

Analysis of a web system for the management of professional practices in a higher education institution

Análisis de un sistema web para la gestión de prácticas profesionales en una institución de enseñanza superior

DÍAZ-SARMIENTO, Bibiana†*, SÁNCHEZ-JIMÉNEZ, Daniel Antonio, AGUILAR-ORTIZ, Gabriela and MORALES-HERNÁNDEZ, Maricela

Instituto Tecnológico de Oaxaca, Departamento de Sistemas y Computación, Avenida Ing. Victor Bravo Ahuja No. 125 Esquina Calzada Tecnológico, C.P. 68030, México.

ID 1st Author: *Bibiana, Díaz-Sarmiento* / ORC ID: 0000-0003-4350-6311, CVU CONACYT ID:820776

ID 1st Co-author: *Daniel Antonio, Sánchez-Jiménez* / ORC ID: 0000-0003-4386-8291, CVU CONACYT ID:1148683

ID 2nd Co-author: *Gabriela, Aguilar-Ortiz* / ORC ID: 0000-0003-3055-5712, CVU CONACYT ID: 730590

ID 3rd Co-author: *Maricela, Morales-Hernández* / ORC ID: 0000-0002-3521-2041, CVU CONACYT ID: 731036

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Abstract

Students of Higher Education Institutions (IES), to finish their degree must carry out professional practices (professional residence), getting into practice the knowledge acquired during the degree, developing a project for the benefit of the company and IES. The development of a Web System for the management of professional practices in an HEI aims to implement a Web System that manages the professional practices of Engineering in Technological Innovation of an IES. The methodology for the development of the Web System is Incremental considering the stages: Communication, Planning, Modeling, Construction and Deployment. This article allows the reader to identify the steps, know the development methodology, analyze the activities developed and the implementation of the aforementioned Web System. You can also identify the contribution that the article has for the HEIs where in many cases the process of professional practices is carried out by hand, there is no control of the activities carried out by the student, the procedure is slow, the process is unknown, the importance of this last subject or activity to finish the degree is not given, being a requirement on many occasions to be titled.

Practices, Methodology, IES

Resumen

Los estudiantes de Instituciones de Educación Superior (IES), para finalizar su carrera deben realizar prácticas profesionales (residencia profesional), poniendo en práctica los conocimientos adquiridos durante la carrera, desarrollando un proyecto en beneficio de la empresa y IES. El desarrollo de un Sistema de Web para la gestión de prácticas profesionales en una IES tiene como objetivo implementar un Sistema Web que gestione las prácticas profesionales de la Ingeniería en Innovación Tecnológica de una IES. La metodología para el desarrollo del Sistema Web es Incremental considerando las etapas: Comunicación, Planeación, Modelado, Construcción y Despliegue. El presente artículo permite al lector identificar los pasos, conocer la metodología de desarrollo, analizar las actividades desarrolladas y la implementación del Sistema Web antes mencionado. También puede identificar la contribución que tiene el artículo para las IES donde en muchas ocasiones el proceso de prácticas profesionales se lleva a mano, no existe un control de las actividades que realiza el estudiante, el trámite es lento, se desconoce el proceso, no se da la importancia que tiene esta última materia o actividad para finalizar la carrera, siendo requisito en muchas ocasiones para titularse.

Prácticas, Metodología, IES

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† Researcher contributing as first author.

Introduction

The Analysis of the Web System for the management of professional practices of a Higher Education Institution, developed during the year 2021 in the distance modality due to the COVID-19 pandemic, allows to identify the importance of carrying out an adequate management of the administrative processes immersed in the professional practices.

Processes where the student, academic coordinator, coordinator of professional practices and director of the IES are involved. Sometimes, these processes are carried out manually, but with the pandemic several activities were developed virtually.

This article allows the reader to know the Analysis of the development of a Web System for the management of professional practices, to have an overview of the methodology used and the phases through which the project passed to reach the implementation stage.

