Web Platform for the Analysis of Physical and Mental Health Data of Students

C. I. Moo-Barrera[1,2], M. G. Orozco-del-Castillo[1,2], M. R. Moreno-Sabido[1(✉)], N. L. Cuevas-Cuevas[1], and C. Bermejo-Sabbagh[1]

[1] Departamento de Sistemas y Computación, Tecnológico Nacional de México/IT de Mérida, Mérida, Yucatán, México
mario.ms@merida.tecnm.mx

[2] AAAI Student Chapter at Yucatán, México (AAAIMX), Association for the Advancement of Artificial Intelligence, Mérida, Yucatán, México

Abstract. The development of systems that help automate and manage people's lives at different levels is what has driven the enormous growth that humanity has had. On the other hand, the COVID-19 pandemic has meant an unprecedented event that has marked a before and after for the entire world. As a result of this, companies and institutions implemented various technological tools to have a greater capacity to respond to the challenges generated by this and other similar potential diseases, however, the development of these technological tools is not always clear and accessible, particularly to small companies and to academic institutions. This paper describes the development of a web tool for the analysis of physical and mental health data of students using a COVID-19 screening tool, commonly used psychological questionnaires and inventories which help diagnose symptoms of mental illnesses, and a microblogging tool for further natural language processing. The results and conclusions reached at the end of this work are also presented.

Keywords: Web development · Health care · Data analytics · Unified modeling language · SCRUM methodology

1 Introduction

The world is facing one of the most important global challenges since the Second World War: the disease COVID-19 provoked by the coronavirus SARS-CoV-2. The pandemic derived from it has generated a crisis in all aspects of people's lives [1] and was declared a public health emergency by the World Health Organization (WHO) [2], an unprecedented multimodal crisis (health, labor, economic, and social) that has a particular impact on developing countries. Among the preventive measures to avoid contracting the virus are social distancing and confinement, which have negative consequences because they produce a great impact on society and personal interactions [3].

The effects of the pandemic have been well documented. For instance, in [4] an increase in negative emotions (anxiety, depression, and anger) and a decrease in positive

M. F. Mata-Rivera et al. (Eds.): WITCOM 2022, CCIS 1659, pp. 139–156, 2022.
https://doi.org/10.1007/978-3-031-18082-8_9

emotions (happiness and satisfaction) derived from the pandemic are mentioned. This generated erratic behavior among people, which is a common phenomenon. In addition to the negative impact on personal interactions, the quarantine also increased the possibility of psychological and mental problems. In the absence of interpersonal communication, depressive and anxiety disorders are more likely to occur or worsen [5, 6].

There are several mental health issues that have emerged during the pandemic, and they represent one of the most far-reaching consequences. In the context of the COVID-19 pandemic, people with high levels of anxiety are likely to interpret harmless bodily sensations as evidence that they are infected [7], which increases even more their anxiety, and influences their ability to make rational decisions and their behavior. This causes maladaptive behaviors, such as frequent visits to health centers to rule out the disease, excessive hand washing, social withdrawal, and anxiety about shopping [7]. A study conducted in the early phase of the pandemic on 1,210 people found that 13.8% had mild depressive symptoms, 12.2% moderate symptoms, and 4.3% severe symptoms. Higher levels of depression were seen in men, in people with no education, in people with physical complaints (similar to those reported in COVID-19) (chills, myalgia, dizziness, runny nose, and sore throat), and in people who did not trust the ability of doctors to diagnose the disease [8]. Similarly, lower levels of depression were reported in people who learned about the increase in recovered patients and in people who followed public health recommendations [8]. Another study of 52,730 people during the early phase of the pandemic found that 35% of participants experienced psychological stress, with higher levels in women [9], in people between the ages of 18 and 30, and over 60 [9]. The higher scores in the 18–30 age group could be because they use social networks as their main means of information, which can easily trigger stress. On the other hand, given that the highest mortality rate from COVID-19 occurs in older adults, it is not surprising that they are more likely to suffer from stress [9]. This pandemic is also having a psychological impact on undergraduate students. In [10], 7,143 medical students were studied during the initial phase of the pandemic and found that 0.9% of them showed severe anxiety symptoms, 2.7% moderate, and 21.3% mild. In addition, living in an urban area, having family economic stability, and living with parents were protective factors against anxiety [10]. However, having an acquaintance diagnosed with COVID-19 worsens anxiety levels [10]. The presence of symptoms due to post-traumatic stress disorder (PTSD) was described in [11], where a prevalence of 7% was found in the areas of China most affected by the pandemic, which exceeds that reported in other epidemics and suggests that the disease had a greater stressful impact on the general population.

Due to the above, it is important that educational institutions develop work environments that allow timely identification of these problems. Currently, it is a fact that hundreds of educational institutions use management systems that speed up student learning but omit diagnostic tools and real-time collaborative interactions in which students participate. Technologies such as social networks, microblogging, multimedia, etc., could improve the deficiencies that the students present [12].

Web platforms have commonly been used to automate and simplify scientific and research-related processes [13], while making possible the collaboration with other users on the internet [13], particularly exploiting the principle of "availability anywhere, at any

time" using web browsers [14], providing multiple users on-demand access across multiple devices and operating systems using an internet connection [14]. These platforms also help to assist the visual interpretation and classification of data and have shown to be very effective in the construction of datasets [15]. Web platforms have successfully been used as research support tools in areas such as chemistry [13], mining [14], remote sensing [15], etc.

