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Article

Innovation in student care: development of a comprehensive system for project management

Innovación en la atención estudiantil: desarrollo de un sistema integral para la gestión de proyectos

Navarrete-Prieto, José Antonio*[a], Díaz-Rincón, Hilda[b], Hernández-Castillo, Eric[c] and Carrizales-Longoria, José David[d]

[a] Tecnológico Nacional de México - Instituto Tecnológico de Tlalnepantla • LQK-8123-2024 • 0009-0005-4157-1584
[b] Tecnológico Nacional de México - Instituto Tecnológico de Tlalnepantla • LQK-7830-2024 • 0009-0002-5043-8812
[c] Tecnológico Nacional de México - Instituto Tecnológico de Tlalnepantla • LQL-1978-2024• 0009-0009-42161-7169
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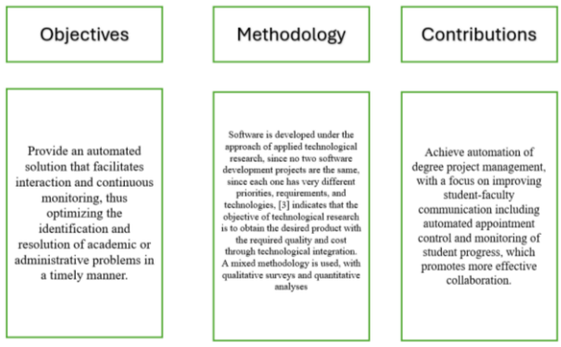
* [jose.np@tlalnepantla.tecnm.mx]

Abstract

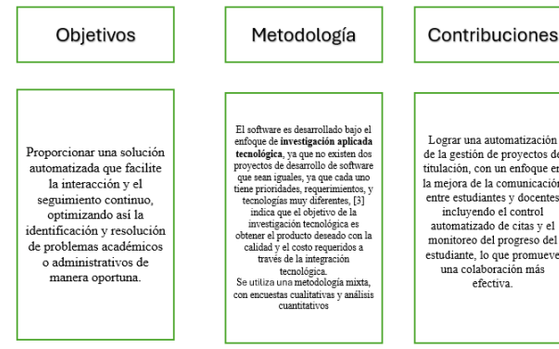
In today's learning environment, implementation and innovation in information systems is essential for the efficient functioning of educational organisations. This applied research focuses on the automation of degree project management, with a focus on improving communication between students and teachers. SAGEP seeks to provide an automated solution that facilitates interaction and continuous monitoring, thus optimising the identification and resolution of academic or administrative problems in a timely manner. The key innovation lies in automated appointment control and student progress monitoring, which promotes more effective collaboration. Using a mixed methodology, with qualitative surveys and quantitative analysis, improvements in operational efficiency and educational quality will be evaluated, fostering an academic environment aligned to new technologies and promoting continuous process improvement.



Innovation, Quality, Project Management, Degree

Resumen

En el entorno de aprendizaje actual, la implementación e innovación en sistemas informáticos es esencial para el funcionamiento eficiente de las organizaciones educativas. Esta investigación aplicada se enfoca en la automatización de la gestión de proyectos de titulación, con un enfoque en la mejora de la comunicación entre estudiantes y docentes. SAGEP busca proporcionar una solución automatizada que facilite la interacción y el seguimiento continuo, optimizando así la identificación y resolución de problemas académicos o administrativos de manera oportuna. La innovación clave radica en el control automatizado de citas y el monitoreo del progreso del estudiante, lo que promueve una colaboración más efectiva. Utilizando una metodología mixta, con encuestas cualitativas y análisis cuantitativos, se evaluarán las mejoras en la eficiencia operativa y en la calidad educativa, impulsando un entorno académico alineado a las nuevas tecnologías y fomentando una mejora continua en los procesos.