The stages of the incremental methodology in software development and the techniques that were necessary to collect the information during the period of realization in the pandemic are identified. Previously the student developer was presented in the company of 4 to 6 hours a day to develop the System, due to the isolation by COVID-19 it was necessary to work with various technological tools to carry out the development of the system.

The characteristics that can be identified in the article are: Identification of the problem, Analysis of the methodology used and activities for the development of the software.

With the Web System for the Management of Professional Practices, a solution is given to the problem of carrying out the management in person, since the student can enter the system from the comfort of their home and carry out the administrative procedures to start, develop and conclude the professional practices, without having to attend school, avoiding contagion by COVID-19.

The article consists of the following sections: Project Overview, Problem Statement, Methodology, Development, Results, Acknowledgements, Conclusions and References.

Project overview

The Web System for the management of professional practices is developed in the city of Oaxaca de Juárez, in a Higher Education Institution, in the Department of Professional Practices belonging to the Academic Coordination, figure 1.

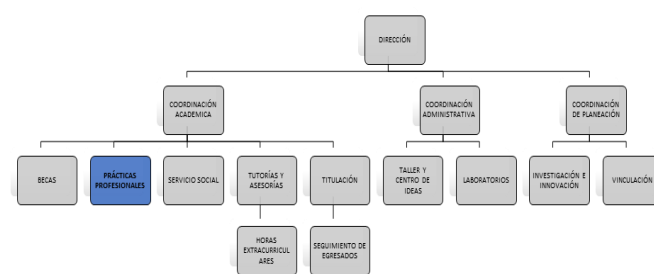


Figure 1 Organization chart
Source: Website of an IES

The processes that are carried out in the department of Professional Practices for the development of these are synthesized in 10 steps, figure 2.

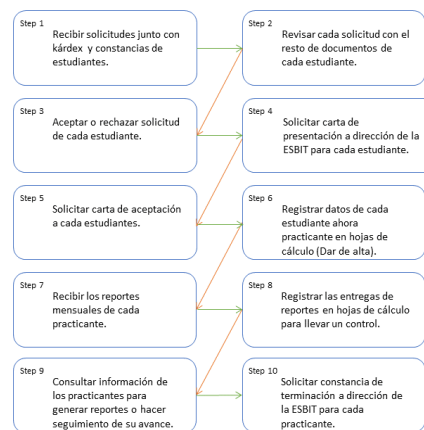


Figure 2 Process for professional practices
Source: Own elaboration

The process starts from receiving applications, kardex (generated by the school control system) and study certificates, once the documentation is reviewed the application is accepted or rejected, this information is recorded in an Excel file, this being the only control that the administrative staff has to keep track of those students who are studying professional practices.

During the development of the Web System, the following activities were carried out:

Phase 1. General analysis

- Requirements.
- Business Modeling.
- Defining iterations.

Phase 2. Development of increments

- Increments
- Communication
- Planning
- Modeling (Analysis, Design)
- Construction (Coding, validation)
- Deployment

Phase 3. Final delivery

- Application validation
- Deploying the application

Problem statement

In the school of Biological Systems and Technological Innovation of an IES in Oaxaca, the problem of not having a system that allows managing professional practices, neither locally nor at a distance, was identified. There are delays in the progress of administrative procedures, storage of physical or digital documents, difficulty in making queries, loss of information, documents, inconsistency or delays in the progress of student's professional practices.

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This problem was aggravated due to the SARS-CoV-2 (COVID-19) pandemic, since the attention on the part of the Educational Institution to carry out the professional practices was null. On the other hand, there is a list of government organizations to carry out professional practices, there is no list of SMEs so that students have a range of opportunities in the development of this activity.

It is worth mentioning that the development of professional practices is a requirement for the student to conclude their career and graduate.

Methodology

“A methodology is a collection of procedures, techniques, tools, and supporting documents that assist software developers in their efforts to implement new information systems.” (Amaya, 2013).

