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Doc management: Proposal for a doctoral management system

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Abstract: Control is an essential function for good management, for which a bureaucratic organization, that is, a system of rules, regularized procedures, division of responsibilities, and hierarchy, contributes. This paper addresses the issues related to a problem encountered in the management of doctorate students. Traditionally manual, this process is no longer efficient. This brings problems such as difficulty in searching a student's file and its information, difficulty in noticing if a student is undocumented, or in figuring out what tasks must be completed and turned in and what dates to do so. The current system is prone to delays, errors and requires unnecessary effort. The goal of this work was to develop a proposal to solve the problems described, by means of an application, with a simple interface, that can manage, create and edit students, their information, their grades and their deliveries, manage, create and edit curricular units and the related information, manage create and edit academic teachers and their functions. In other words, it is intended that the application is able to facilitate the management of all course processes and document a student's academic path. This will provide workers with a better quality of life, reducing the probability of error and generating gains in quality and efficiency in the management of student processes, thus improving the professional life of those who use the application.

Keywords: Management Application; Student Management; Course Management; School Management; Web Development.

1 Introduction

1.1 Topic Relevance

Management applications allow organizations to have the best possible performance in their activities and organization, this shows the importance of these types of applications and why they are being increasingly used. "The importance of project management tools is apparent for any project manager seeking to ensure project success" [1].

One advantage of having so much data and information which can be compiled and dissected instantly by your software is that potential risks can be calculated with a high degree of precision" [1], this means that with a software we can decrease the risk of human error". "Research suggests that, humans make 3 to 6 errors per hour and on average 50 errors per day in comparison, technical or machine malfunction cause only a small percentage." [2]. Not only machines and software can reduce error but they can help improve the work's efficiency.

Project managers have used software tools to automate the administration of individual projects or small groups of projects for years [3], that prove their efficacy and efficiency. According to a report titled The Sorry State of Digital Transformation in 2018 by Forrester, up to 22 percent businesses don't have process excellence and workflow automation yet. These are critical aspects for customer satisfaction [4]. "Business process automation is the use of technology to execute recurring tasks or processes where manual effort can be replaced. It is done to minimize costs, increase efficiency, and streamline processes" [4].

1.2   Motivation, Background and Goals

Organizations rely on simple and informal procedures but with the expansion, it is necessary to formalize relationships and processes [6]

Nowadays, the management of Doctorate students is manual, meaning that there is no application to help manage and comply with the procedures. The people responsible for the management of these courses and their students, use basic Microsoft Excel files towards this end. When using that old system, several problems are encountered, such as the difficulty in **searching through a student's process** and **their information**, the difficulties in **realizing if a student is lacking documentation** or finding out **which assignments are due to completion** and delivery and what are the **respective expiry dates**. This system brings a lot of **workload** to those who use it and, there is a lot of susceptibility to **human error**. By tackling all these problems and difficulties is intended to lowering unnecessary stress and workload.

According to Pressman, software is seen as the engine which drives decision-making in different business areas. It is even considered the key factor in differentiating modern products and services. We can argue that the use of software is practically inevitable nowadays [5].

To measure if the application can really help it is intended, to validate if there can actually **be less** and **simpler work** and respond to any needs that may appear.

This application's main goal is to **minimize human errors, improve the process** in the student's management, **improve the work** and make sure that those who use the application have their **professional life improved** and **better quality of life**. To do this the system needs to **to integrate all this information efficiently, with less probability of errors and within easy and reliable processes.**

To achieve this goals, information systems and digital tools are the right answer. As Bruegge and Dutoit said, software that adds value needs to meet the user's needs [7].

This application is a Backoffice that aims to manage **courses** and Doctorate **students**, by doing the management work in a simpler and effective way.

2 Concepts

2.1 Tools and technologies

The use of open source applications for content management and academic management has been one of the ways to rationalize resources [16], since with open source software, developers can customize the system to meet the needs, reducing the costs of commercial licenses, especially those of periodic payment [17].

Also in this case, open source software was considered the most suitable, using the following technologies.

MYSQL is a database management systems with great capacity to create powerful databases and some features are **Great speeds in WEB applications**, **Innovation and constant updating**, **Portability** , **Easy to use** [11].

Server2Go Is a web server that **runs without any installation**, has **intuitive configuration menus**, and has a **wide support community** and a **graphical interface.**

HTML (HyperText Markup Language), is a **markup language**, used for the **creation of web pages**.[12].

CSS (style sheet language) is a **style sheet language** with the goal of **defining styles**, **formats and layouts** [13].