Innovación, Calidad, Gestión de Proyectos, Titulación

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Introduction

In today's educational environment, characterised by an increasing reliance on technology and information, process automation has become a critical factor for the efficiency and effectiveness of academic institutions. Degree project management, which involves coordination between students and faculty, is one area that can benefit significantly from technological innovation. Traditional management systems often face challenges related to lack of adequate follow-up, communication problems and delays in resolving academic or administrative issues.

SAGEP (Automated Degree Project Management System) presents itself as a comprehensive solution to address these challenges, providing a platform that facilitates the organisation, appointment control and tracking of student progress. This applied research focuses on the implementation of SAGEP to optimise open and effective communication between stakeholders, ensuring a more coherent educational experience aligned with the demands of the contemporary academic and professional environment. The introduction of automated technologies not only improves the quality of education, but also drives a culture of continuous improvement and adaptability in higher education institutions.

State of the Art

The automation of project management through web-based systems has become an essential strategy to improve efficiency and effectiveness in educational environments. These systems allow for optimised resource allocation, improved communication and more accurate tracking of student progress. In modern academic environments, the ability to manage projects in real time and access information remotely is critical for flexibility and educational continuity (Lagstedt et al., 2020; Armenia et al., 2019).

Automated web-based systems offer multiple benefits for degree project management. They facilitate the planning, scheduling of assignments, monitoring and evaluation of projects, which is critical for maintaining quality and efficiency in academic processes.

Operating through web-based platforms, these systems allow continuous access from any location with an internet connection, thus enhancing collaboration between students and faculty (Hansson, 2014). Automation reduces human error and provides transparency, resulting in more reliable and accurate management of degree projects (Fitzgerald et al., 2014).

In higher education institutions, the implementation of automated web-based systems has shown significant improvements in operational efficiency and quality of education. Systems that include features such as automatic appointment scheduling and continuous tracking of student progress have optimised coordination between students and faculty, fostering effective and timely communication (Armenia et al., 2019). In addition, the ability to collect and analyse data in real time facilitates more informed decision-making and better management of educational resources (Lagstedt et al., 2020).

Similarly, Stockholm University in Sweden uses SciPro, an automated system to support thesis writing, which facilitates communication between students and supervisors, manages progress monitoring and automates the scheduling of meetings and reviews (Hansson, 2014). At the MIT Sloan School of Management in the US, digital tools have been adopted for educational management, enhancing informed decision-making and real-time task management (Fitzgerald et al., 2014). Similarly, the University of Surrey in the UK and the Technical University of Munich (TUM) in Germany have implemented automated tools for academic and research project management, improving collaboration and operational efficiency in their educational programmes (Lagstedt et al., 2020; Armenia et al., 2019).

Despite the benefits, the adoption of automated web systems in education presents challenges. Some critics argue that an over-reliance on automation can lead to a reduction in social interaction, which is fundamental in traditional education (Horning, 2021). In addition, data security and privacy are critical concerns, as these systems collect and process large volumes of personal information (Andrejevic, 2020).

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Implementing automated systems not only improves operational efficiency, but also allows teachers to focus on more valuable pedagogical activities. Automation frees up time by handling routine administrative tasks, allowing teachers to devote more effort to tutoring and direct academic support (Fitzgerald et al., 2014). This ability to integrate technologies into accessible platforms fosters effective collaboration between students and faculty, which is essential for successful degree projects.

Automating project management through web-based systems has become an essential strategy for improving efficiency and effectiveness in educational environments. These systems allow for optimised resource allocation, improved communication and more accurate tracking of student progress. In modern academic environments, the ability to manage projects in real time and access information remotely is critical for flexibility and educational continuity (Lagstedt et al., 2020; Armenia et al., 2019).

Automated web-based systems offer multiple benefits for degree project management. They facilitate the planning, scheduling of assignments, monitoring and evaluation of projects, which is critical for maintaining quality and efficiency in academic processes. Operating through web-based platforms, these systems allow continuous access from any location with an internet connection, thus enhancing collaboration between students and faculty (Hansson, 2014). Automation reduces human error and provides transparency, resulting in more reliable and accurate management of degree projects (Fitzgerald et al., 2014).

