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Artículos científicos

Automatización de los procesos de gestión de proyectos de investigación: caso ITSC

Automation of Research Project Management Processes: ITSC Case

Automação de processos de gestão de projetos de pesquisa: caso ITSC

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Resumen

Este trabajo tiene como objetivo desarrollar un sistema de información para administrar y automatizar el seguimiento de proyectos de investigación en el Instituto Tecnológico Superior de Comalcalco (ITSC). Se aplicó una metodología de tipo mixta, que se caracteriza por su enfoque interdisciplinario. Los datos se obtuvieron mediante la realización de una entrevista virtual a cada uno de los involucrados en el proceso de investigación del ITSC. La muestra total fue de 30 investigadores. La aportación de este proyecto es la automatización del proceso de registros y seguimiento de los proyectos de investigación de los profesores investigadores del ITSC. Para el desarrollo del *software* se atendieron las necesidades básicas de gestión de proyectos (generación de reportes por periodos, registro y exportación en formato CSV o PDF e incluso mandar a imprimir, así como el protocolo de los proyectos de investigación en ejecución y el desarrollo de la hoja de vida, gracias a lo cual se podrá medir el desempeño de los investigadores). Se trata de una herramienta importante que contribuye a reducir el tiempo de búsqueda de documentación, el consumo de papeles, facilitar el seguimiento, búsqueda y almacenamiento de los proyectos, así como conocer en tiempo real el estatus de los proyectos de investigación que están desarrollando los profesores.

Palabras clave: automatización, gestión, proyectos de investigación.

Abstract

This work aims to develop an information system to manage and automate the monitoring of research projects at the Instituto Tecnológico Superior de Comalcalco (ITSC). A mixed type methodology was applied, characterized by its interdisciplinary approach. The data was obtained by conducting a virtual interview with each of those involved in the ITSC research process. The total sample was 30 researchers. The contribution of this project is the automation of the registration process and monitoring of the research projects of the ITSC research professors. For the development of the software, the basic needs of project management were met (generation of reports by periods, registration and export in CSV or PDF format and even sending to print, as well as the protocol of the research projects in execution and the development of the resume, thanks to which the performance of the researchers can be measured). It is an important tool that contributes to reducing the time spent searching for documentation, the consumption of papers, facilitating the monitoring, search and storage of projects, as well as knowing in real time the status of the research projects that are being developed by the teachers.

Keywords: automation, management, research projects.



Resumo

Este trabalho tem como objetivo desenvolver um sistema de informação para gerir e automatizar o acompanhamento de projetos de investigação no Instituto Tecnológico Superior de Comalcalco (ITSC). Foi aplicada uma metodologia de tipo misto, caracterizada pela sua abordagem interdisciplinar. Os dados foram obtidos por meio de entrevista virtual com cada um dos envolvidos no processo de pesquisa do ITSC. A amostra total foi de 30 pesquisadores. A contribuição deste projeto é a automação do processo de registro e acompanhamento dos projetos de pesquisa dos docentes pesquisadores do ITSC. Para o desenvolvimento do software foram atendidas as necessidades básicas de gestão de projetos (geração de relatórios por períodos, cadastro e exportação em formato CSV ou PDF e até envio para impressão, bem como o protocolo dos projetos de pesquisa em execução e no desenvolvimento do currículo, graças ao qual o desempenho dos pesquisadores pode ser medido). É uma importante ferramenta que contribui para reduzir o tempo gasto na busca de documentação, o consumo de papéis, facilitando o acompanhamento, a busca e o armazenamento dos projetos, além de conhecer em tempo real o andamento dos projetos de pesquisa que estão sendo desenvolvidos pelo professores.

Palavras-chave: automação, gestão, projetos de pesquisa.

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Introduction

At the Comalcalco Higher Technological Institute (ITSC), academic and administrative processes used to be carried out in an analog way. In 2009, however, the information system called the Academic Monitoring System (SSA) was implemented. This technological tool has the Home, School, Reports, Utilities and Session logoff modules, but it does not contemplate the process of monitoring research projects, since this activity was not considered essential at the time.

As a result of the growth in student enrollment and the creation of new careers at the ITSC, the Research and Graduate Department was created. In charge of promoting research, he has contributed to the development of academic projects. The registration of this type of projects has increased to such a degree that the need has arisen for more tools for monitoring and continuous improvement of the products generated, such as a more efficient registration process, participation in lectures, publication of articles. , get more desirable profiles, participation of students with thesis and links with the business and government sector.

