Optimization of Income and Expenditure Control through an Information System at the "La Perla" Shopping Center

Optimización del Control de Ingresos y Egresos mediante un Sistema de Información en el Centro Comercial "La Perla"

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Abstract

This project focuses on the design and implementation of a web-based system to automate the recording, control, and consultation of income and expenses. It also aims to support proper user management and the generation of informative reports to assist decision-making at La Perla Shopping Center, located in Teziutlán, Puebla. The study followed an applied research approach and used the Object-Oriented Hypermedia Design Method (OOHDM) for system analysis and design. The system was developed using Java 17, Spring Boot 3.4.3, Hibernate, JPA, MySQL, Jakarta Validation, and ModelMapper. Testing activities were carried out using Postman, and GitHub was used to manage version control. The study sample consisted of members of the board of directors of the Shopping Center Tenants Association, who actively contributed to the identification of system requirements through interviews and regular meetings. As a result of this process, fifteen functional modules were developed and implemented, covering features such as user authentication, PDF report generation, rent management, payments, expense tracking, repair management, notifications, and financial dashboards. Overall, the automation of these processes is expected to provide more agile, reliable, and centralized management of the shopping center's financial and administrative activities.

Keywords: web application, financial resources, expense control

Resumen

El presente trabajo surge con la intención de desarrollar e implementar un sistema web para la automatización del registro, control y consulta de los ingresos y egresos; de igual forma llevar una correcta administración de usuarios, a la vez que se puedan generar reportes informativos para la mejor toma de decisiones del Centro Comercial La Perla, perteneciente a la Ciudad de Teziutlán, Puebla. Se realizó la investigación con un enfoque aplicado, mediante la implementación de la metodología OOHDM (Método de diseño de hipermedia orientado a objetos) utilizada para diseño y análisis del sistema; Java 17, Spring Boot 3.4.3, Hibernate, JPA, MySQL, Jakarta Validation, y ModelMapper para el desarrollo. Las pruebas fueron realizadas con Postman y GitHub se utilizó como plataforma de apoyo a control de versiones realizadas. La mesa directiva de la Asociación de Locatarios del Centro Comercial fue la que conformó la muestra de estudio, quienes participaron activamente en la identificación de requerimientos mediante entrevistas y reuniones periódicas. El resultado obtenido fue la creación e implementación de 15 módulos funcionales que van desde la autenticación de usuarios hasta llegar a la generación de reportes en formato PDF, sin dejar de remarcar los referentes a funcionalidades como la gestión de rentas, pagos, egresos, reparaciones, notificaciones y dashboards financieros. Se concluye que la automatización del proceso permitirá una gestión más ágil, confiable y centralizada de la información financiera, contribuyendo a la modernización de la administración del centro comercial.

Palabras clave: aplicación web, recursos económicos, control de gastos

INTRODUCTION

Efficient management of economic resources is essential to ensure the profitability and sustainability of public and private institutions; administrative efficiency and rapid access to information have become fundamental pillars for the success of any organization (Ortiz, 2024). The La Perla Shopping Center, located in the municipal capital of Teziutlán, Puebla, faces administrative difficulties due to the use of manual processes to control income and expenses, which is why there was a need to implement a technological solution that would automate and centralize financial management. The lack of a centralized digital system has led to information loss, human error, and slow decision-making.

This project is based on cases such as Mall Plaza in the Maule Region of Chile, where the challenge was to consolidate multiple data sources (stores, suppliers, macroeconomic) to improve decision-making. The solution they found was to implement an ETL (Extract, Transform, Load) architecture using technological tools such as Python, APIs, web scraping, storage in SQL Server on AWS (Amazon Web Services), and reports with Power BI. Everything is centralized in a Data Lake, resulting in a significant reduction in reporting time and access to reliable and timely information for the shopping center's administration (NetRed, 2025).

Another example of financial process automation is offered by the SmartConcil system, which features automatic reconciliation with ERP, payment gateways, bank statements, and POS systems covering sales by store, by product, accounts payable, transactions, etc. This provides benefits such as the elimination of manual errors, rapid detection of inconsistencies or possible fraud, and accessibility to reports and indicators in real time, resulting in an 83% reduction in the time spent on financial reconciliation (SmartConcil, 2024).