For the development of the Web System, traditional and agile development methodologies, characteristics, phases, number of increments, advantages, disadvantages and appropriate scenario were analyzed. The methodologies analyzed were: Incremental, Spiral, XP and Scrum (Kendall, 2005).

The Incremental Methodology met the characteristics according to the project, the user's requirements are prioritized, we work from 1 to 4 phases, depending on the difficulty you can have 1 or more increments, in each increment the client will have at his disposal a prototype that reflects part of the requirements, it is useful when the personnel is not enough for the complete implementation of the system. Figure 3 shows the stages of the incremental model.

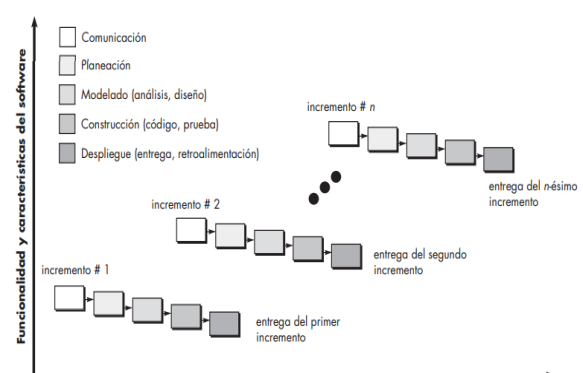


Figure 3 Stages of the incremental model

Source: Pressman, 2010

It was also necessary to work with different terms, these are:

UML: is a standard for object-oriented modeling, use cases and obtaining requirements based on use cases are increasingly used to obtain requirements, Sommerville 2011.

Web Engineering: allows systems to fulfill the functions for which they were developed, this is achieved because Web Engineering is more rigorous than traditional, Pressman 2010.

Cervantes 2017 mentions that: "A Web application runs on a server under the control of special software, which is also called a server"

For Cobo 2005, the programs reside next to the web page on the server, but are transferred to the client for execution. Java, JavaScript, VBScript are client-side programming languages."

Development

Based on the Incremental Methodology (Laudon, 2005), the following activities were developed:

1st Phase. General analysis.

The actors involved in this phase are: Academic Coordinator, Student, Coordinator of professional practices, and director.

In this phase, the Day tool was used for the elaboration of UML diagrams. Figure 4 shows the Diagram: Processes for the realization of professional practices, where the actors are identified: Academic Coordinator, Student, Coordinator of professional practices and director. In this diagram you can identify the current processes for Professional Practices.

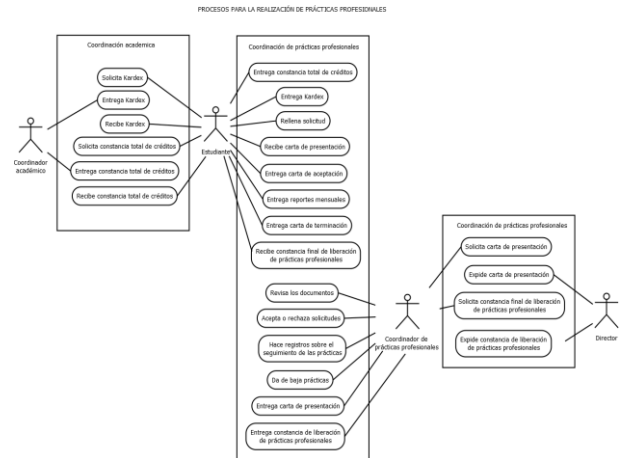


Figure 4 Use case diagrams: Professional practices. Source: Own elaboration.

In this phase, different business use cases were also carried out:

- Business use case: Kardex request and delivery.
- Request and delivery of the total proof of credits.
- Kardex review and constancy.
- Review of internship application.
- Application and delivery of cover letter.
- Application and delivery of letter of acceptance.
- Review of the monthly report.
- Review of termination letter.
- Request and delivery of proof of release.
- Make record of attentions.
- Request and delivery of letters of acceptance.
- Application and delivery of final certificates of internship.