JavaScript is a programming language that allows to **create content that is updated dynamically**, **control multimedia**, **animated images**, and **everything else that is interesting** in a Web application and it allows to **store useful content in variables**, **run the code in response to several events** that occur on a web page, **use APIs and mainly allows to help with application security**.

PHP (Hypertexr Preprocessor), is a programming language, whose goal is the **development web applications**, is **open source**, **works on the server side** PHP, **have a short learning curve**, **large community** documentation, **most web hosting servers support PHP**, is **regular updated** and only needs to be **installed on the server**;[14].

2.2 Development Methods

In software development, it is necessary to apply the notion of process. A process have distinct and sequential stages that are divided into tasks and these into activities. Each task must be well defined and there should be a responsible individual for carrying it out. Each task has several goals associated and this should only be considered completed when those goals are reached [8]. The development stages are **Planning, Analysis, Design, Development, Tests, Installation and Maintenance.**

Nowadays agile development methodologies are replacing traditional ones. According to Sommerville [9], any agile methodology follows five basic principles **Incremental development, Customer involvement, The people not the process, Change and Maintain simplicity.** The methodology presented and adopted for the development of the project is called Extreme Programming (XP). This methodology consists on obtaining feedback from the customer by delivering software in a fast, progressive and quality way.[10].

2.3 Software development

For the creation of a WEB application one of the methods is to divide it into 12 steps divided by 4 different stages.

The first stage is the **Ideation Stage** where one **Source an idea** where the goal is to understand what it's intend and why. The idea should stem from solving a problem. **Market Research** where one should research if whether the idea has a market and similar products. And finally **Define the web apps functionality**.

The second stage is the **Design Stage**. The first step is to **Sketch the web app**. Then one must **Plan the workflow** of the app. The third step is **Wireframe the UI**. It's when we turn sketches into a wireframe/prototype. Then it's time to **Seek early validation**. At this stage the goal is to get constructive feedback.

The third Stage is the **Development stage**. The first step is to **Architect the database.** We also need to **Develop the frontend** that is the visual element and **Build the backend** that is manages the data.

The last stage is the **Launch stage** where one **Host the web app** and then **Deploy the web app**. Or as it is usually said "Go to production".

2.4 DSR

Design Science Research (DSR) is a problem-solving methodology. It seeks to enhance human knowledge with the creation of innovative artifacts and the generation of design knowledge. DSR process includes six steps **Problem identification and motivation, Setting the solution goals, Design and development, Demonstration, Evaluation, Communication.** And four possible entry points **Problem-centered initiation, Objective-centered solution, Design and development-centered initiation, Client/context initiation.** By using this methodology in the making of this project, one of the first tasks was to answer to these 6 steps.

The DSR Grid enables researchers to effectively **plan**, **coordinate**, **communicate** their projects and **receive feedback** from different stakeholders The DSR Grid intends to put an entire DSR project on one page, highlighting its essential components. As shown in the Figure 1, the DSR Grid consists in six important dimensions. [15].
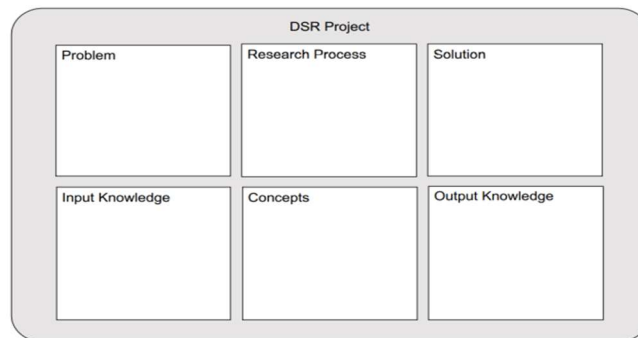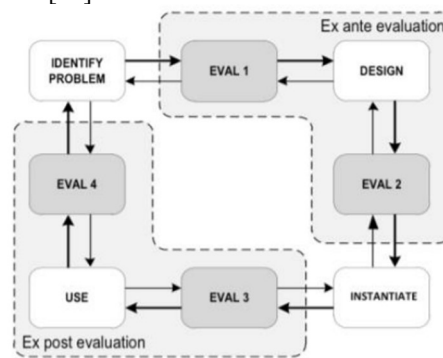

Fig. 1. DSR Grid (source: [15])

The process of conducting DSR has been developed, specifically paying attention to the evaluation activities. Sonnenberg and vom Brocke (2012) conceptualize concurrent evaluation according to different aspects of design as shown in the Figure 2. And Such evaluation can mitigate risk [15].

