

Contingency Access Control COVID-19

Control de Acceso por Contingencia COVID-19

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Abstract

The main goal of this work is to show results obtained from a software called "Access Control by Contingency COVID-19" which allows the institution control the access to facilities after returning from COVID pandemic in order to avoid crowds of people, this software will help avoid COVID-19 infections. The methodology used for this project was Scrum, since the development of the project required mainly a constant testing and delivery follow-up, prioritizing activities and adapting changes for greater flexibility to modifications to achieve the main objective in a established time. Currently web applications are being used as a resource in order to put together different projects, in this case health control and University access, applying a survey to generate a QR code with which people will be able to enter the university facilities, this code is read by a mobile application that sends data via wifi to a desktop application that is in charge for validating and recording student's data, employees and external personnel accessing the institution facilities.

Contingency, Pandemic, Contagions

Resumen

El presente trabajo tiene como objetivo mostrar los resultados obtenidos del software "Control de Acceso por Contingencia COVID-19" que permite a la institución el acceso y control de personal en la reanudación de actividades, para evitar aglomeraciones de personas, buscando como resultado evitar los contagios de COVID-19. La metodología utilizada para este proyecto fue Scrum dado que el desarrollo del proyecto requirió principalmente un seguimiento de prueba y entrega constante, priorizando actividades y adaptando los cambios para mayor flexibilidad a las modificaciones para lograr el objetivo en el tiempo establecido. Las aplicaciones web se están utilizando como recurso frecuente para acoplar diferentes proyectos, en este caso el control de salud y de acceso a la Universidad, aplicando una encuesta para generar un código QR con el cual las personas ingresan a las instalaciones, este código es leído por una aplicación móvil que envía los datos por wifi a una aplicación de escritorio que se encarga de validar y registrar los datos de los alumnos, empleados y personal externo que ingresa a la institución.

Contingencia, Pandemia, Contagios

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Introduction

The main goal of this work is to show results obtained from a software called "Access Control by Contingency COVID-19" which allows the institution control the access to facilities after returning from COVID pandemic in order to avoid crowds of people, this software will help avoid COVID-19 infections. Web applications have been used since browsers got greater capabilities other than displaying text and images. Software industry relays on a new generation of modern applications that take advantage of new web technologies (HTML, CSS and JavaScript) to create interfaces for Internet services. Web applications have become indispensable because of their usefulness. Basically, it is a web page that has been optimized in order to be used from a cell phone. It is also called a web app. The objective is no more than increasing the adaptability of the web to any device. (Ayoze Castillo, 2015)

The QR code technology was created in 1994 by the Japanese company Denso Wave, a subsidiary of Toyota, to speed up the process of registering the necessary parts during the car production process. The goal of its creators was always to develop a system that could allow a certain content to be displayed very quickly. In 1999 the company released the patent for widespread use. QRs are very common in Japan, where they are the most popular two-dimensional code. (Gascón, 2021). There are multiple uses of QR codes. Some of the most important ones are mentioned below:

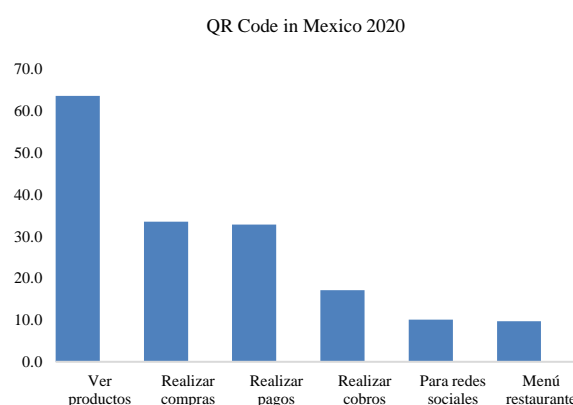
1. Storage and dissemination:

As it replaces the traditional bar code, its use is very similar to the previous one, although taken to the digital terrain in which we move. In summary, it is used to store information and spread it instantaneously, simply and creatively.

2. Creation of company-consumer relationships

They are being used for marketing campaigns and, even, to contact your audience and create closer ties with them, but, be careful, not all companies know how to integrate them or where to place them. (Regrag, 2018).