All of the above raises the research question: How can La Perla Shopping Center improve the management of its income and expenses through a technological solution that automates and centralizes its financial processes? This question is supported by the project's objective. Design and implement an information system (RESTful API and FRONT-END) that allows for the efficient management of income, expenses, rents, payments, and reports for La Perla Shopping Center.

Although shopping centers do not yet show much specific financial automation (more oriented towards BI (Business Intelligence), the trend is clear. Budget and reconciliation automation is a latent opportunity.

The system developed represents a key tool for strengthening administrative decision-making, improving transparency, and facilitating reliable and effective financial control.

METHODOLOGY

The project was conducted using a practical, applied research approach aimed at addressing a specific problem related to the manual and analog management of financial records at La Perla Shopping Center. The research focused on the development of functional, modular, and scalable software capable of automating and centralizing income and expense management processes. In addition, a modular study design was adopted, based on independent components that allow system decoupling and facilitate maintenance and future scalability.

To support the development process, two methodologies were employed. SCRUM was used for back-end development, organizing the work into iterative sprints with weekly deliverables, regular review meetings, and continuous adaptation to project requirements (ScrumGuides, 2025).

During the initial phase of the SCRUM methodology, the following elements were defined:

Project Vision: The project was primarily focused on developing a robust API capable of centralizing and automating the shopping center's financial management processes, with the aim of optimizing real-time record keeping and report generation.

Scrum Roles: Key scrum roles and their specific responsibilities were determined: Scrum Master, who focuses on facilitation and impediment management; their activities include coordinating Scrum ceremonies, which are: Sprint Planning, Daily Scrum, Sprint Review, and Retrospective. Progress monitoring was carried out using tools such as GitHub Issues, and acting as an agile coach for the team. The Product Owner, as a second role, served as the main liaison with stakeholders; their responsibilities included defining the product vision and scope, managing and prioritizing the Product Backlog based on user stories according to their business value and technical complexity, validating deliverables at the end of each sprint, and communicating directly with the shopping center's management. The Development Team was responsible for developing the technical solution; they were in charge of designing and developing the API modules, implementing validations and security, as well as testing with Postman, documenting and deploying the code; they were also responsible for self-organization and planning their own workload. Finally, there are the Stakeholders, high-level elements that guide the project, such as those identified for the "Rental Management," "Payment Notifications," and "Financial Dashboard" modules.

This approach provides a clear and concise understanding of the team structure, the responsibilities associated with each role, and how these roles align with the overall project objectives.

Similarly, the OOHDM methodology was applied with a focus on the planning and design of multimedia applications. This methodology covers key stages such as requirements elicitation, conceptual design, and navigational design, among others. Table 1 summarizes the phases of this methodology, which was used for the development of the front-end (Martínez Ramírez et al., 2023).

Table 1

Summary of Implemented OOHDM Phases

| OOHDM Phase	Phase Description	Project Implementation
Requirements Gathering	Identification and definition of user and stakeholder needs.	Meetings and interviews were held with the board of directors and partners of the shopping center to define the functionalities, and the functional and non-functional requirements were documented through written use cases.
Conceptual Design	Representation of the system's class diagram, describing objects, attributes, operations, and their relationships.	The system's data structure was defined, which served as a guide for developing the programming logic and defining the entities.
Navigation Design	Representation of the structure and flow of interaction between the application's screens and modules.	A navigation map was created so that users could navigate the system intuitively and efficiently.
Abstract Interface Design	Conceptual representation of the layout of elements, interaction, and screen structure.	Interface designs were created to show the organization of the user experience so that stakeholders could get a rough idea of the final product.

Implementation	Final stage where the product is built, turning the abstract design into a real, interactive user interface.	The system was implemented on a local server using technologies such as HTML5, CSS3, and JavaScript, and an Nginx web server was configured to serve the files.

Below are the most representative diagrams for the development of the methodologies used in the web application that represents the system developed for the "La Perla" Shopping Center.

The web application allows you to register a new commercial premises by requesting a unique ID "Premises name," rental price, and availability status within the web application, as shown in Figure 1.