Fig. 2. DSR Evaluation (source: [15])

The Figure 2 shows a cyclic high-level DSR process that includes the activities of problem identification, design, construction, and use. The Figure 2 suggests that each DSR activity is followed by an evaluation activity, as follows:

- Eval 1: Evaluating the problem identification; criteria include importance, novelty, and feasibility.
- Eval 2: Evaluating the solution design; criteria include simplicity, clarity, and consistency.
- Eval 3: Evaluating the solution instantiation; criteria include ease of use, fidelity with real-world phenomena, and robustness.
- Eval 4: Evaluating the solution in use; criteria include effectiveness, efficiency, and external consistency.

3 Web Application – Doc Management

3.1 Development

According to the methodology for the application, before any development, a meeting was held with the people that will be using the application, the main goal was to understand what the **current process was**. Then it was discussed **ideas** about what an **application should be** what **features were needed** and this was doing by **brainstorming** ideas of layouts, features, etc. After that it was necessary to pass on all the generated ideas to a kind of **prototype**, basically a summary was made of what the application would look and would be.

After these first steps and having a kind of **low-fidelity prototype**, there was another meeting for the **validation** of this prototype before the beginning of the development stage.

In the development stage the first step was **Database architecture** in which it was necessary to start designing the entire data model where the application would be based. After the data model it was necessary to start with **Frontend** to organize the application structure. With the Frontend completed, the entire core of the application began to be made, that is, the **Backend**.

3.2   Application

The application is a Web app with a simple interface and that can manage, create and edit students, their information, their grades and their deliveries, manage, create and edit curricular units and related information, manage, create and edit academic teachers and their duties. In other words, the application manages all the course and the entire academic journey of a student.

The application user's are the **Main User,** these users can manage user accounts and do the management of the course and **Secondary User/Report** these users only have permissions to access a page to make an information request or to contact the administrator users.

The application is divided into three parts. The **Login/Registration part** is a page that in addition to authenticating it also authorizes and offers a way to do a pre-registration that a users with administration roles can accept it or not.

The **Report part** is a page that goal is to get in touch with people with administration roles.

And finally the **Manage part** that have <u>four different groups</u> of pages.

In the **Created "Tickets"** group it is possible to see all open "tickets", and of course it is possible to edit them, when editing we can add comments and change the status.

In the **Application Users** group it is possible perform all of the operations related to the users of the application. This is very important menu as it allows the control who uses the application and what permissions they have.

The **Student Management** Group is where everything happens. It is here that we manage the students and their academic journey. Here we are able to edit all data relating to students and their academic information and with this, we have always an up-to-date database of students and their academic journey. Inside of Student Management group one of the main and most important subgroup is the <u>Global Dashboard</u> This will be the main menu because this is where all the information from the rest of the menus in this group is summarized with the possibility of editing, in addition, is also where the alerts regarding student delivery deadlines are summarized.

The **BACKOFFICE Settings** group is where we do all the configuration of the app so that it can be used. This is where the entire app will be configured like subjects, teachers, important dates etc.

Finally, there is the **Database** and its architecture that were one of the first things to be thought of. It was decided that there should be **four groups of tables**. The <u>individual tables </u>that would support the application's functionalities, the <u>registration</u>, <u>login</u> and <u>ticket creation</u> tables, the <u>student</u>, <u>notes</u> and <u>all the necessary information in the student's journey</u> and finally the tables <u>to manage the course</u> such as Curricular units, teachers, or their responsibilities.

4   Conclusion and Future Work

This work has the main goal of making a proposal for a doctoral management system to simplify and improve the work of those who manage doctorates.

To this, First it was necessary to understand the problem, the **difficulty with the management of Doctorates courses** at the school. After studying the problem and by **being a bureaucratic problem**, it was required to understand the **procedures and rules that had to exist**. After having a solution, it was necessary to think about it and that is how the idea of designing an application appeared. After meetings with interested parties and some study, we realized that it was necessary for the app to be with a simple interface and manages the course and the entire academic journey of a student.

We can now conclude that a well-established, functional and accepted bureaucratic system is important to an organization and will make an organization successful. It is also concluded that applications whose goal is to manage something are increasingly important and brings countless improvements to an organization. This app has great potential and is prepared so one can improve it. For example one of the main features that the application can have is to serve multiple courses and it is easy to adapt for it and without effort it is possible to add new features that may be needed. Briefly, there are some planned changes and so the application was designed with them in mind and is ready to be adapted. But even if new features have not been thought of, the application will always "accept" new features that may be included.

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