Also made increments, in Table 1, the number of Increments and the activities developed by each one are shown, all depending on the development of the Web System.

Increment	Activity
First	Database development. Capturing student information. Application and delivery of Kardex and total proof of credits. Business contact list.
Second	Filling of student requirements (pre-application) Application for professional internships.
Third	Management and monitoring of professional practices.
Room	Liberation of professional practices.

Table 1 Definition of increments

Source: Own elaboration

2nd Phase. Realization of increments

Each increment takes up the requirements obtained from the first phase, analyze them in a specific way, better identifying the problem, creating Models (M), Views (V) and Controllers (C). The MVCs that are created will be tested independently and then in integration with the rest of the system.

Results

The Web System for the management of professional practices in an IES, allows the control and monitoring of this activity aimed at students who are about to conclude their professional career; for this system the software development methodology called Incremental Model is carried out, where four increments were made during the development of the project.

Each of these increments has the following phases: Communication, Planning, Modeling, Construction and Deployment (Pressman, 2010). With this methodology you can see sections already built, which are improved in each increment.

Below are the results obtained in each increment.

First increment.

Communication: doubts are clarified by asking questions about what was identified in the requirements obtained from the first phase.

Planning: the tools to be used for the development of the system were selected, which include tools that facilitate modeling (analysis and design) and construction (code and testing).

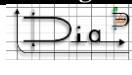

Name	Image	Description
Dia		Free software under the terms of the Dia, the GPLv2, general purpose for the creation of UML diagrams.
MySQL Workbench		Software that provides data modeling, SQL development, and comprehensive management tools for server configuration, user management, backup, and more.

Table 2 Tools for the modeling stage

Source: Tools websites

Tools for the construction stage







Name	Image	Description
PHP		Open source language suitable for web development that is focused on server-side script programming.
Laravel		Framework open source for developing web applications and services with PHP, which uses the MVC pattern.
Composer		Composer is a tool for managing dependencies in PHP.
Node js		It's a runtime environment for JavaScript built with Chrome's JavaScript V8 engine.
XAMPP		It is a development tool that allows you to test your web development based on PHP on your own computer without having to have access to the internet, this software is from an Apache distribution that includes different free software.
Visual Studio Code		It is a source code editor, which includes support for debugging, built-in Git control, syntax highlighting, intelligent code completion, snippets, and code refactoring.

Table 3 Tools for the construction stage

Source: Tools websites

Modeling: Requirements analysis and modeling was developed in this iteration using more detailed use case diagrams than was obtained in the first phase, for the purpose of identifying user activities in the system.

Construction: Laravel 8 was used, allowing the structured and orderly development of software, this framework uses the model-view-controller. Also in this first increase, the authentication and account registration forms for students were programmed.

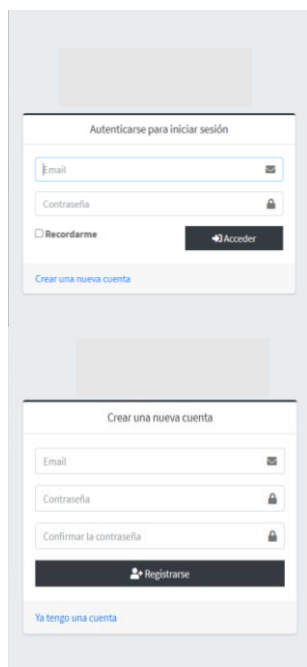


Figure 5 Login and new account creation
Source: Own elaboration



Figure 6 Consultation of personal and school data
Source: Own elaboration

Deployment: In the first deployment, the system was presented to the coordinator of professional practices, using a local server, accessing through the Google Chrome browser and the Microsoft Edge browser.

Second increase

It allows students to enter information about the project they will carry out and the company where they will carry it out. Also the advisor who will accompany them for the duration of the project. During this increase, the communication, planning, modeling, construction and deployment phases are carried out again.

In the Construction phase of this second increase, the complementary Registration /Company Data is carried out.