Hence the importance of improving process control for the administration of research projects at the ITSC. Currently, these are recorded in a Microsoft Word document and are stored in folders on the computer equipment of the person in charge of the Research and Postgraduate Department, according to the school period in which each project is registered, with a duration of one year, that is, 12 months.

The result of this study on the development of research projects shows that 60.6% of teachers and students are not developing or are enrolled in a research project; while the remaining percentage, 39.4%, is working at least one. This is related to the gradual increase in teachers and students who are increasingly interested in this activity at the ITSC.

Scientific research, through the development of research projects, has the noble function of promoting and increasing knowledge through critical thinking. Currently, it is one of the most important indicators for all higher education institutions in Mexico, and in particular for the ITSC. The research carried out in these institutions is observed both by different public and private organizations. They are a source of funding, capable of providing academic well-being to organizations.

In effect, research is a substantive activity of academic work at ITSC: increasing the flow of knowledge on a particular topic that seeks to contribute to the development of the environment. Through data analysis, it was found that the majority of researchers and students prefer to carry out research projects in the area of technological development. Unfortunately, this interest is not reciprocal, as the tech community is not heavily involved in educational sciences.

The Research and Postgraduate Department began to detect new problems with the administration of the research projects that are developed there. Without a doubt, it is necessary to carry out systematic work on the processes and products of technological research and thus contribute to the linking of the different economic and social sectors. Not having proper control of these is a red light that must be addressed as soon as possible. Hence the value of automating the registration process and ensuring that the monitoring of research projects involves all parties (teachers, students, administrative areas, productive sectors), as well as facilitating access to information from each of projects by creating reports and statistics.

Materials and methods

According to Hernández and Mendoza (2008), the mixed research methodology is characterized by its interdisciplinary approach and is usually used for applied purposes and the construction of theories.

The data were obtained by applying a virtual interview to each of those involved in the research process at the ITSC. A total sample of 30 researchers was interviewed, who contributed largely to the gathering of the information.

The data dump was carried out by means of an interpretive analysis. The nature of the responses was carefully examined, taking into account the context in which each of the interviewees operates. As a result of this analysis, the need to develop an information system based on web technologies for the automation of research project management processes in the ITSC Research and Graduate Department was detected.

The question that guided this research was the following: how does the development of an automated information system improve the management processes of research projects at the ITSC?

The project will be applied only in the ITSC Research and Graduate Department and will cover the registration processes, the follow-up of research projects and the generation of reports.

Likewise, from the analysis carried out in this research work, some limitations were detected: the lack of financial resources for the implementation of the software, the duration of the project development time and situations of non-controllable variables such as the health status of the patients, participants or events of natural forces.

Currently, at the ITSC the process of registration and monitoring of research projects is carried out through Microsoft Word. And when it is required to know the degree of progress of the research projects, the research professors and students involved have to request it directly from the Research and Postgraduate Department. Something important in this area is to identify the professors with research projects to assign in the academic load, corresponding research hours, as well as the resume, which is to show all the research professor information related to research and their work performance.

The objective, then, is to develop an information system to control the administration of research projects that automates the monitoring of projects, delivery of reports, organizes the personal, labor and professional information of the ITSC research professors through the sheet of life. This system will be an important tool for the institution; It will allow minimizing the time spent searching for documents, reducing paper consumption and freeing up the physical space where the information is currently located.

Data collection

For the data collection, the application of a face-to-face interview and a virtual survey to those involved in the research process at the ITSC was determined. In total, 30 research teachers and the department head in question were interviewed. Likewise, a sample of 93 people, who contributed in the information gathering phase. Next, a report of the results obtained is presented.

Analysis of the information collected by interview

Data analysis was performed according to the constant comparison method, adapted and described by Maykut and Morehouse (1994). The main source of information for data analysis corresponds to the interviews carried out.

Most of the interviewees (95%) believe that, to generate project ideas, they must identify the problem, propose a solution to it, write objectives, scope, limitations, justification and schedule of activities, this from an analysis of the reality of the environment, as well as taking into account the state development agenda. In the same way, it is mentioned to follow the use of formats that contain the necessary points to document a project, as well as the institutional protocol; a few suggest the structure managed by the National Autonomous University of Mexico (UNAM) and the National Polytechnic Institute (IPN) and the research methodology established by Roberto Hernández Sampieri.