A study conducted in 2020 identified the most frequent applications of QR (Quick Response) codes in Mexico. The majority of mobile internet users who participated in the survey, about 64%, mentioned that they used QR codes to see the features of a product. Other frequent uses were for shopping and making payments, with 33.5% and 32.8%, respectively. Lack of interest is one of the main reason for not using QR codes according to Mexican consumers. (Kohl, 2021)



Graphic 1 Percentage of people who have used a QR code in Mexico in 2020, by type of use

Source: Statista

Java with SQLite

One of the advantages that SQLite has over common database engines, is that it does not need to be installed to run it, you simply need the binary execution file, add it to the system variables, so that later we can use it wherever we want, now well, query commands, insertion, and creation are exactly identical to those of SQL, however, commands such as show databases and show tables of MySQL do not exist, for this we use .tables, even so as in every good engine, we can consult the help section with .help to see all possible commands. (Diaz, 2014)

SQLite stores data in a single cross-platform file. Since there is no dedicated server or specialized file system, "deploying" SQLite is as simple as linking your library and creating a new regular file. This simplicity has resulted in the mass adoption of SQLite as the database system of choice for embedded applications and devices.

Just to mention, the total count of SQLite implementations overpasses that of all other database engines combined, as it is included with all major operating systems, most programming languages, an extensive list of embedded hardware, and many major software products. Java and JavaScript. (Olg, 2021)

JavaScript was designed to add effects and animations to websites, but it has evolved over the years, becoming a multipurpose language. It is from 2005, with the arrival of Gmail and its use of AJAX, Asynchronous JavaScript And XML technology (thanks to the XMLHttpRequest object created by Microsoft for Internet Explorer 5.0), that launched its popularity.

Currently JavaScript is used in many places, Frontend, Backend, isomorphic applications, microcontrollers, Internet of Things, wearables, etc.... Making it one of the most important programming languages of the present. Recently (March 22, 2016), the website Stackoverflow published a report from a survey of developers using its platform this reports shows that JavaScript is in fact the most used language in the world, not only by Frontend developers but also by Backend developers. (Azaustre, 2016)

Java is a general purpose programming language, especially for internet and web; it is currently found in numerous applications, devices, communication networks, etc. (Joyanes Aguilar & Zahonero Martínez, 2011)

C++ allows programming in high-level language, and if needed, it can even be downgraded to assembly language. That is, it is a language that allows both high, as well as low level programming, to optimize our program. (Bustos, 2018)

Problem

During the pandemic, regular activities that are part of the curriculum and work at the Universidad Tecnológica de San Juan del Río were affected, and students, employees and external personnel interested in accessing the university facilities were not allowed to access the institution due to their unknown health status, as well as the access control all facilities

Justification

The Technical Board of Health requests as a requirement to report on the health status and symptoms of COVID-19 of the people who need to enter the facilities of the institution, that is why a survey is the most convenient thing to do.

Methodology

A project involves a collaborative effort to create a new product, service, or other outcome. Projects are affected by constraints of time, cost, scope, quality, resources, organizational capabilities, and other limitations that make them difficult to plan, execute, manage, and ultimately succeed. (Satpathy, 2013)

A Scrum methodology was chosen because it has the advantage of adapting to the constant change of projects, in which there are three main roles: product owner, scrum master and development team.

Product owner role is the only profile that constantly talks to the customer, which requires him to have a lot of knowledge about the business.

He is responsible for maximizing the value of the development team's work. Maximizing the value of the work goes hand in hand with good product backlog management. The scrum master role is responsible for ensuring that scrum techniques are understood and applied in an organization. It is the scrum manager, a leader who is responsible to remove impediments or drawbacks that the team has within a sprint. Applying the best techniques to strengthen the digital marketing team. (Jeff Sutherland, 2016)

The development team is in charge of carrying out the tasks prioritized by the product owner. It is a multifunctional and self-organized team. They are the only ones who estimate the product backlog tasks, without being influenced by anyone. (Abellán, 2020)

This process consists of the following phases: sprint planning, development stage, sprint review and feedback.

In sprint planning, the goal is to define what can be delivered in the sprint and how that work will be accomplished. Sprint planning is done in collaboration with the entire scrum team. (West, 2022)

A list of activities were made based on the project requirements, considering the estimated days of development, the status of each activity, the conditions and the approval of the result.

In the development stage, when the sprint is in progress, we must ensure that:

- No changes are made that affect the objective of the Sprint;
- Quality objectives are not lowered

Scope may be clarified and renegotiated between the product owner and the development team as it is learned. (Perez, 2021).