Figure 1

Use Case Diagram: Add Commercial Premises
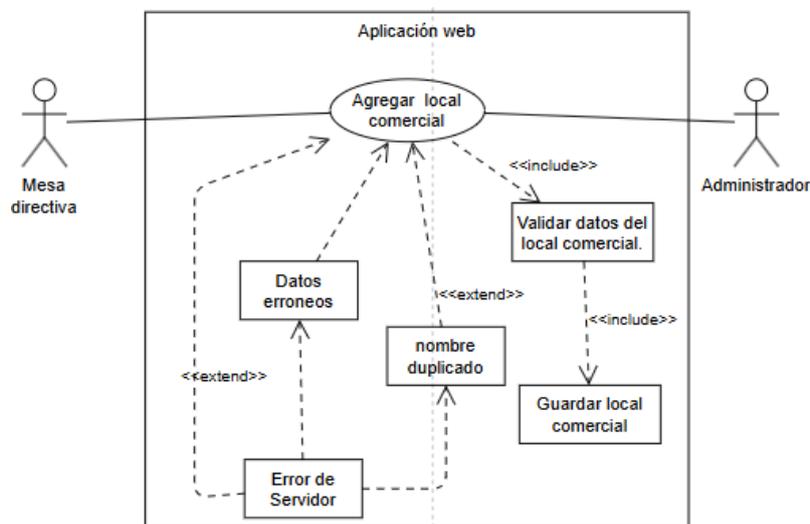
Similarly, Figure 2 presents the use case diagram that enables the registration of the lease for the selected commercial unit and its association with a selected user.

Figure 2

Use Case Diagram: Add Commercial Premises Lease
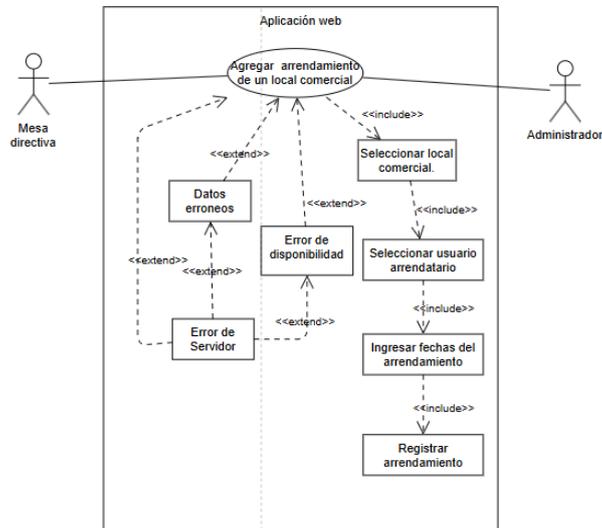
As the third class diagram, the lease consultation diagram is presented. The web application allows users to retrieve lease information through filtering methods. As a precondition, leases must be associated with both a user and a commercial unit. Figure 3.

Figure 3

Use case diagram: Inquire about leasing commercial premises
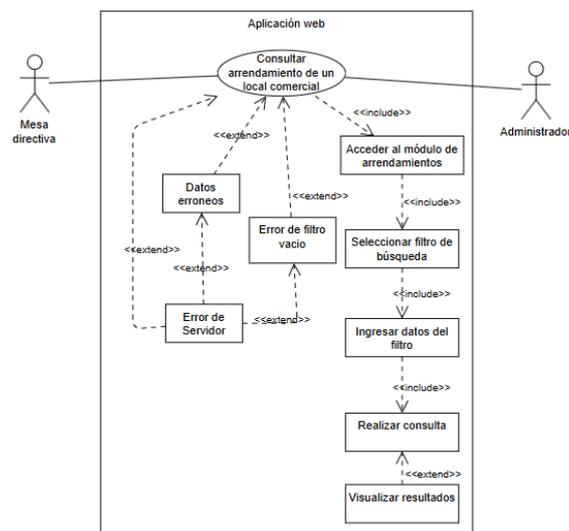
The database diagram shown in Figure 4 graphically represents the logical structure of the tables used in the system, as well as the relationships between them. This model is essential for ensuring data integrity and consistency, and serves as a guide for developing business logic in the API.