Analysis of the information collected through the survey

To collect quantitative data, the tool used was the survey, which was applied virtually, using Google Forms. This was carried out on a sample of 93 individuals. Next, a graphical representation of the data obtained is made.

As shown in table 1, 40.9% of the respondents are developing or involved in a research project, while 59.1% answered that they are not currently carrying out a research project. Despite the fact that one of the functions of higher education institutions is to develop research, it is observed that a high percentage of students and teachers are not carrying out this function.

Tabla 1. Tabulación de datos sobre proyectos de investigación

¿Desarrollas actualmente algún proyecto de investigación en el ITSC?	
Sí	40.9 %
No	59.1 %

Fuente: Elaboración propia

Regarding the question “Types of research projects?”, technological projects accumulate the highest percentage with 34.7%, following basic research with 23.3%, innovation with 16.7%, scientific and technological services with 8.3%, earth sciences and environment with 6.8%, economic-social sciences with 5.5%, natural sciences with 2.7%, education sciences with 1.4% and, finally, biochemical sciences with 0.6%. Thus, the area in which they focus the most is technological development and in which the least, the biochemical sciences.

Tabla 2. Tabulación de datos sobre tipos de proyectos

¿Tipos de proyectos de investigación?	
Desarrollo Tecnológico	34.7 %
Innovación	16.7 %
Ciencias naturales	2.7 %
Ciencias económico-sociales	5.5 %
Ciencias bioquímicas	0.6 %
Ciencias de la tierra y del medio ambiente	6.8 %
Ciencias de la educación	1.4 %
Investigación básica	23.3 %
Servicios científicos y tecnológicos	8.3 %

Fuente: Elaboración propia

Results

What has been achieved in this research generates a direct impact on the ITSC research and postgraduate area. This area is made up of a total of 50 research teachers, who work with a significant number of collaborating students in research projects (30%).

Now, according to 90% of the teachers interviewed, the characteristics of a research project should be the following: viability of the project, that solves a real problem, that it is an innovation project, that the solution is in accordance with the line of research, availability of the ITSC resource, linkage, that is unpublished, the social and technological impact and that is susceptible to financing (economic impact).

The interviewees are from different areas and have various academic backgrounds. The areas of specialization mentioned are: software engineering, process engineering, technological innovation, biotechnology, food and technology, industrial and electronics. Likewise, 95% of the professors interviewed agreed that a student can be considered to be a collaborator in a

research project from the 7th semester of her career. Exceptionally, if they have the necessary knowledge, students from 4th semester onwards may also be considered.

Many of the projects developed in the field of research are multidisciplinary in nature, so that in a single project there may be professors and students from different academies. Regarding the latter, although the ideal is that they have programming logic, knowledge of the web and database environment, in general the priority knowledge they should have are the following: be a good writer, technological knowledge, basic English, the use of current information technologies, make use of research methodologies and have taken basic science subjects (electronics or mechatronics, as the case may be).

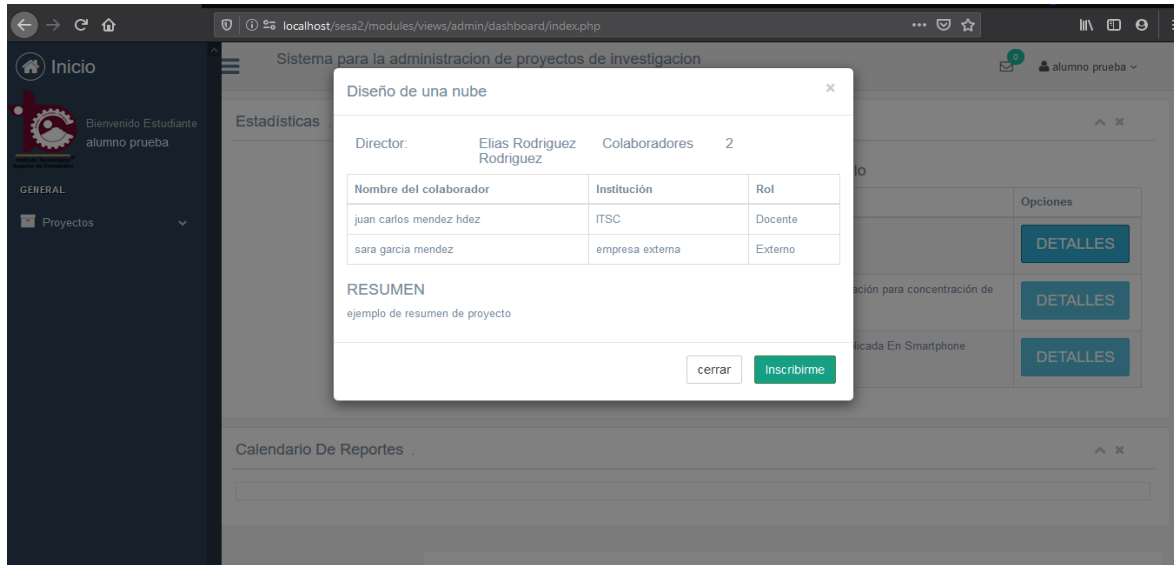
Finally, 80% of the interviewees determined that it is essential to understand the basic English language as the minimum required for the development of most of the projects, since the most innovative theoretical material is in this language.