Figure 7 Supplementary registration/Company data.
Source: Own elaboration

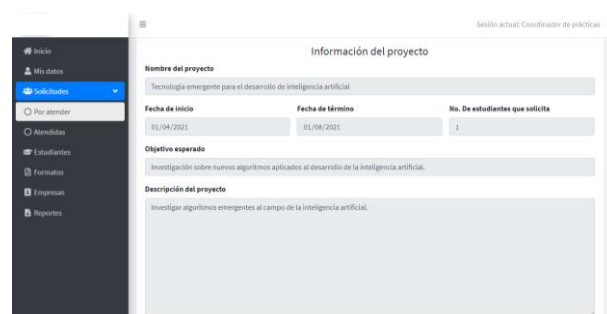


Figure 8 Recording project information.
Source: Own elaboration

Third increase

It is focused on attending the procedures corresponding to the process of delivering monthly reports. The phases of Communication, Planning, Modeling, Construction and Deployment are covered. In the Construction phase you can identify the first monthly report of professional practices, the student must deliver 4 monthly reports during the professional practices.



Figure 9 Consultation of personal and school data
Source: Own elaboration

Fourth increment

Once the four monthly reports have been delivered by the student, he is informed that he can already request from the company the letter of completion of professional practices where it is stated that he has completed 300 hours.

This document must be delivered to the coordinator of professional practices to request the director of the IES the certificates of release, the proof of release of professional practices is an internal document.

During the construction phase, in the student's account, the Certificate of Release of professional practices is observed in the documents section.

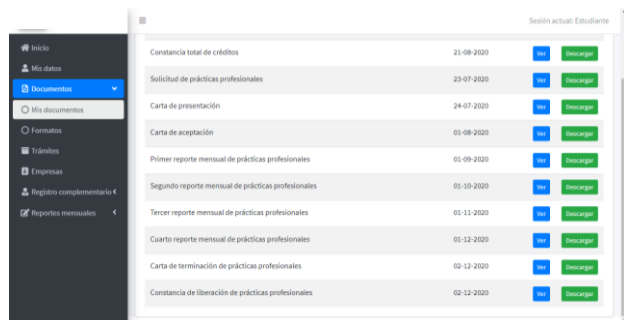


Figure 10 Download the Release Certificate.

Source: Own elaboration

Gratitude

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Conclusions

For the elaboration of the project, it was essential to establish direct communication with those interested in the professional residence project entitled "Web system of control, management and monitoring of the professional practices of the Engineering in Technological Innovation of the ESBIT", where a student of the career of Engineering in Computer Systems of the Tecnológico Nacional de México – Instituto Tecnológico de Oaxaca became interested in working with the project. It is worth mentioning that our students must study the Professional Residence developing a project that meets a problem raised in an organization (Manual de Lineamientos Académico-Administrativos del Tecnológico Nacional de México, 2015).

In the Analysis of a Web System for the management of professional practices of a Higher Education Institution, various tools and web technologies were used for the development of the system, providing a solution to the problem raised.

It is important to perform an analysis of software development methodologies to identify characteristics, advantages and disadvantages, I am helping to choose the methodology according to the project. The incremental methodology was adapted to the needs of the project, in it a functional software product was obtained, each increment was adjusted to the requirements requested by the Coordinator of professional practices, also during the testing phase in each increment processes were improved, errors corrected and validations were added in the MVC that give operation to the system.

It was necessary to make frame increments. It was also valuable to model with use case diagrams and make the respective BPMN diagram where the processes were represented schematically and functionally, contributing to the improvement made in the development stage.

Currently the project is implemented with testing phase with real data.

This project has improvement options, where a mobile application can be developed and implemented where actors enter from anywhere and operate the system from their mobile device.

It is important to continue in the continuous improvement once the software is implemented, remember that the needs are constantly changing, due to the pandemic by SARS-CoV-2 (COVID-19) many traditional systems of carrying the information had to migrate to web systems or mobile applications.

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