In this paper we describe the development of a web platform aimed at the undergraduate student community of Tecnológico Nacional de México (TecNM)/Instituto Tecnológico de Mérida (ITM) that involves physical health diagnostic tools (focused on COVID-19 screening) and mental health commonly used in psychology (questionnaires and psychological inventories), along with a module that enables microblogging, a service widely used by young people, which can also be used for diagnostic purposes through natural language processing techniques. The integral development of this platform is described using the SCRUM software development methodology.

2 Theoretical Framework

2.1 Psychological Questionnaires and Inventories

Psychological questionnaires, particularly those self-reported, are usually comprised by a set of questions formulated with the desire to obtain information from the person to whom it is applied. On the other hand, psychological inventories are a list of traits, attitudes, preferences, interests, abilities, actions, words, among other things, used to evaluate characteristics of a person; these inventories may have various focuses or specializations (e.g., depression, anxiety). Some of the most common depression inventories are listed as follows:

- **Beck Depression Inventory II.** The Beck Depression Inventory (BDI) is a self-administered assessment tool created by psychiatrist Aaron Beck; it consists of 21 items or multiple-choice questions, which rate the severity of 21 symptoms of depression that have been observed, relate the answers and their score to the estimated level of depression in that range; it tends to be a questionnaire that can be completed in less than 10 min [16].
- **Center for Epidemiologic Studies Depression Scale.** The Center for Epidemiologic Studies Depression Scale (CESD) is a measure published by Lenore Radloff in 1977; it consists of 20 items which are scored by the frequency of times a person has experienced symptoms associated with depression in the previous week [17].
- **Carroll Rating Scale for Depression.** The Carroll Rating Scale for Depression (CRSD) is a self-assessment instrument to detect signs of depression developed in the 1970s. It consists of evaluating patients for somatic and behavioral manifestations [18].
- **Patient Health Questionnaire.** The Patient Health Questionnaire (PHQ-9) is an instrument that allows the detection of mild, moderate. or severe depressive symptoms. The results of this questionnaire help detect the presence and severity of depression if it is detected. It consists of 9 items, based on diagnostic criteria for depression through questions about what the patient has experienced in the last two weeks [19].

2.2 Microblogging

Today, distributed environments are of paramount importance for information technologies. Computer applications are constantly evolving, so it is now more common to find easy-to-use, intuitive applications that allow collaboration at highly affordable costs, which could even be free [12]. In relation to education, there is still a large gap in this type of platform for students, so institutions are continually looking to somehow create better Learning Management Systems to enrich student performance; for this, they have dedicated much effort to the study of these platforms, however, they fail to reconcile important factors such as education, support, and interaction between teachers and students, or simply between the student body itself [12].

Microblogging has recently generated a lot of interest in research topics. However, previously little was known about how people used these tools in their daily lives. It is estimated that by the year 2008, only in the United States of America, 11% of the population had published something on a microblogging site, and by the following year, around August 2009, there were already more than 32 million of people on Twitter [20]. These studies revealed that these tools were useful for sharing information, keeping up to date with topics of interest, having direct communication with other people, among other purposes [20]. Currently, microblogging is a form of communication through which users describe their current status in posts with brief content that can be distributed through different media (instant messaging, cell phones, email or web platforms). People use microblogging to share their daily activities or even to search for information [21]. The latter is related to the fact that microblogging is increasingly considered as a means of communication on emergency issues due to its increasing speed and accessibility to the multiplatform, so it could be a place in which information can be collected during some critical event [22].

3 Methodology

For the development of the web platform for the analysis of physical and mental health data of students, the agile development methodology SCRUM [23] was used. Being an agile development methodology, it is based on the idea of closing short development cycles; such cycles are commonly called “Iterations”, but in SCRUM they are known as “Sprints” [23]. In Fig. 1 the iterative cycle of SCRUM is shown. The Product Owner identifies and writes the User Stories, which are added to the Product Backlog. Subsequently, the Product Owner determines the priorities of the User Stories and orders the Product Backlog according to the established priorities. The SCRUM Team carries out the Sprint Planning to establish the User Histories that will be considered during the Sprint. This will make up the Sprint Backlog; the User Histories are then broken down into tasks by the development team. The Sprint can be 1, 2, 3 or 4 weeks. The SCRUM Team conducts the Daily SCRUM, which is a daily meeting of approximately 15 min. As a result of the Sprint, a potentially deliverable product is obtained that is part of a demo during the Sprint Review. The cycle ends with the Sprint Retrospective, which is a meeting that takes place at the end of each Sprint [24].

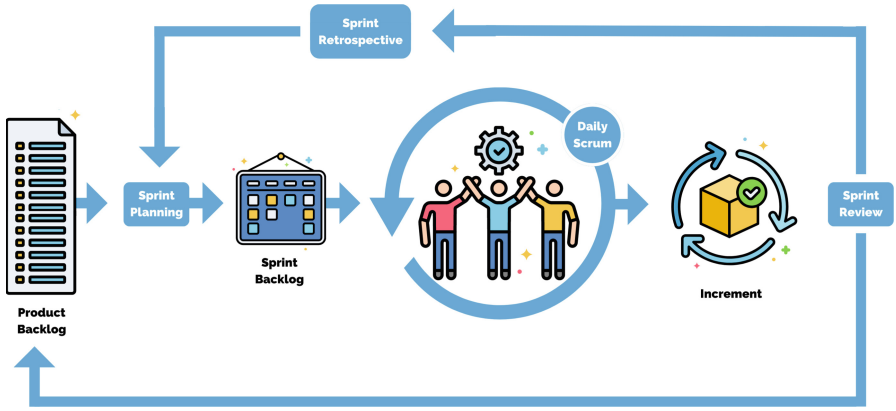


Fig. 1. The Product Owner identifies and writes the User Stories, which are added to the Product Backlog. Subsequently, the Product Owner determines the priorities of the User Stories and orders the Product Backlog. The SCRUM Team carries out the Sprint Planning which will make up the Sprint Backlog; the User Histories are broken down into tasks. The SCRUM Team conducts the Daily SCRUM, and a potentially deliverable product is obtained during the Sprint Review. The cycle ends with the Sprint Retrospective, a meeting that takes place at the end of each Sprint. Adapted from [24].