The main result of this project was the development of a web system for the optimization of the processes of the research and postgraduate area of the ITSC. This system was developed using web technology such as PHP 5, HTML5, CSS3, JS, Bootstrap and MySQL, which met the technical requirements necessary for the development of the project, based on the processes proposed by the agile Scrum methodology.

The application of the structured HTML5 language, in combination with the Bootstrap 3.0 framework, allowed the generation of ergonomic interfaces and integration to the existing information systems in the ITSC, following the needs detected in the collection and analysis of the data, which were important stages for the web system design.

As a result of the analysis of the processes, the creation of profiles for the management of the platform was determined, namely: Student, Research Teacher and Administrator. Students, prior to enlisting in a project, will be able to consult online the names of the available projects, the directors of these, the collaborators and the role of the professors, either director or collaborator, as well as a summary where it is described what the investigation consists of (figure 1).

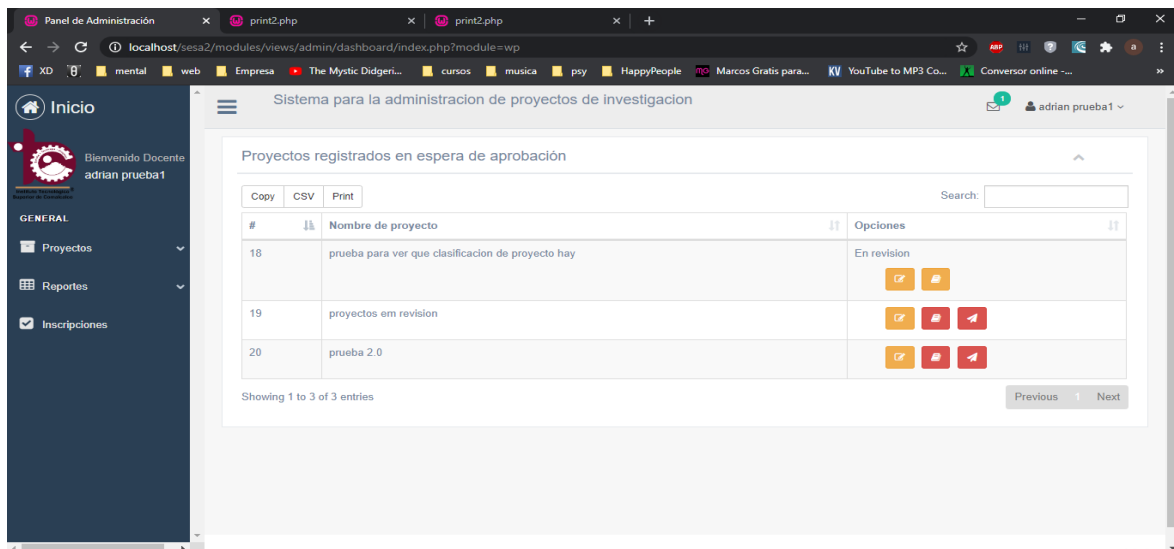
Figura 1. Interfaz de proyectos (perfil Alumno)



Fuente: Elaboración propia

The research professors, after registering their research projects, will be able to check their status. In the "Under review" section, you will be able to see a kind of traffic light: red indicates not approved, yellow indicates pending and green indicates approved by the ITSC Research and Graduate Department, as shown in figure 2.