In several higher education institutions, the implementation of automated web-based systems has shown significant improvements in operational efficiency and quality of education. For example, the Universidad Técnica del Norte (UTN) in Ecuador has implemented an automated system for the management of research groups and networks, facilitating more effective control of project progress and coordination between different actors (Repositorio Digital Universidad Técnica del Norte, 2024).

Similarly, Stockholm University in Sweden uses SciPro, an automated system to support thesis writing, which facilitates communication between students and supervisors, manages progress monitoring and automates the scheduling of meetings and reviews (Hansson, 2014). At the MIT Sloan School of Management in the US, digital tools have been adopted for educational management, enhancing informed decision-making and real-time task management (Fitzgerald et al., 2014). Similarly, the University of Surrey in the UK and the Technical University of Munich (TUM) in Germany have implemented automated tools for academic and research project management, improving collaboration and operational efficiency in their educational programmes (Lagstedt et al., 2020; Armenia et al., 2019).

Despite the benefits, the adoption of automated web systems in education presents challenges. Some critics argue that an over-reliance on automation can lead to a reduction in social interaction, which is fundamental in traditional education (Horning, 2021). In addition, data security and privacy are critical concerns, as these systems collect and process large volumes of personal information (Andrejevic, 2020).

Implementing automated systems not only improves operational efficiency, but also allows educators to focus on more valuable pedagogical activities. Automation frees up time by handling routine administrative tasks, allowing teachers to devote more effort to tutoring and direct academic support (Fitzgerald et al., 2014). This ability to integrate technologies into accessible platforms fosters effective collaboration between students and faculty, which is essential for successful degree projects.

The automation of degree project management through web-based systems offers significant opportunities to improve the efficiency and quality of education. However, it is critical to implement these technologies in a balanced way, ensuring that the human elements of teaching are maintained and privacy and security concerns are addressed.

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Methodology

The methodology used in this research combined qualitative and quantitative approaches, following an applied and mixed research design. This methodology allowed for the evaluation of the implementation of an automated degree project management system, providing a comprehensive understanding of its impact on the efficiency and quality of education.

The applied approach focused on solving specific problems related to degree project management through the development of an automated system. According to Creswell (2014), applied research aims to use the results to solve practical problems and improve professional practice. This type of approach is ideal for studies that seek to apply findings directly in real-world contexts, such as in educational institutions, where efficient project management is crucial for academic success.

The research combined qualitative and quantitative methods to provide a comprehensive evaluation of the automated system. According to Tashakkori and Teddlie (2003), mixed methodology allows for a better understanding of research problems by using multiple forms of data collection. This approach was key to assessing both qualitative perceptions and quantitative outcomes associated with the implementation of the system.

Semi-structured interviews and focus groups were conducted with teachers, academic leaders and students, following Merriam's (2009) recommendations on the importance of using qualitative methods to understand participants' experiences and perceptions. In this study, a total of 45 students from the Information and Communication Technologies (ICT) Engineering course taking the Research Workshop II subject, 3 lecturers who teach the subject and the Head of Linking Projects who are the main actors influencing the administration and process of the Integrated Degree were interviewed. The focus groups provided a space for in-depth discussion of experiences with current systems and expectations of the automated system.

Fowler (2009) highlights the importance of surveys in gathering statistical data, which allow for measuring the impact of the system and making objective comparisons before and after its implementation. The applied and mixed research methodology provides a solid framework for evaluating the effectiveness of an automated degree project management system. By combining qualitative and quantitative methods, this methodology provides a comprehensive understanding of how these technologies can improve project management in the educational environment by optimising communication and task tracking.