In the sprint review, a review is made to check the progress of the project, short meetings are held and with this rhythm irregularities in the performance and vision of the project are identified.

The project is tracked and built to obtain the final result of the first sprint, at the same time planning the next review for product improvements.

At the end of the process, the results are delivered to the customers who could use the software and in response to which they could have opinions as feedback and which allow for correction and testing each time a sprint is completed.

The empirical process control is retrospective and not predictive (as in traditional management) It implies that decisions are made based on evidence and knowledge is enhanced by experience. (Duarte, 2019).

The product backlog contains all the work that is necessary for the development or construction of our system or product and is the responsibility of the product owner. In fact, it is the result of the product owner's work with the different stakeholders (customer/s, user/s). (Tamarit, 2019).

Development

Once user stories were analyzed, tasks were prioritized in the product backlog, It then allows the approval and estimation of times and degree of difficulty of the list of tasks.

The following tables describe each of the the tasks prioritized according to the institution's development needs, with three products to be developed.

Task ID	Tasks	Estimate (days)	Priority	State	Condition of approval	Approved
1	As a student, employee or external staff, I want to obtain my QR code to enter the university facilities.			100%	The Qr code saves the data and the answers made.	Ok
2	As a student, employee or external personnel, I would like to complete a survey to verify my health status with the university.	5		100%	Have a yes and no option to answer concise questions.	Ok
3	As a student or employee, I require medical attention for my checkup in case I have any symptoms.			100%	The physician can visualize the patient's symptoms and receive the staff.	Ok
4	As a student, employee or external personnel I want to record my time and date of entry for attendance control.			100%	The time and date of entry for the validity of the Qr code is recorded.	Ok
5	As a student, employee or external staff, I want to record my answers every 24 hours for my follow-up in case I have any symptoms.			100%	That the Qr code has an expiration date so that the survey can be answered each day of admission to the university.	Ok
6	As a student, employee or external staff, I want to select the type of person to enter the university facilities.			100%	Have the option to select the type of user, employee, students and external and generate forms according to the type of user.	Ok
7	As a student, employee or external staff, I want to download my qr code to print it and present it physically.			100%	That the Qr code is generated in a pdf file that allows it to be downloaded and subsequently printed.	Ok

Table 1 Product Backlog of the QR generator
Source: Own Elaboration

Task ID	Tasks	Estimate (days)	Priority	State	Condition of approval	Approved
1	As administrator I want two options for connecting and disconnecting from the server			100%	Automatic disconnection if the server is not started	Ok
2	As administrator I want it to show the number of detected when reading Qr.	5		100%	Display the number of Qr detections read.	Ok
3	As an administrator I want to display the data saved in the qr code when reading.			100%	The personal data of the student, employee or external personnel, as well as the survey responses, are displayed.	Ok

Table 2 Product Backlog of the server
Source: Own Elaboration

Task ID	Tasks	Estimate (days)	Priority	State	Condition of approval	Approved
1	As administrator I want to connect to the server to use the reader.			100%	The server validates the client connection to be able to use it	Ok
2	As an administrator I want to check the server status to verify my connection.	5		100%	Display a server status message	Ok
3	As administrator I want to have the option to connect and disconnect to start and close the server.			100%	The interface has two buttons to connect and disconnect.	Ok
4	As an administrator I want to see the number of users connected to have a control			100%	When generating connection status, show the number of connected clients.	Ok

Table 3 Product Backlog of the QR reader
Source: Own Elaboration

A meeting is held with the team to define the deliverables and objectives of a sprint, then the team asks itself some questions for a better definition: What is going to be done in the sprint? and How are we going to achieve it?

The team develops and defines the necessary tasks based on the needs of the project. This definition commits the team to the delivery of value that would be made in each final milestone with the client. As a result of the meeting a sprint is created with the defined tasks.

The tasks that were proposed in the start of the product backlog, to carry out the follow-up of the project.

Product backlog		Start		End
To do		Doing	Review	Done
Question Form	Home page design			
Question Form	User type option			
Multiple choice of questions	QR download button			
Page generates QR	Information panels			
SQLite database design	Page that lists users with symptoms			
Database connection	Database connection tests			
Customer connection and disconnection	Server status			
QR reader interface	Server interface			
Test with generated QR	Connection to the server			

Table 4 Set of general project tasks
Source: Own Elaboration

Three sprints were created, one for each part of the project.