3.1 Elements of SCRUM

The elements of SCRUM [24] are described as follows:

Roles. They are each of the people or teams that are involved in the process and application of the methodology. The roles make sure that the SCRUM philosophy is carried out in the best way. The roles covered by SCRUM are:

- Product Owner
- Scrum Master
- Team

Events. They are used to minimize the need for undefined meetings and establish a cadence that allows the team to foster communication and collaboration, reducing time in extensive meetings as well as reducing restrictive and predictive processes. All events have a time box or TimeBox. Once a Sprint is started, it has a fixed duration and cannot be shortened or lengthened. The following events can end as long as the purpose of the event is achieved, but within the time box and ensuring the promotion of transparency. The SCRUM events are:

- Sprint
- Sprint Planning
- Daily SCRUM
- Sprint Review
- Sprint Retrospective

Artifacts. They are ways to provide transparency and opportunities for inspection and adaptation. The artifacts defined by SCRUM are specifically defined to foster transparency of information so that everyone has the same understanding of what is being accomplished through the artifacts. The SCRUM artifacts are:

- Product Backlog
- Sprint Backlog
- Increment

4 Development

This section describes the development of the web platform for the analysis of physical and mental health data of students, for which the following technologies were used:

- Python: programming language used for the BackEnd in conjunction with Django; it was also used for data analysis and visualization.
- Vue.js: used for modular development of the FrontEnd, for students and administrative staff.
- PostgreSQL: relational database used for information storage.
- Django: framework for the realization of the Application Programming Interface (API) that performs the necessary services for the correct functioning of the platform.

4.1 Architecture

The platform architecture contains various internal features that work together. Figure 2 shows the technologies used for the FrontEnd of the microblogging and questionnaire platform, with the usual and classic languages of web development, such as CSS, HTML, and JS, along with the Vue.js framework and the Buefy library, which together with the components for the user interfaces became responsive (suitable for any device) with a selection of colors and a pleasant and intuitive distribution for the students and the administrative staff that will use the platform. In Fig. 2, the tools in which the BackEnd is developed are also shown. These allow the FrontEnd to have the ability to interact with the database and the actions through APIs using the Django framework for the development of models, logic, and CRUDs (Create, Read, Update, and Delete). Finally, the database used in the project is shown, PostgreSQL. This database provided facilities for interaction and adaptation with the Django framework.

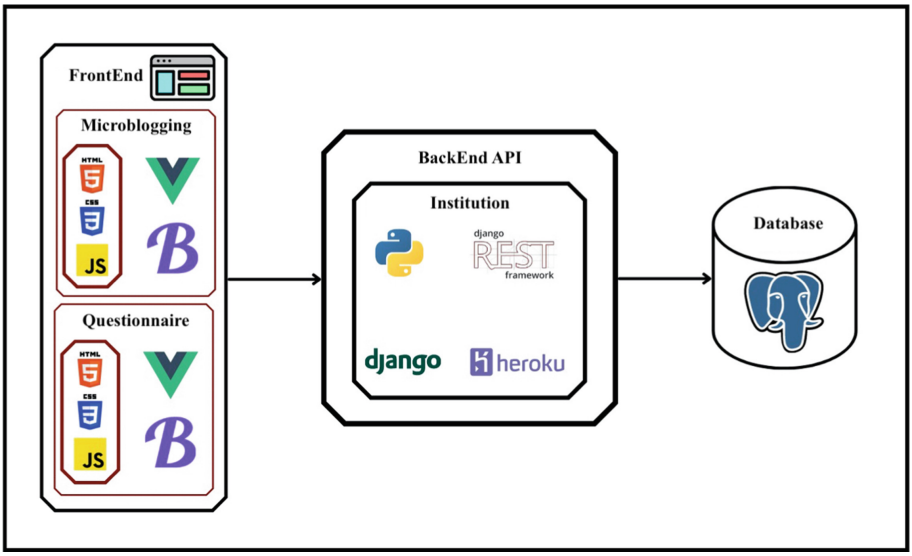


Fig. 2. Architecture that illustrates the services and technologies contained in the platform. On the left side you can see the technologies that were used for the FrontEnd of microblogging and the questionnaires. In the central part, the different Backend APIs to which the platform is linked, as well as the technologies used for development, are represented. These APIs are the ones that connect to the database (represented on the right).

4.2 Sprint Planning

In the Sprint Planning, the tasks to be developed were listed, as well as the start date, the end date, and the progress reviews of the development of the platform. Table 1 shows the Sprint Planning in detail.

Table 1. Sprint Planning that describes the tasks to be carried out, as well as the progress reviews, start date and end date.