Problem statement

During the course of the integration process, significant difficulties were detected that persistently affect those involved, starting with the fact that there is no mention of defined deadlines in some processes and even some exist but are not met, as in the case of students sending their pre-project to those in charge of project management, a situation that causes delays when assigning an advisor to projects, which in turn generates rushed advising and therefore causes delays in the development of projects, In some cases, the advisor is not known physically and therefore there is no way of contacting him or her. If the aforementioned problems continue, they may generate more problems caused by the current problems, leading to confusion, delays in processes, urgent workloads, inconsistencies, unassertive decisions and unnecessary postponements.

The formats that are developed by the department or the advisor during this process are elaborated manually, generating implicit delays because they are developed by the staff, without omitting that at a certain point their elaboration may contain errors that cause them to be redone. In general terms, specific metrics, necessary for decision making and essential for future project planning, are not performed for this process.

Therefore, the creation of a web application that integrates various modules where, in a complete way, the information of the projects will allow their assigned advisor to generate their respective appointments for advice, so that the establishment of a more effective and dynamic form of communication.

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For the development of the system, the Unified Process Development (UPD) was used. UPD is an iterative, model-driven software development methodology that focuses on defining the processes and phases required to build a robust system. This methodology is ideal for web projects and is widely used in both academic and industrial development environments.

The Unified Development Process is an iterative methodology that follows four main phases for software development:

Initiation: This phase focuses on defining the scope and vision of the project. Essential requirements are established and a basic model of the system is built. The main objective is to understand what is to be built and why. In this phase, the key stakeholders and use cases that the system will support are also identified (Jacobson, Booch, & Rumbaugh, 1999).

Elaboration: During the elaboration phase, the requirements are detailed and the basic architecture of the system is developed. Here the key aspects of the software are modelled and the core components are designed. The focus is on developing a prototype that reflects the system architecture, which allows design decisions to be validated and provides a solid foundation for full development (Jacobson et al., 1999).

Construction: In this phase, the complete system is developed based on the models and architecture established in the elaboration phase. The software code is written and the different functionalities and components of the system are integrated. The construction is carried out in iterative cycles, which allows for testing and adjusting the functionalities as they are developed, ensuring that the system meets the established requirements (Kruchten, 2000).

Transition: The transition phase focuses on delivering the system to the end user and ensuring that the software is ready for use in a production environment. During this phase, final testing activities, minor adjustments and bug fixes are carried out. In addition, end-user training is provided and the necessary documentation for system maintenance is prepared (Kruchten, 2000).

As defined in the previous paragraphs, UPD was applied for its development, where the objectives were defined in the start-up stage, such as improving the efficiency of project management and facilitating communication between students and teachers. Initial meetings were held with stakeholders (teachers and administrators) to identify the main use cases and the basic requirements of the system. In addition, for a correct understanding of the requirements of the application to be developed from its inception to its conclusion, it is necessary to know everything that corresponds to the processes and their characteristics, such as the personnel responsible, the time allocated to develop each activity, the documentation involved, among other details, designed with specific questions to the role to be interviewed, with the aim of obtaining all the necessary and sufficient information, in addition, in all interview formats a strategic question is placed in the final part, with the aim that the interviewee comments on events, experiences and opinions on activities that have deficiencies and the application can be improved, the question is:

What processes could be improved for a better implementation?

What processes could be improved for a better performance of your activities?

Subsequently, the diagrams that allow to know the complete process that involves the integrating process are made using the technique of problem trees, which allows to identify deficiencies and problems within the process, which can be mitigated through the application to be developed. In addition, three main roles were identified: Administrator, Advisor and Learner. Each of these roles performs specific activities, is associated with different users and has different functionalities implemented within the system. Figure 1 provides a more detailed overview of these roles and their distinctions.