The first sprint of the project corresponds to the creation of the web application that aims to present the survey of health status of the person and the generation of a QR code with such data, also within this sprint is the creation of the database and finally the testing.

Sprint	Start		End
To do	Doing	Review	Done
QR download button	Page that lists users with symptoms	Question Form	Information panels
Home page design		User type option	Question Form
Multiple choice of questions			SQLite database design
Database connection			Page generates QR
			Database connection tests

Table 5 Sprint May 2021 QR Generator
Source: Own Elaboration

The second sprint is executed for the creation of the desktop application, a server that is responsible for maintaining connections with mobile devices for the registration and updating of the database of people entering the University.

Sprint	Start		End
To do	Doing	Review	Done
			Server interface
			Customer connection and disconnection
			Server status

Table 6 Sprint June 2021 Server
Source: Own Elaboration

At the end, the sprint was carried out where the tasks prioritized for the generation of the mobile application, responsible for reading the QR code, sending information to the server for registration and showing the person responsible for admission if an individual has any respiratory symptoms, She or He must be addressed to the medical department or if he/she can be admitted to access the facilities.

Sprint	Start		End
To do	Doing	Review	Done
			QR reader interface
			Connection to the server
			Test with generated QR

Table 7 Sprint July 2021 Lector
Source: Own Elaboration

One of the activities of the scrum methodology is the sprint review, which consists of demonstrating the hard work of an entire team: scrum master, product owner and development team. According to the methodology, it is desirable to keep sprint reviews informal. Team members gather around a desk for informal demonstrations and describe the work they are doing for that iteration. (Radigan, 2020).

Finally Scrum methodology asks us to do a sprint retrospective, which is a type of meeting within the agile framework, where teams reflect on what went well and what could be improved in the next sprint. These are essential to continuously improve the development process and ensure that key learnings are incorporated for the next sprint. (MacNeil, 2022)

Results

The web application for the execution of a survey with the health elements related to COVID-19 for all persons interested in entering the facilities of the Technological University of San Juan del Río and the generation of the QR code with the data of the person and the survey.

This web application contains a welcome section with a form where time and day of a visit is selected, as well as the type of user entering the university and depending on whether a user is a student, employee or external staff, a different window in the application is displayed to select where to go, after that the survey is displayed with the same selection elements, for all persons. With this data the QR code is generated and can be downloaded in PDF format.

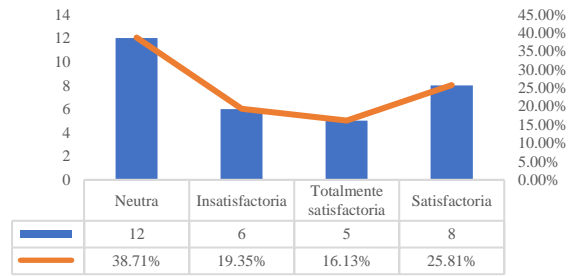
The desktop application was also developed, which serves as a server that allows connecting with the mobile application. The server reads the data sent by the client and stores it in the database. It was developed C++ .

Finally, a mobile application was developed to read the QR code generated with the web application, this information is sent to the server for registration. As the server was developed with C++, the QZXing library was used for the generation and reading of QR codes.

QZXing is a library that has been used for years in all kinds of applications, from personal to professional. This library allows us in a very simple way to read a large number of codes, but we focus on the QR code. (Kotlin Course, 2021)

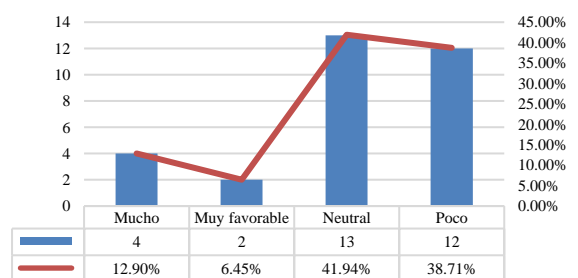
We applied a survey to the students, to reflect their opinion when using the applications developed in the present project. The following figures show the results obtained from the questions asked.

How would you rate your experience answering the survey from the student portal?