Heading	Description
Start date	February 23, 2021
End date	June 23, 2021
Progress review	Progress reviews will be carried out monthly. The review dates will be as follows: • March 15, 2021 • April 15, 2021 • May 15, 2021 • June 22, 2021

(*continued*)

Table 1. (*continued*)

Heading	Description
Tasks	• Create the components for the interface of the questionnaires • Design the views • Design the script to evaluate the student's responses • Design the database • Develop the REST API for the questionnaires • Integrate the FrontEnd with the BackEnd • Test the operation of the platform (black box) • Fix possible errors that may arise in the development of the project

4.3 Requirement Engineering

In this stage, the information obtained through interviews and meetings with the Product Owner, as well as with the administrative staff, was analyzed. Specifically, the data obtained was related to the expected functionality of the system and the restrictions of the development. The result of such an analysis is presented in a list of system requirements presented below.

Functional Requirements. They are those actions that the system was expected to be able to do. Below are some of the functional requirements that were identified for the development of the platform:

- FR01: Students and administrators must be able to log in to the platform.
- FR02: Students must be able to answer the questionnaire.
- FR03: The platform must generate a dynamic acknowledgment (it must change as the student's responses fall within a predetermined range).
- FR04: The student must be able to download the acknowledgment from the platform.
- FR05: The platform must send the acknowledgment by email to the student.
- FR06: The platform must generate a history of the times the student has answered the questionnaire.
- FR07: The administrator must be able to download a CSV file with the answers of the students to the questionnaires.
- FR08: The administrator must be able to manage the questionnaires (add, modify, delete and consult).

Non-functional Requirements. They represent quality characteristics in the performance of the system to be developed. These requirements were used to detail development constraints. Below are some of the non-functional requirements that were identified:

1. The platform must be able to update the data simultaneously, without affecting the response time of the system.
2. The confidentiality of the student's responses must be guaranteed, as well as their integrity.

3. The interfaces must be friendly and minimally invasive for the user so that their responses are not affected.
4. The platform must be available 24 h a day.
5. The student will only be able to answer the questionnaire once a day.

Use Case Diagram. As part of the platform development process, it was necessary to make use case diagrams to graphically capture the functionalities that the actors could perform on the platform.

In Fig. 3 the diagram of general use cases of the platform is presented.

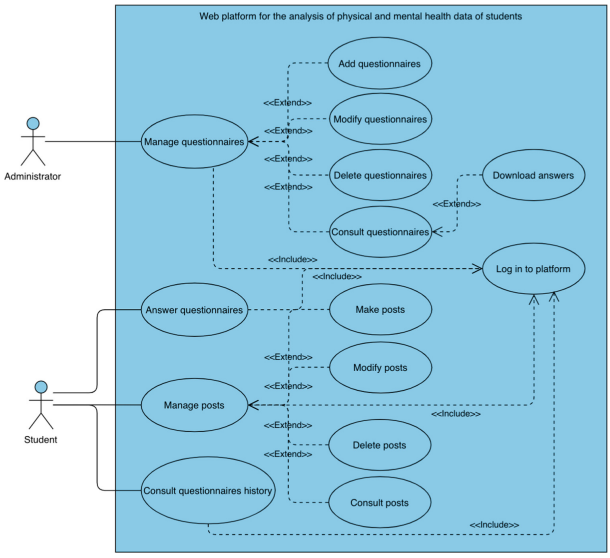


Fig. 3. Diagram of use cases that illustrates the actors of the web platform, as well as the main processes that they can carry out, particularly "Manage questionnaires", "Answer questionnaires", "Manage posts", and "Consult questionnaires history".

Use Case Descriptions. The descriptions of the use cases were made with the purpose of textually describing the ways that the actors could work with the platform. Table 2 shows an example of the use case description for the "Answer questionnaires" process by the "Administrator" actor.

Table 2. Description of the use case to answer a questionnaire by the student.

Heading	Description
Use case	Answer questionnaires
Actor	Student

(*continued*)

Table 2. (*continued*)

Heading	Description
Summary	The student selects the questionnaire to answer, records their answers and saves it
Preconditions	• The student must be logged in to the system • The student must not have answered another questionnaire during the day • There must be at least one active questionnaire to be answered
Main flow	1. The student must access the questionnaire through the main page of the platform 2. The student must completely answer the questionnaire before sending it 3. The student sends the answers to the questionnaire with the "Send" button 4. The platform displays a sent confirmation alert 5. The platform, based on the student's answers, generates an acknowledgment 6. The platform sends the acknowledgment to the email address of the student who answered 7. The platform links the downloadable acknowledgment with the student's profile in the "History of questionnaires" section
Exceptions	If the student did not answer all the questions, the system sends them a notification message
Priority	High

4.4 Design

During the platform development process, the design phase was important because it allowed the system models to be produced before generating the code, and in this way, characterize the solution to be implemented.

As part of the platform design, class diagrams and activity diagrams were mainly made. Below are some examples of the diagrams that were made.

Class Diagrams. The class diagrams were fundamental for the correct understanding of what would have to be encoded. These diagrams allowed describing the classes that made up the model of the web platform. Figure 4 shows the class diagram for the questionnaire module. As can be observed, it is made up of seven classes, each one with its respective attributes and methods (except for the community class, which is only made up of attributes). It is important to note that the diagram does not show the classes of services or utilities that were used for the development.