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Box 1

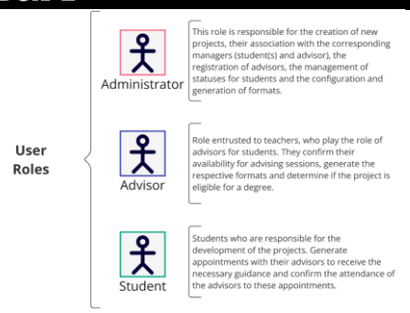

Figure 1
Roles within the system
Source: Own elaboration

A rigorous check on the registration of advisors was put in place to prevent the improper registration of any person as an advisor. In addition, a gender field was integrated to allow the appropriate formulation of the forms according to the gender of the user, including the option to upload the electronic signature in order to optimise the completion of forms as shown in Figure 2.

Box 2

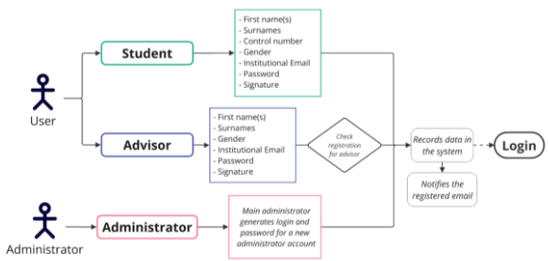

Figure 2
Use cases of system users
Source: Own elaboration

Elaboration

After the initial phase, the development of the system begins, which considers above all its usability, where it first verifies the state of the network, with the aim of ensuring that the activities carried out by the user are not interrupted. In order to quantify and evaluate general aspects of the project, based on the results obtained and to have a greater approximation to certainty in decision-making, indicators were included as shown below. Projects by Area According to the total number of active projects, how many belong to each collegiate group, in order to know the trends and technologies of the development of the projects. See Figure 2.

Box 3

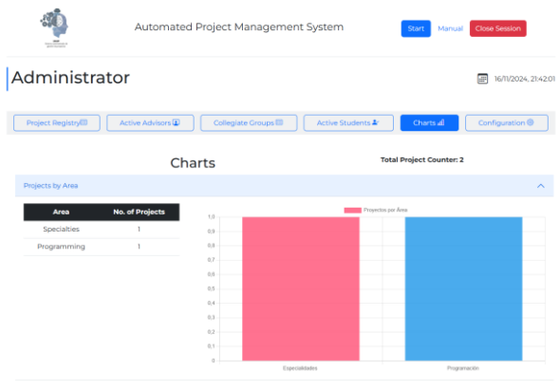

Figure 3
Graphic of projects by area
Source: Own elaboration

Projects by consultant

This shows the total number of active projects, indicating the number of projects that belong to each teacher who is presented as an advisor, in order to measure the workload for each advisor. See figure 4.

Box 4

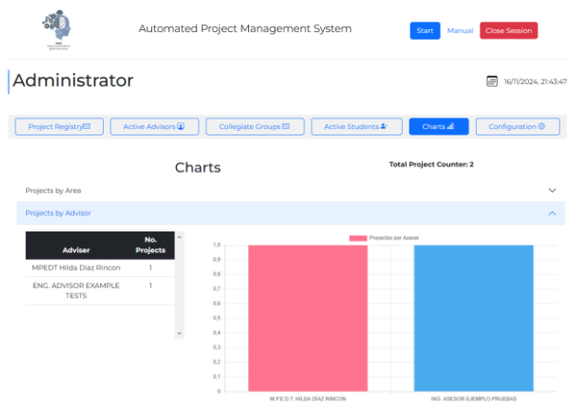

Figure 4
Graph of Projects by Advisor
Source: Own elaboration

Degree projects

According to the total number of active projects, how many of them have been concluded and are suitable for graduation including which ones will not be considered for graduation. See figure 5.

