyed population thinks this way, however, for the team and 52% of the population, it is just as important that users have the necessary information that allows them to reflect on this disease, keeping in mind that for many people it does not have due importance and can cause death.
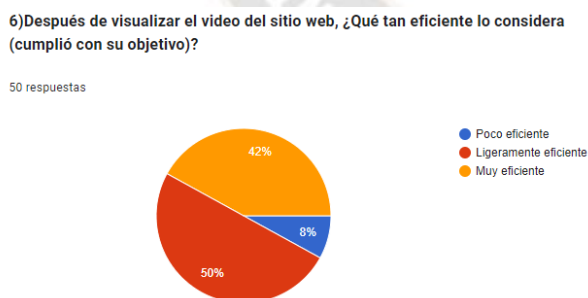

Figure 9.   Amount of website content

In Figure 10, it's shown the question that was formulated to find out if the content related to activities to treat stress is sufficient for the target audience; the results indicate that 30 persons consider that the website needs more of this information to help the treatment of the user, while 20 persons consider that the amount is adequate. These results show that for the 60% of

the target population that can become probable users of the website, the information that helps them to know activities that allow them to mitigate stress is more important, in addition users suggest to add more content to be displayed on the web.
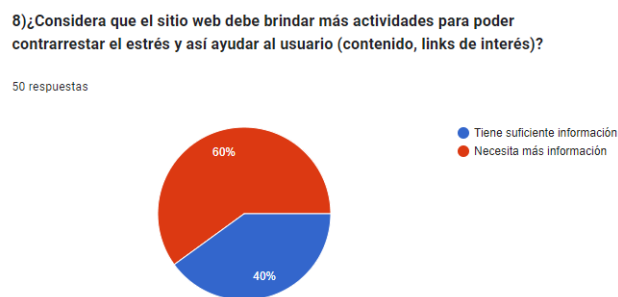

Figure 10. Amount of activities to deal with stress
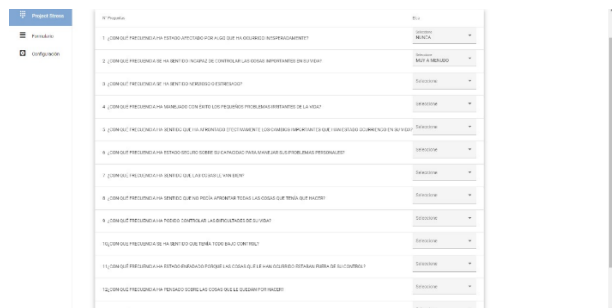
B.   About the prototypes

The development of the website was carried out taking into account the agreed prototypes for its design, the most important pages of the project in question are shown below. It is necessary to remember that the purpose of this project is to evaluate the user's stress, but it is also essential to provide information to the population on important issues related to the objective of stress; In Figure 11 one of the informative pages can be seen, precisely the home page, which helps to inform the user about said disease, mentioning its definition, its most frequent causes and the situations that cause it. The website also has other pages where topics of relevance to the reader are addressed, such as a page where the relationship between stress and Covid-19 is explained, and also a page where the possibility of to treat stress.

Figure 11. Information pages

On the other hand, in Figure 12 you can see a form with 14 multiple choice questions which aims to detect stress, this form is the evaluation instrument which is required to achieve the objective of this project; in order to access this, the user of this website must previously create an account in the respective section, once said account is created, they will access it in the login section, when entering they will be shown a main page of the easy to understand user where in the upper left part there is

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an option with the name "form". The mentioned form was prepared taking into account the Perceived Stress Scale, this was done with the purpose that the user has full assurance that this website provides a correct result when detecting their stress based on the alternatives that this one chooses, because the result has a scientific fundament that supports it.

Figure 12. Stress form page

C. Discussions

After the development of this project, it is pertinent to make observations which will be detailed in the following lines. In the first place, the project was developed under the Scrum methodology, which allowed a large part of the aforementioned proposal to advance, however, the website could not be made available to the population due to the low information about virtual servers that was collected and the various limitations that were presented due to the technologies used on the website.

Secondly, a salvageable aspect of the aforementioned methodology is the feedback stage that for said methodology at the sprint level is known as Sprint Retrospective, at this stage many observations regarding the website were rescued, which were considered and implemented, whose results are reflected in the survey carried out, reaching ratings of very efficient and slightly efficient by 92% of possible web users; in addition, in the final part of the project there is the Review and retrospective, which allows us to carry out a self-criticism with respect to the present project, also to showing the shortcomings that occurred during the development that will be considered as points to improve in future works.

Thirdly, it can be indicated that the detection of diseases is possible through the technologies that are currently available, an example of which is the present project and the works of the authors that were mentioned during the introduction. Regarding the authors [9] these perform stress monitoring through vital signs, said data gives credibility to their results but makes it impractical since they necessarily depend on the electronic system, on the other hand, this proposed website once it is completed and is available to the public user, it is considered as a more practical measure for the detection of stress because it will be available 24 hours a day, in addition to mentioning its

great reliability, which was indicated by the same target population.

Fourthly, it is important to mention that, according to the results of the survey carried out on the target population, as can be seen in Figure 13, that the majority of people regardless of their sex have suffered from stressful situations, this can be due to many factors, but without a doubt, Covid-19 could have served as a trigger for stress in some cases.
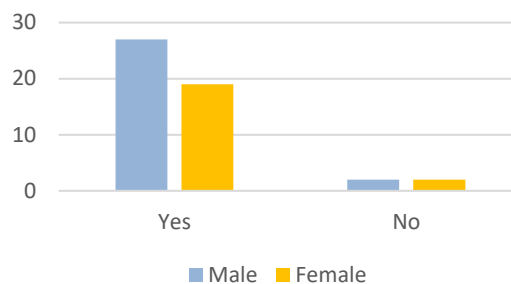

Figure 13. Analysis of stressful situations according to gender

IV. CONCLUSIONS AND FUTURE WORK

The present work largely achieved the development of a website which its main objective is to detect the stress of its users, it is known that, due to the present pandemic context, academic and work responsibilities, a part of the population that was affected were university students; for these reasons, it is to whom this website is directed at first. This idea arises from looking for a new alternative that serves as support for students who do not have the means and sometimes the time, to be able to worry about their mental health; as mentioned in previous paragraphs, stress is a response that the body offers to stressors, in many cases, a large part of the people who have this disease do not give it enough importance and it can generate serious health problems and even death, for this reason it is important that students can have sufficient information about this disease and an alternative that helps its detection, it should be noted that this project was created to be a support, through this what is sought is that the user realize your situation and based on the seriousness of it, they must seek professional help.

Keeping in mind the great acceptance that this project received from the target population, it is considered that it should be continued and finalized, in this way all the suggestions made by them can be added, such as increasing the information that explains to the user how to cope, control and overcome stress, in addition to emphasizing that resorting to psychological help is a fundamental part of the treatment and the consequences of not treating stress, such as the increase in other diseases such as anxiety and depression. Once this first objective has been achieved, the final objective is to make this website available to all of Peru, in this way the stress rate can be reduced at the national level.

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On the other hand, readers are recommended to continue using the technologies to help the population in the detection of diseases, since it has been shown that these projects are quite accepted, in addition to generating benefits for the community.

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