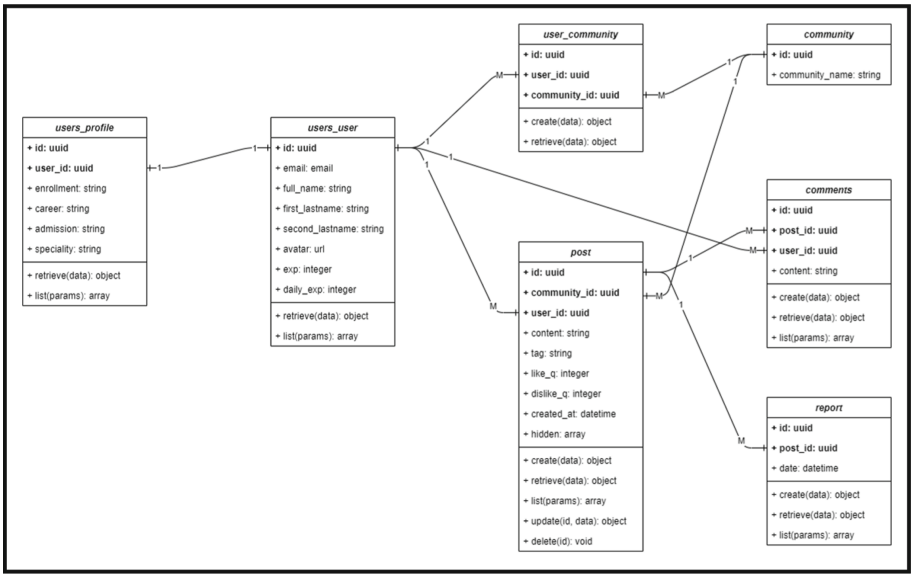


Fig. 4. Class diagram for the questionnaire module which illustrates the developed classes (along with their attributes and methods), as well as the relationships between them.

Activity Diagrams. Activity diagrams helped visualize what was happening within the use cases at a more detailed level, showing the flow of activities through the web platform. These diagrams allowed to illustrate the flow of work from the start point to the end point, detailing many of the decision paths that exist in the progress of events contained in the activity. Figure 5(a) shows the activity diagram for the "Log in to platform" process, and Fig. 5(b) for the "Make posts" process. The diagrams show the interaction of the actor (in this case the student) with the platform to carry out some of the activities that are represented in the use cases of Fig. 3. For the "Log in to platform" process, the student enters their access credentials, the system validates them, and if they are correct, access is allowed; otherwise, they are denied access to the platform. For the "Make posts" process, the student makes the post, but before it is displayed on the platform, the content is validated to see if it is appropriate. If everything is correct with validation, the post is created; otherwise, the student is informed.

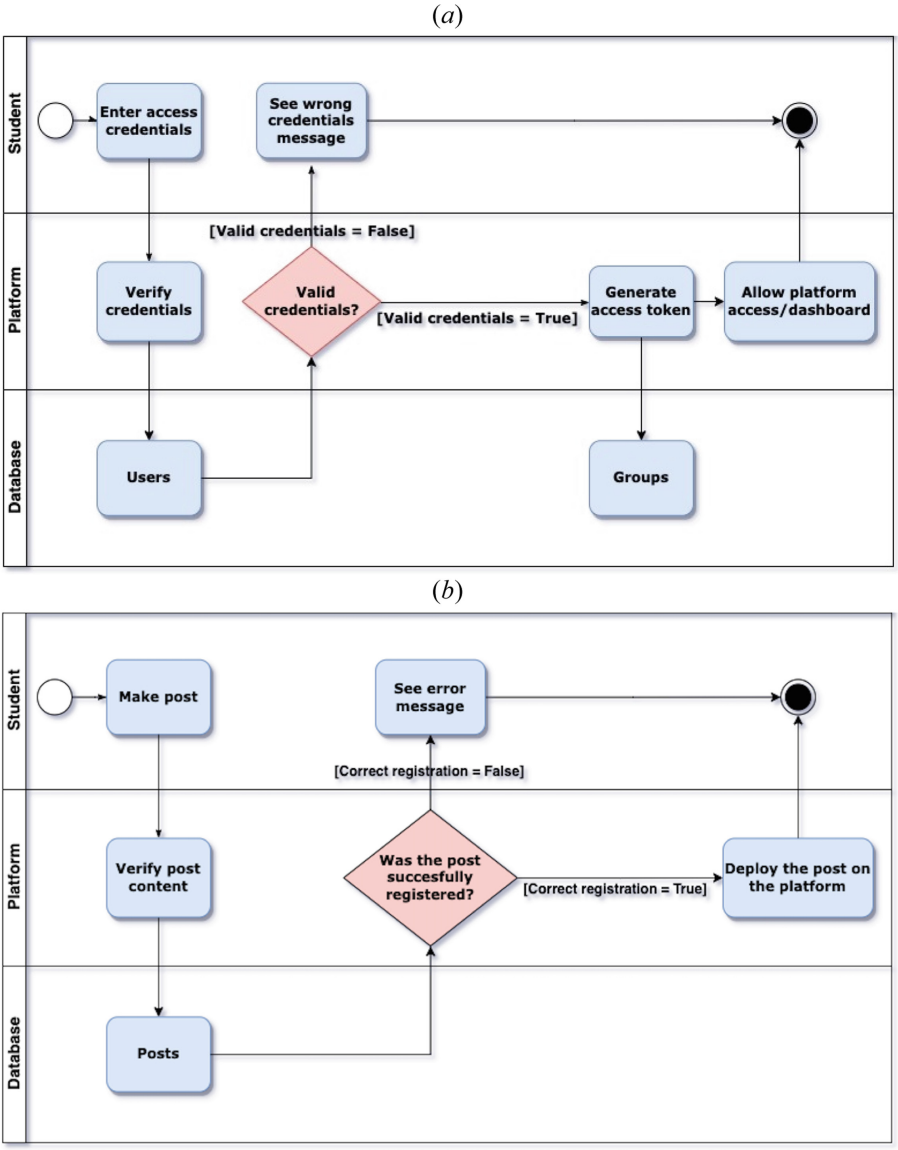


Fig. 5. Activity diagrams for the student (*a*) to log in to the platform and (*b*) to make a post on the platform.