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Box 5

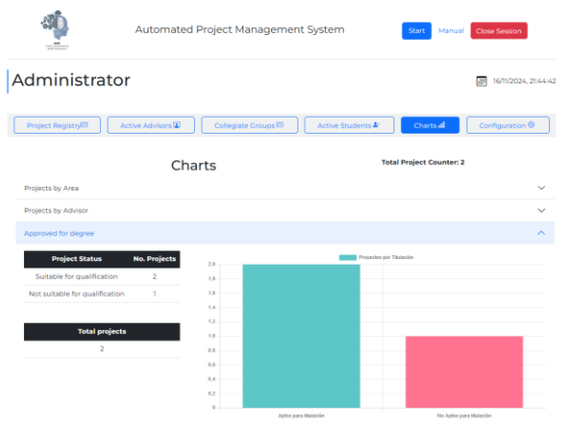

Figure 5
Titling Projects Graphic
Source: Own elaboration

Figure 5
Source: Own elaboration

As part of the description and architecture of the system, the innovative part of the appointment control was integrated as shown in the diagram in figure 6.

Box 6

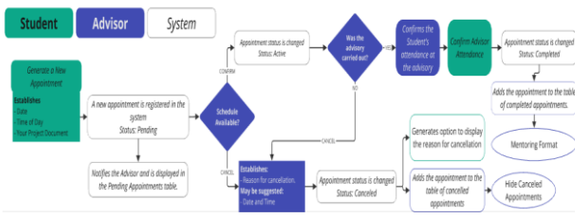

Figure 6
Diagram of citations
Source: Own elaboration

The figure highlights the importance of the learner in generating and finalising the appointment, as it is the end user who determines whether the appointment can be considered as completed. On the other hand, the advisor assumes the responsibility of managing intermediate status changes and being the one who initiates the process of finalising the appointments, which, as mentioned above, the student ends up completing. In the analysis of the system, several tools were identified that contributed to its construction, including languages, software, frameworks, among others. The following table (Table 1) summarises the technologies used throughout the development process.

Box 7

Table 1
Technologies used

NAME	VERSION	TYPE
PHP	8.1.5	Language
JavaScript	-	Language
Bootstrap	5.2	Framework
Xampp	8.1.5	Software
Visual Studio Code	1.84.2	Software
Figma	Web	Design tool
Trello	Web	Work management tool

Source: Own elaboration

Construction

In this phase, system development was completed using the tools listed in Table 1. The construction was done in an iterative manner, allowing for continuous testing and adjustments as new functionality was added, ensuring that the system met the requirements and provided an effective user experience. Within this phase, the system was first implemented locally to perform the necessary tests for validation and functionality for subsequent implementation on a production server.

Transition: Finally, the system was deployed on a production server and made available to end users. During this phase, final acceptance tests were carried out, minor bugs were corrected and users were trained in the use of the system. User documentation was prepared, identifying the role of the administrator, assessor, student and technical manual for the installation of the system, and maintenance procedures were established to ensure the continued operation of the system. In addition, a QR code was included for system monitoring, including a form for students, to be applied after an informative talk on degree alternatives.

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Box 8

Figure 7
QR code for access to student form
Source: Own elaboration

Results

As part of the modules that make up the system, they are shown in the following figures.

Box 9

Figure 8
Initial user registration screen
Source: Own elaboration

The first interface is the start interface which, in addition to the user registration, requests the digital signature that must be included to validate the different formats found within the IMS based on ISO9001:2015 and I know that they are certified by it. See figure 8.

At the end of your registration and depending on the type of user, you will be shown the different modules you can access. Some of the interfaces of the system are shown below.

Box 10

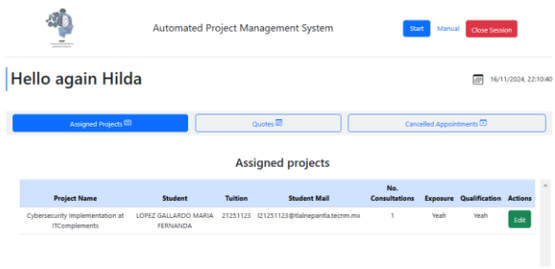

Figure 9
Advisor module overview
Source: Own elaboratiom

This figure 9 shows the projects assigned to the advisor, which allows him/her to visualise his/her assigned projects, indicating the number of advisories carried out, if the student has already made his/her presentation and the status if the student was considered for a degree, in addition the advisor can monitor and manage his/her appointments, where this process is shown in the following figures.