Figura 2. Interfaz de registro, “Proyectos en espera de aprobación” (perfil Docente)

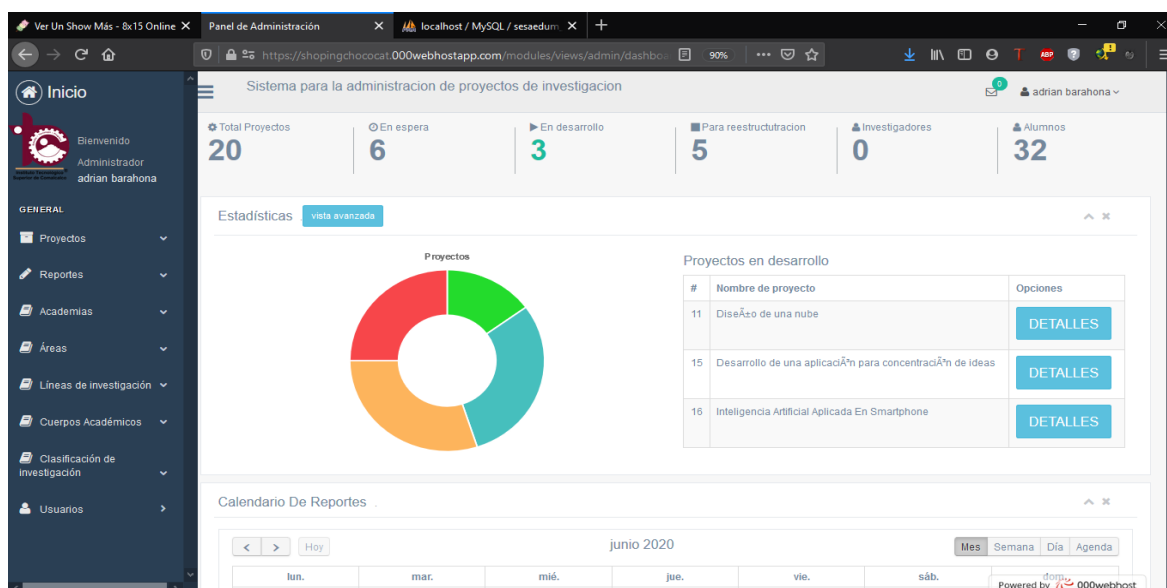


Fuente: Elaboración propia

For the administrator, the interfaces were elaborated from the requirements that were obtained as a result of the application of the research methodology. The administrator, the person in charge of the ITSC Research and Graduate Department, will have access to research projects: those awaiting approval, those in development, projects undergoing restructuring, as well as the researchers and students involved. in projects. By clicking on the Detail button, the

administrator will be able to consult all the research projects in development and their degree of progress. This is one of the advantages of the automation process: having the status of all research projects visible and at the click of a button (figure 3).

Figura 3. Interfaz principal (vista Administrador)



Fuente: Elaboración propia

If the administrator clicks on the Details icon, within the "Projects in development" section, he will be able to consult all the research projects in development, the collaborators, students, external parties involved and the total number of personnel that are part of the projects (figure 4). In addition, it has the advantage of exporting said information in CSV or PDF format and even sending the information to print.

Figura 4. Módulo “Proyectos en desarrollo” (vista Administrador)



Fuente: Elaboración propia

Another option is the view “Registered projects awaiting approval” (figure 5). This screen displays the concentrate of the research projects. On the right side, in the Options column, there are three icons: the green one indicates that the project has been approved, the orange icon indicates that there are observations and the red icon indicates the research projects that were rejected or that do not meet the guidelines to be considered as such. Thus, the person in charge of the Research and Postgraduate Department has real-time information on all projects.