5 Results

5.1 Coding

During this stage, the concepts developed in earlier stages were coded and converted into source code. We here discuss some of the modules developed for the platform. The "COVID-19 Screening Tool", also known as the "SARS-CoV-2 Questionnaire", aims to detect symptoms of this disease among students. It consists of 16 multiple choice questions which were determined by the medical personnel of the TecNM/ITM. As part of these user tools, the "Health and Wellness questionnaire" was also developed. This questionnaire addresses different aspects of physical and mental health in the students. The questionnaire consists of four sections with 279 total items extracted from the BDI, CESD, CRSD, PHQ-9, the Rosenberg self-esteem scale, and other commonly used

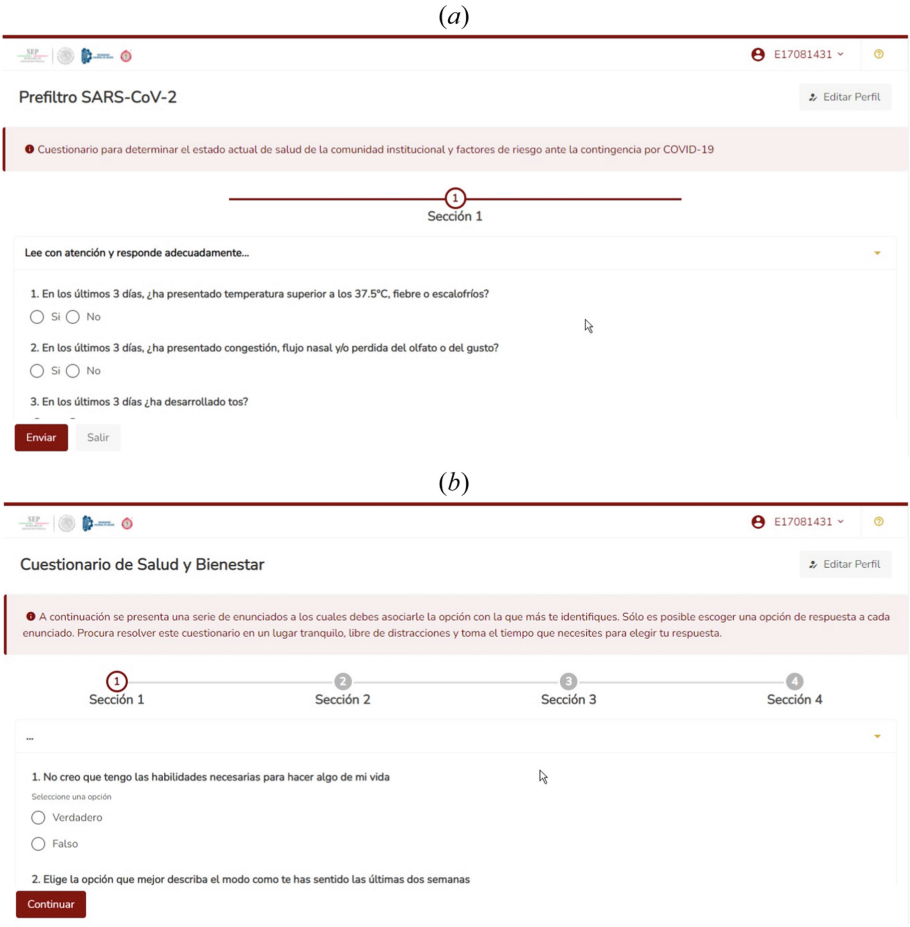
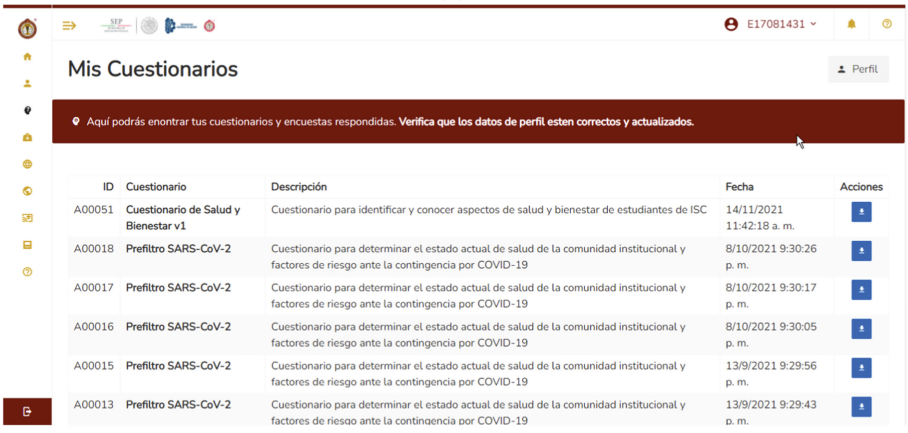


Fig. 6. User interfaces of the (*a*) COVID-19 screening tool and (*b*) the Health and Wellness Questionnaire.

psychology inventories and questionnaires. The interfaces of the COVID-19 Screening Tool and the Health and Wellness Questionnaire are shown in Fig. 6(a) and Fig. 6(b), respectively.