Box 11

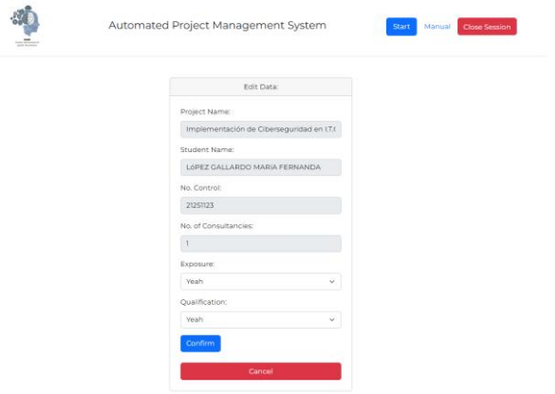

Figure 10
Project registration
Source: Own elaboration

The system allows the data of the projects generated by the students to be entered for their follow-up and, if necessary, their integral degree option. See figure 8. Continuing with figure 11 where you can see the innovation module that allows the management and control of appointments where the advisor and student will have direct communication to improve the efficiency of this. See figure 11.

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Box 12

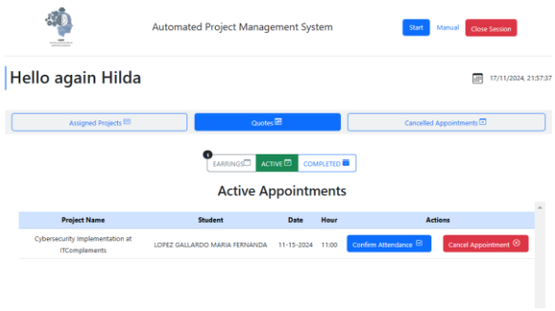

Figure 11

Viewing Active Appointments for the advisor

Source: Own elaboration

In addition, this appointment management, allows to visualise the pending, active and completed appointments for each project assigned to the student as shown in Figure 12, this appointment module also allows the advisor to cancel appointments where he/she will have to indicate the reason for the cancellation as shown in Figure 13 where a section is included.

Box 13

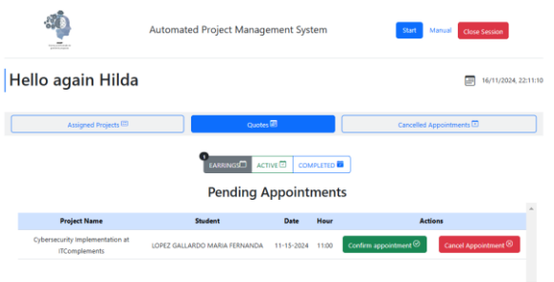

Figure 12

Appointment control by project

Source: Own elaboration

Figure 13 shows how the system indicates the appointments that have been made for each project, so that at the end of the consultancy for each period or whenever desired, the format indicated by the institutional QMS system is generated for the follow-up of the consultancies, thereby optimising delivery times and the student or the advisor not registering it in time and form.

Box 14

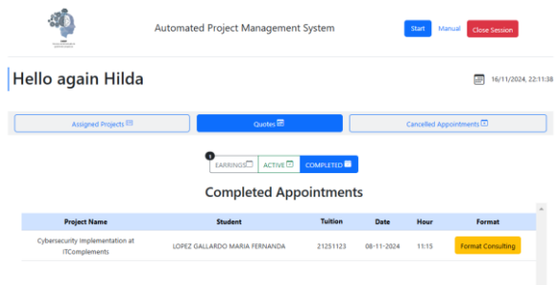

Figure 13

Appointment tracking

Source: Own elaboration

In the following figure 14, you can visualise the format that is generated automatically, which allows to reduce errors and to comply with the indicated in the procedure of the process in accordance with the established in the SGI according to the mentioned norm, as well as the offices and documents that are integrated to the process in an informal way such as the office of assignment of the advisor and the project registration form.

