Design and development of a PWA - Progressive Web Application, to consult the diary and programming of a technological event.

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Abstract. Expotecnología is an event aimed at students, teachers and professionals in the areas of systems, computing, petrochemicals, process control and industrial instrumentation, electronics and telecommunications, electricity, electromechanics and civil works, with the purpose of addressing not only the challenges that accompany the various activities in which related professionals perform, but also the problems, projects and programs of the academic units in which they are trained. In addition, it is a conducive space to enhance their role in the profession, research and academy. Currently, there is a website for the Expotecnología event, which can be seen here: https://expotecnologia.unitecnar.edu.co. But all the scheduling and schedule management is consulted manually by means of flyers, billboards or email. In this sense, it is necessary to develop a progressive web application, where all the optimized processes can be carried out, in addition the participants to the event would not have any inconvenience to know the day, time and place where they will be presented, because it can also work without internet connection (offline).

1. Introduction
Understanding the concept in a very simple way, PWA (Progressive Web Application) are applications that work in the same way as native or traditional ones, because they are developed in an environment and interface of similar navigation and interaction with users. The main and true difference between these types of technologies is that, in the PWA, it is not necessary to download from any application store such as Google Play or the App Store, because these are executed directly in the browser of the device where it is displayed. Progressive Web Applications are considered as the evolution of applications developed in HTML5 with the help of Service Workers, which allows running all services in browsers, but in the background. Therefore, these PWAs can be charged almost immediately, even without internet connectivity. The applications called PWA are mobile web applications that take advantage of the new possibilities and APIs offered by the new Web technologies, such as Service Workers (a script that runs in the background and allows the implementation of functionalities that do not require a web page or user interaction, user) and Web App Manifest (JSON file that allows you to specify application metadata such as name, color and icon that distinguishes it), among others. This allows a web application to incorporate some of the historically unique features of native applications, such as offline operation, receiving push notifications and having an access icon in the application launcher [1].

Hybrid applications and, more recently, PWA (Progressive Web Application) applications are emerging as the trend in the way of accessing and serving content. PWAs allow emulating the concept of a native application, supported by the technologies provided by web browsers [2]. During this project the benefits of using various technologies to serve pages in a friendly and simple way will be
explained, such as Cache Storage, Service Workers, Manifest (Json), JavaScript, Firebase, HTML5 and CSS3.

Currently the logistics of the agenda and programming of the Expotecgnologia event at Unitecnar, is carried out manually. Seeking to optimize this process and to be able to visualize the complete schedule from the day it starts, the schedules, the name of the exhibitor and the spaces where it will be presented, it is necessary to venture into new technologies such as PWA (Progressive Web Application), which provide us various benefits and comforts.

A PWA is a much lighter application than a native application, its download and installation is much easier, updates are made directly on the website and can work without an Internet connection. The updates are reflected directly in the application that is on the mobile device and can work on Android and IOS platforms.

2. Materials and methods

2.1. Problem statement
The development of this project is within the framework of quantitative research, through which all the related variables can be measured, an analysis of the results obtained and all the conclusions can be expressed. Quantitative research is a process based on testing a theory composed of variables, measured with numbers and analyzed using statistical techniques. The goal of quantitative methods is to determine whether the predictive generalization of a theory is true [3].

The main objective of this project is that all the people who participate in it as speakers, have the possibility of having a tool that avoids confusion when looking for the place and time of their presentation. Basically, by means of a query through your identity card, you can observe through a responsive graphical interface, all the information stored in a database (name of the speaker, title of the presentation, day, time and place) using Google's Firebase, through the application's graphical interface developed with JavaScript, HTML5, CSS3 and Service Worker implementation. Under this premise, the question arose: How to develop a low-cost application with free software, which shows an electronic agenda through a query of a technological event? Through this project, the production and development of applications is encouraged within the group of students who participate in the research seedbeds at Unitecnar (see figure 1).

Figure 1. Responsive Graphical Interface
3. Stages in the development of the PWA
Initially, for the development of this application, it was necessary to investigate and know what the Firebase technology was and how it works (platform for web and mobile development, developed by Google) and then make the implementation with all the technologies described below.

3.1. Google Firebase
The Firebase Realtime Database is a NoSQL cloud-based database that syncs data across all clients in real-time, and provides offline functionality. Data is stored in the Realtime database as JSON, and all connected clients share one instance, automatically receiving updates with the newest data [4].

With a prior registration to the Application and free of charge, the database was created and all the information of the speakers registered and accepted to the technological event called Expotecnología was stored. In this way, and having the database connected through the JavaScript code embedded in the HTML5, it was possible to generate the desired queries (see figure 2).

![Firebase graphical interface](image)

**Figure 2. Firebase graphical interface**

3.2. HTML5 language
Through a simple, friendly Code, using AJAX requests, JSON requests and the most important HTML5 classes, shaping through CCS3, it is possible to incorporate these advanced technologies to implement modern and pertinent solutions in information systems (see figure 3).