When a student answers a questionnaire, he must enter the corresponding panel to see which ones are active at that moment, select the one they want, answer all the questions, and send the answers. Once the answers have been saved, the system displays the questionnaire in the "My questionnaires" section, where all the questionnaires that have been answered by the student are found. Similarly, a CSV File Download Interface was also developed. This module is for the exclusive use of the system administrator. It allows to download a file in CSV format which contains the data of the students' posts, as well as the questionnaires answers. These data are used to perform sentiment analysis based on the language used by the student. The interfaces of the history of questionnaires and for downloading a CSV file are shown in Fig. 7(a) and Fig. 7(b), respectively.

(*a*)



(*b*)

Fig. 7. Interfaces of the (*a*) history of questionnaires answered by the students and (*b*) for the download of the CSV files by the administrator

5.2 Tests

In this phase, performance tests were carried out on the system before its launch. A very common type of tests in the SCRUM methodology are black box tests. For this project they were used to verify the correct functioning of the platform. Table 3 shows an example of the black box tests that were performed.

The complete development of the web platform for the analysis of physical and mental health data of students covered four Sprints, however, in this work only the documentation related to the first Sprint is presented.

Table 3. Black box test to evaluate the correct functioning to answer the Health and Well-being questionnaire by the student.

Heading	Description
Purpose	For the student to answer the Health and Wellness Questionnaire
Prerequisites	• The student must be logged in to the system • The student must not have answered another questionnaire during the day • The questionnaire must be active to be answered
Input data	Questionnaire answers
Steps	1. The student answers the questions in the questionnaire 2. The student sends their answers to the platform 3. The platform saves the data of your answers 4. The platform analyzes the responses to generate the acknowledgment 5. The platform links the acknowledgment generated with the user's profile
Expected result	The platform displays a successful delivery notification
Obtained result	The student's responses were successfully saved, and the acknowledgment was generated
Test result	Satisfying

5.3 Final Modules

The modules were deployed to students of the TecNM/ITM from August 2021 to date. The information collected from the COVID-19 Screening Tool allowed the access of students to the institution during the fall semester. The Health and Wellness Questionnaire allowed us to monitor symptoms associated with mental illnesses and to timely assist and properly channel students to receive psychological assistance. Data obtained from the microblogging application as CSV files was used to feed a natural language processing sentiment analysis tool, whose description is out of the scope of this work.

6 Conclusions and Future Work

6.1 Conclusions

The COVID-19 pandemic has encouraged institutions to develop tools for the analysis of data on the physical and mental health of students. This article presented the

development of a platform that serves this purpose, which was developed using the SCRUM agile development methodology. Using this methodology, a web platform for the implementation of questionnaires (COVID-19 Screening Tool and a Health and Wellness Questionnaire based on psychological inventories and questionnaires) and a microblogging module was developed.

The platform described in this work is used to timely detect symptoms associated with different mental health illnesses (depression, anxiety, etc.) and to generate a dataset of responses for subsequent textual analysis to further enhance the detection of the aforementioned illnesses. This analysis can be carried out through the sentiment analysis of the information from the CSV files [25].

On the other hand, the COVID-19 Screening Tool is used to evaluate possible symptoms among students and determine their severity to avoid potential and substantial infections. This tool allowed the efficient access to the TecNM/ITM during the 2022 fall semester, serving over 500 students.

The SCRUM agile development methodology was perfectly adapted to the development team, allowing updates to be released, and measuring the development speed of the team based on the score of the user stories. Likewise, the use of technologies was very convenient for development, since they streamlined the process and the reuse of components, which is an important factor in the development of this type of system.

6.2 Future Work

The development of the web platform for the analysis of physical and mental health data of students described in this article represents a great advance for future projects, such as integrating text analytics techniques, or any other text processing technique in search for patterns or signs of depression in student responses. Future work is planned in terms of upgrading the platform to track peripherals (e.g., mouse, keyboard) to recognize patterns possibly associated with mental illnesses. As well, the platform is expected to allow the recording of audio files of the speech of the students to further analyze the linguistic and the acoustic characteristics of such information.

Acknowledgements. This work was carried out with the support of project 13933.22-P "Diagnóstico preliminar y predicción oportuna de trastornos psicológicos en estudiantes del Instituto Tecnológico de Mérida mediante técnicas de inteligencia artificial" and Project 14601.22-P "Desarrollo de un sistema de refinamiento de cuestionarios psicológicos utilizando técnicas de reducción de dimensionalidad" of the Tecnológico Nacional de México/IT de Mérida.

References

1. Zhu, N., Zhang, D., Wang, W., Li, X., Yang, B., Song, J., et al.: A novel coronavirus from patients with pneumonia in China, 2019. N. Engl. J. Med. **382**, 727–733 (2020)
2. World Health Organization: Coronavirus disease (COVID-19) pandemic. Geneva: WHO (2020). www.https://who.int/emergencies/diseases/novel-coronavirus-2019
3. Duan, L., Zhu, G.: Psychological interventions for people affected by the COVID-19 epidemic. Lancet Psychiatry **7**, 300–302 (2020). https://doi.org/10.1016/S2215-0366(20)30073-0