Box 15

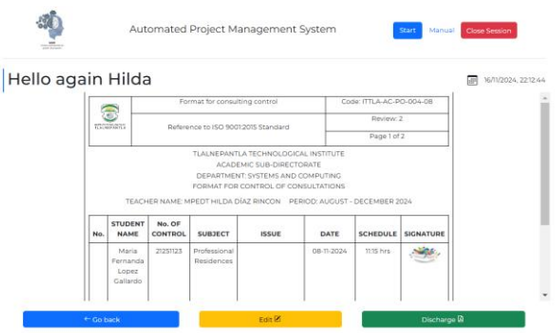

Figure 14

Generation of the Advisory Format in accordance with the QMS

Source: Own elaboration

Students can view their project, the name of their advisor, email and establish communication when scheduling an appointment, as well as see their appointment calendar and its status. See figure 14.

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Box 16

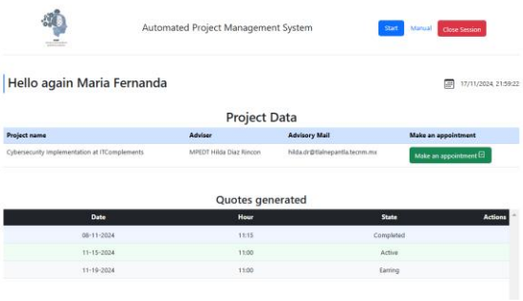

Figure 15
Visualisation of the project as a student user
Source: Own elaboration

For the administrator, this displays the information of the advisors, collegiate groups, students, graphs of indicators and, if necessary, makes changes in the configuration of the different roles that are required. See figure 15.

Box 17

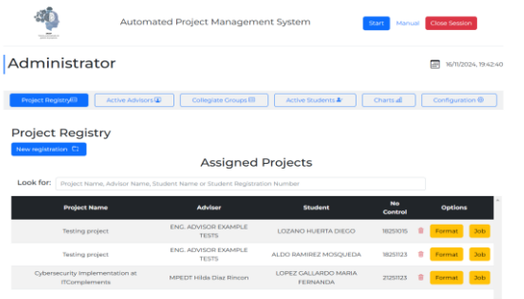

Figure 16
User Administrator displays assigned projects
Source: Own elaboration

Finally, the formats generated automatically by the system are shown, which allow them to reduce errors and comply with the process procedure as established in the IMS in accordance with the aforementioned standard, as well as the offices and documents that are informally integrated into the process, such as the advisor assignment office and the project registration form, see Figure 16.

Box 18

Figure 17
Formats generated by the system
Source: Own elaboration

Conclusions

As an automated solution, the system allowed for a reduction in student service times, in addition to allowing direct communication with the student and their assigned advisor, the system allows for the management of projects from the beginning to the end of the project, including whether the student presents their project, which is a requirement for the integral qualification of the integration process, the system allows for monitoring whether the advisor and the student are in communication, obtaining a report of the appointments made and with the indicators generated by the system, the corresponding area has elements to disseminate and establish the monitoring of the degrees generated by this option, so that the student also verifies that he/she is being continuously advised by the advisor.

As part of the continuous improvement, the system complies with the accrediting body's request to establish mechanisms to improve communication with the student, which is why some of the benefits obtained from the development of the system are listed below.

Technological tools were included for continuous improvement in the corresponding area.

A system was developed that was totally designed to the measures and needs of the requesting area.

Security measures were included from the programming stage, in order to avoid unauthorised access to sensitive information, access through access credentials and security functions specific to the programming language used.

User-friendly interfaces were developed.

The assignment and control process of projects and their advisors was improved.

Metrics (indicators) for better decision making were implemented.

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