![HTML5 code](image)

**Figure 3. HTML5 code**

HTML has been used as the standard method for developing web pages since it was first introduced in the early 1990s. Over the past twenty years, HTML, with the help of JavaScript and CSS, has enabled the web to evolve from a simple document-sharing device into a complex and dynamic platform for application development. The introduction of JavaScript allowed web developers to construct intricate web applications with functionality rivaling that of modern desktop applications. However, most web applications require functionality beyond what JavaScript alone can provide; this forces developer to supplement these needs with server-side technologies such as PHP, Perl, or Ruby.
This process is often tedious, as the programmer must develop different portions of the application in different languages. As hardware inevitably evolves to meet consumers requirements, web applications must grow more complex to compete with their desktop counterparts. To meet this growing need, HTML5 introduces methods for storing data that may allow future web applications to see vast improvements to performance, security, and privacy, without unnecessary supplemental languages [5].

3.3. Using the Sweet Alert 2 library and JavaScript

Through the incorporation of the JavaScript library called Sweet Alert 2, dynamic and incredible interfaces are achieved to implement in web projects. A fairly simple and clean Code was used in the development of this progressive web application (see figure 4).
JavaScript is not the only scripting language; there are others such as VBScript and Perl. So why choose JavaScript over the others, the main reason for choosing JavaScript is its widespread use and availability. Both of the most commonly used browsers, IE and Firefox, support JavaScript, as do almost all of the less commonly used browsers. So, you can assume that most people browsing your web site will have a version of JavaScript installed, though it is possible to use a browser’s options to disable it. Of the other scripting languages already mentioned, VBScript, which can be used for the same purposes as JavaScript, is supported only by Internet Explorer running on the Windows operating system, and Perl is not used at all in web browsers. JavaScript is also very versatile and not just limited to use within a web page. For example, it can be used in Windows to automate computer-administration tasks and inside Adobe Acrobat PDF files to control the display of the page just as in web pages, although Acrobat uses a more limited version of JavaScript. However, the question of which scripting language is more powerful and useful has no real answer. Pretty much everything that can be done in JavaScript can be done in VBScript, and vice versa [6].

3.4. Design Responsive and CCS3 language

The term responsive web design was popularized by an article that web designer and developer Ethan Marcotte wrote in 2010. The goal of responsive web design is to make a web page look equally good regardless of the screen size of a device. Before the introduction of responsive web design, web designers and developers created most websites by following the principles of pixel perfect web design. Pixel perfect web design treats a web page like a page from a magazine. In this approach, the mock-up of a web page is first created in Photoshop, and then a developer recreates that design to fit a web browser. The goal of pixel-perfect web design is to make a web page resemble the original mock-up as much as possible.

The greatest advantage of responsive web design is that a library does not have to maintain and update more than one set of content. Another advantage is that there is no need for additional promotion of the library’s mobile website, since whenever a library patron accesses the library website on a mobile device, the web-site automatically adjusts its layout to be mobile-friendly. This is a great plus considering that libraries often experience difficulty in promoting their mobile offerings such as down-loadable e-books, tablets for borrowing, and a mobile website. From the library patron’s perspective, a library website with responsive web design presents all the information found in the full website. This content-parity enables patrons using a mobile device to find and do almost everything that they can do on the full desktop site as long as their mobile devices support the features in the full desktop site. (Flash on the mobile Safari web browser would be the example of an unsupported feature. [7]. (see figure 5-6).
3.5. Use of Service Worker and manifest Json

A service worker is a fairly robust tool that creates a sequence of commands, which are run by the browser in the background. It really is a JavaScript file that continues to run even though the website is closed. The Json manifest causes the Web Application to tell the browser what elements to display for each Web page, such as color, splash screen, etc. In addition, all these technologies cause an icon to be installed on the cell phone without the need to install anything additional, or download any application.
4. Results
As a result of this research and development work of a progressive, completely responsive and clean Web Application, a very friendly interface was obtained, which is currently working mounted on a private server for its implementation (http://www.cesargoweb.com/pwaexpo/). It should be noted that it is fully scalable and upgradeable and can be adapted to any technological event or institution of higher education. The application is deployed without problems and runs at an optimal speed, which leads us to be able to navigate smoothly from any electronic device, even without having an internet connection, due to its local storage in browsers, another important advantage of working with Service Worker, Json Manifest and JavaScript (see figure 7).

![Figure 7. Computer view](image)

5. Conclusions
Progressive web applications or PWA, have become the new trend in application development that make the most of all the benefits offered by information and communication technologies in the web field. Unlike native or conventional applications, we can run PWAs in any browser or operating system, presenting many advantages to the user, such as push notifications, increased functionality depending on the device on which we deploy it and also its performance. That is, they behave like a native Application but using web technology and consuming less system resources as such.

Among the most important features of progressive web applications, we have:

- They can be run directly on the desktop, without having to download it from the Play Store or App Store and consuming fewer resources
- Progressive web applications work the same for each user, regardless of the web browser they are using.
- Its Responsive & Clean design makes it work on any device, computer, Laptop, Tablet or Smartphone.
- They are generally developed to be deployed under the HTTPS protocol, with its SSL certificate.
- All progressive web applications are kept up to date with the latest versions
- They are easily identifiable, more like an Application than a website
• They can be shared only with their URL, without the need to install.

The most important of these PWAs are the Service workers, which are scripts that are executed between the browser and the server to form the fundamental basis of development and using the web cache to show the results immediately. These Service workers are so important that they can use the cache immediately above to view the application when the internet connection is unstable or slow. As successful cases of progressive web application implementation we have: AliExpress, Twitter, Lancôme, Nikkei, among others.

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