4. Ho, C.S., Chee, C.Y., Ho, R.C.: Mental health strategies to combat the psychological impact of COVID-19 beyond paranoia and panic. Ann. Acad. Med. Singapore **49**(1), 1–3 (2020)
5. Xiao, C.: A novel approach of consultation on 2019 novel coronavirus (COVID-19)-related psychological and mental problems: structured letter therapy. Psychiatry Investig. **17**(2), 175–6 (2020). https://doi.org/10.30773/pi.2020.0047
6. Zandifar, A., Badrfam, R.: Iranian mental health during the COVID-19 epidemic. Asian J. Psychiatr. **51**, 101990 (2020). https://doi.org/10.1016/j.ajp.2020.101990
7. Asmundson, G.J.G., Taylor, S.: How health anxiety influences responses to viral outbreaks like COVID-19: what all decision-makers, health authorities, and health care professionals need to know. J. Anxiety Disord. **71**, 102211 (2020). https://doi.org/10.1016/j.janxdis.2020.102211
8. Wang, C., et al.: Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. Int. J. Environ. Res. Public Health **17**(5) (2020). https://doi.org/10.3390/ijerph17051729
9. Qiu, J., Shen, B., Zhao, M., Wang, Z., Xie, B., Xu, Y.: A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. Gen. Psychiatr. **33**(2), e100213 (2020). https://doi.org/10.1136/gpsych-2020-100213
10. Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., et al.: The psychological impact of the COVID-19 epidemic on college students in China. Psychiat. Res. **287**, 112934 (2020). https://doi.org/10.1016/j.psychres.2020.112934.doi:10.1016/j.psychres.2020.112934
11. Liu, N., Zhang, F., Wei, C., Jia, Y., Shang, Z., Sun, L., et al.: Prevalence and predictors of PTSS during COVID-19 outbreak in China hardest-hit areas: gender differences matter. Psychiat. Res. **287**, 112921 (2020). https://doi.org/10.1016/j.psychres.2020.112921
12. Pita Garrido, J.: Plataforma para el apoyo al aprendizaje de manera colaborativa en ambientes distribuidos: aula social – UDLAP. Tesis profesional, Universidad de las Américas Puebla (2012). http://catarina.udlap.mx/u_dl_a/tales/documentos/lst/pita_g_jm/. Accessed 24 June 2021
13. Sushko, I., et al.: Online chemical modeling environment (OCHEM): web platform for data storage, model development and publishing of chemical information. J. Comput. Aided. Mol. Des. **25**(6), 533–554 (2011). https://doi.org/10.1007/s10822-011-9440-2
14. Newman, C., Agioutantis, Z., Schaefer, N.: Development of a web-platform for mining applications. Int. J. Min. Sci. Technol. **28**(1), 95–99 (2018). https://doi.org/10.1016/j.ijmst.2017.11.016
15. Adami, M., Mello, M.P., Aguiar, D.A., Rudorff, B.F.T., De Souza, A.F.: A web platform development to perform thematic accuracy assessment of sugarcane mapping in South-Central Brazil. Remote Sens. **4**(10), 3201–3214 (2012). https://doi.org/10.3390/rs4103201
16. Cummins, N., Scherer, S., Krajewski, J., Schnieder, S., Epps, J., Quatieri, T.F.: A review of depression and suicide risk assessment using speech analysis. Speech Commun. **71**, 10–49 (2015). https://doi.org/10.1016/j.specom.2015.03.004
17. Center for Epidemiological Studies-Depression: American Psychological Association (2011). https://www.apa.org/pi/about/publications/caregivers/practice-settings/assessment/tools/depression-scale. Accessed 23 June 2021
18. Carroll, B.J., Feinberg, M., Smouse, P.E., Rawson, S.G., Greden, J.F.: The Carroll rating scale for depression. I. Development, reliability and validation. Br. J. Psychiatry **138**(3), 194–200 (1981). https://doi.org/10.1192/bjp.138.3.194
19. Baader, T., et al.: Validación y utilidad de la encuesta PHQ-9 (Patient Health Questionnaire) en el diagnóstico de depresión en pacientes usuarios de atención primaria en Chile. Rev. Chil. Neuropsiquiatr. **9**(1), 10–22 (2012). http://www.scielo.cl/scielo.php?script=sci_arttext&pid=S0717-92272012000100002&lng=en&nrm=iso&tlng=en. Accessed 23 June 2021

20. Ehrlich, K., Shami, N.S.: Microblogging inside and outside the workplace. In: ICWSM 2010 - Proceedings 4th International AAAI Conference on Weblogs and Social Media, pp. 42–49 (2010)
21. Java, A., Song, X., Finin, T., Tseng, B.: Why we Twitter: an analysis of a microblogging community. In: Zhang, H., et al. (eds.) SNAKDD/WebKDD -2007. LNCS (LNAI), vol. 5439, pp. 118–138. Springer, Heidelberg (2009). https://doi.org/10.1007/978-3-642-00528-2_7
22. Vieweg, S., Hughes, A.L., Starbird, K., Palen, L.: Microblogging during two natural hazards events: what Twitter may contribute to situational awareness. In: Proceedings of the Conference on Human Factors in Computing Systems, vol. 2, pp. 1079–1088 (2010). https://doi.org/10.1145/1753326.1753486
23. Trigas Gallego, M., Domingo Troncho, A.C.: Gestión de Proyectos Informáticos. Metodología Scrum., Openaccess.Uoc.Edu, p. 56 (2012). http://www.quimbiotec.gob.ve/sistem/auditoria/pdf/ciudadano/mtrigasTFC0612memoria.pdf. http://openaccess.uoc.edu/webapps/o2/bitstream/10609/17885/1/mtrigasTFC0612memoria.pdf
24. The Scrum Framework Poster: Scrum.org (2021). https://www.scrum.org/resources/scrum-framework-poster
25. Kolasani, S.V., Assaf, R.: Predicting stock movement using sentiment analysis of Twitter feed with neural networks. J. Data Anal. Inf. Process. **8**(4), 309–319 (2020)