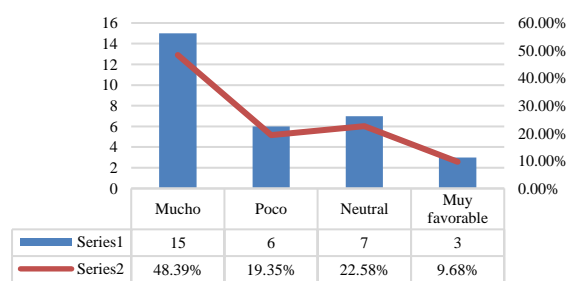
Graphic 2 Satisfaction survey
Source: Own Elaboration

How convenient do you think it is to answer the survey every day?



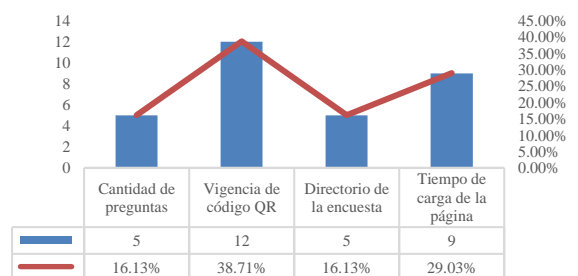
Graphic 3 Satisfaction survey
Source: Own Elaboration

How important do you consider it is to consult the privacy notice?

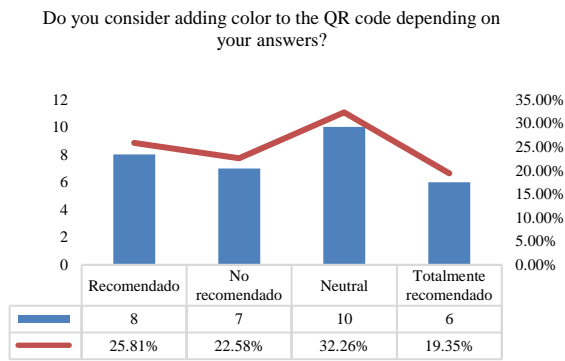


Graphic 4 Satisfaction survey
Source: Own Elaboration

If you could change anything about the COVID-19 survey, what would it be?



Graphic 5 Satisfaction survey
Source: Own Elaboration



Graphic 6. Satisfaction survey
Source: Own Elaboration

We show a comparative table showing the differences between projects similar to those of other universities in Mexico.

Comparative characteristics:

1. Students
2. Employees
3. Interest offer
4. E-mail address
5. External
6. Date/time
7. Privacy Notice
8. File number
9. Family member data
10. Questionnaire COVID-19
11. COVID-19 test data
12. Color QR code
13. Generate document with QR
14. Legend with QR

Institution	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 San Juan del Rfo Technological University	X	X			X	X	X	X		X				X
Anahuac University Mexico	X	X			X		X	X		X		X		
Mexicali National Technological Center	X							X		X		X	X	
Monterrey Institute of Technology	X	X												
5 Millennium University	X	X	X	X	X		X	X		X				X
Tecnológico Nacional de México	X	X				X		X	X	X	X		X	X

Table 8 Similar projects of universities in Mexico
Sources: Anahuac Oro, Tecnológico Nacional de Mexicali, Tecnológico de Monterrey, UniverMilenium, Tecnológico Nacional de México

The process for registration with Indautor began with the necessary requirements.

The National Copyright Institute (Indautor) is a decentralized entity in charge of promoting creativity, cultural development and the administration of the public registry of copyright by promoting international cooperation among institutions in charge of the registration and protection of copyright and related rights. (López, 2015)

Conclusions

A pandemic is a situation that we were not prepared to face it , during the first days of confinement we were obligated to adapt as soon as possible to the changes generated like online work and occasional attendance at work facilities , one of the challenges was to control the entrance and attendance in order not to exceed the number of persons allowed within the facilities. Technology is a tool that has made our work much easier, web applications, desktop applications and mobile applications have helped in the control of the capacity to avoid possible infections and thus cut the chains of infection, to try to achieve as far as possible the health safety of the community at the University.

In addition, the development of the project was carried out with great haste because the situation warranted it, there are many opportunities for improvement in the presentation of the user interfaces, possibly more graphics can be used for a better experience, it is necessary to evaluate the client-server technology through sockets to see if it is the most efficient way to solve the problem or if some technological alternative can improve the speed, the distance of the clients with the server since wifi is used and has well known limits in the scope.

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