Figura 5. Concentrado de proyectos (vista Administrador)

#	Nombre de proyecto	Opciones
3	Extracción de muestras en campos de cultivos	[Green] [Orange] [Red]
4	Estudio de los procesos fotosíntesis	[Orange] [Red]
5	Elaboración de protocolos de investigación	[Orange] [Red]
6	Diseño de una plataforma educativa	[Orange] [Red]
7	Ejemplo de registro de proyecto	[Orange] [Red]
12	prueba	[Green] [Orange] [Red]
13	SISTEMA BASADO EN REGLAS PARA APOYO EN LA GESTIÓN DE PROYECTOS DE TITULACIÓN	[Green] [Orange] [Red]
14	Inteligencia artificial móvil	[Green] [Orange] [Red]
17	La Inteligencia Artificial En Los Smartphones	[Green] [Orange] [Red]
18	prueba para ver que clasificación de proyecto hay	[Orange] [Red]

Fuente: Elaboración propia

Of course, the software allows the research professor to register the projects: name, person in charge, academy, line of research, academic body, project classification, start and end date (figure 6). Once this is done, he will go to the "Project Description" window, where he will assign roles and activities. Once all this information is registered, it will be awaiting approval by the ITSC Research and Graduate Department.

Figura 6. Registro proyecto (vista Docente)

Fuente: Elaboración propia

With this web system, the optimization of times in attention and monitoring of research projects was improved. Similarly, communication was improved between the areas involved in the same process: linking, research and postgraduate studies, the academic sub-directorate and the area of research professors. The processes are faster because the execution of these is in real time.

In the area of "Selection of students", a subsystem was obtained that provides enough information to automatically determine which is the optimal prospect to work on research projects. In this way, it is possible to read control statistics and progress of projects developed, pending or canceled.

Discussion

The need to have information systems that allow the registration, control and monitoring of projects has caused educational institutions to develop their own initiatives that allow to improve and facilitate this process, however, there are also online information systems of companies and organizations private companies that meet those needs.

For example, Scoro business management software helps manage business projects. It has the project management, work management, sales, finance, reports and dashboards modules; presents project planning, scheduling and monitoring; offers the ability to manage all projects in customizable views and view progress using the project timeline. It also prioritizes assignments, avoids overlaps, and helps set realistic deadlines. Lastly, it includes calendars, to-do lists, timesheets, and a built-in time tracker. Its great disadvantage lies in the cost, since

many educational organizations do not have a budget for these types of needs, so, as already mentioned, they choose to develop their own information systems.

Trello, Write and Basecamp online systems allow teams to work more collaboratively and be more productive. It includes cards, lists, and boards that help teams organize and prioritize their projects in a fun, flexible, and profitable way. However, these softwares do not consider the option to save the information indefinitely as free, so if you want this service, you will have to pay.

The software resulting from this research was developed in accordance with the needs of the ITSC Research and Graduate Department. The modules of main interest are those that help to manage projects, the resume and periodic reports. In addition, three profiles were developed for each type of user (students, professors / researchers and administrators). Each version has specific modules for the user to carry out activities according to the role they will have in the projects to be developed.

Conclusions

As a result of the research work, a research project management information system was developed for the ITSC, exclusively for the Research and Postgraduate Department. The resources and programming languages PHP 5, HTML5, CSS3, JS, Bootstrap and the MySQL database were used, which meet the technical requirements established by the agile Scrum methodology.

The contribution of this project is the automation of the registration process and monitoring of the research projects of the ITSC research professors. Of course, the project management needs were met (generation of reports by periods, registration and export in CSV or PDF format and even sending to print, without forgetting the protocol of the research projects in execution and the development of the worksheet). life, which is to have all the records of the projects that the researcher has developed, thanks to which they will be able to measure their performance). It will undoubtedly be an important tool by reducing the time to search for documentation, the consumption of paper, facilitating the monitoring, search and storage of projects, as well as knowing in real time the status of the research projects that the research professors are developing. .

Internet access is required for its operation. It is worth mentioning that, within the information system, the allocation of research hours of research professors per registered project is not automatically determined. Due to policies for the development of institutional information systems, the system will be stored on local servers, so the security of information from research projects should be considered as an important element. One of the advantages is



that it contributes to another institutional policy, namely: digitizing all the educational services offered by the ITSC through web platforms.

Future lines of research

As future lines of research is to integrate this information system with the SSA to be able to consult and store information on teachers and students; in order to assign the academic discharge and determine student profiles as future project prospects based on grades and curricular progress.

Another area of research would focus on creating a new module to manage programs and budgets for your projects, development life cycles, assigning deadlines, costs, human resources, materials, determining their priority, progress with increasingly defined roles, focused on create an effective communication strategy to make the most of each team and delegate tasks optimally.

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