Figure 4

Database Diagram
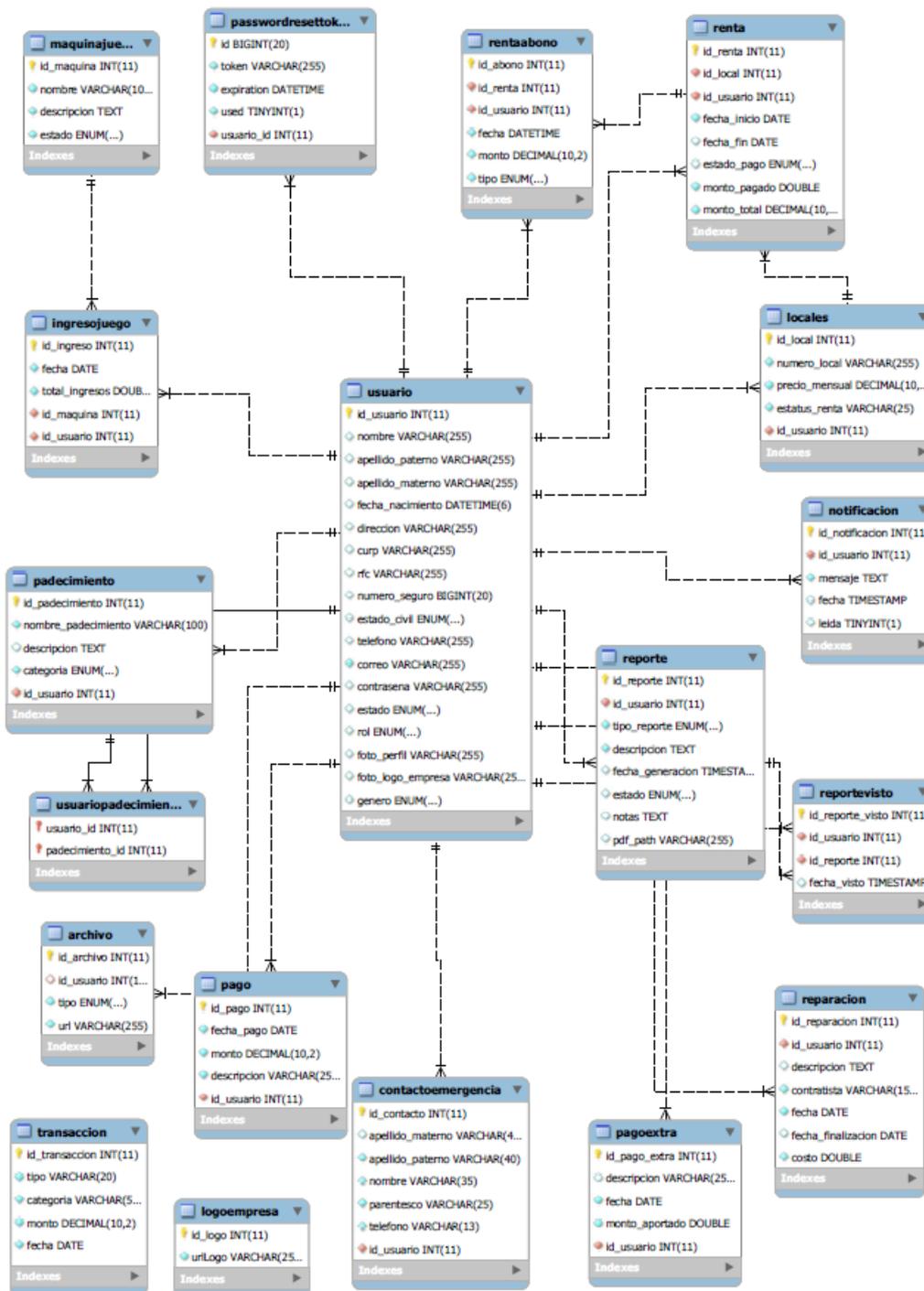
Population and Sample

The target population for the research was the Association of Tenants of the "La Perla" Shopping Center, which has 99 members. The sample consisted of six members of the board of directors: a

president, a secretary, a treasurer, and three members, representing approximately 6.06% of the total population.

Data were collected through the following methods:

Online interviews and in-person meetings with the Product Owner and stakeholders, as shown in Figure 5.

Figure 5

Virtual Interview with the Product Owner
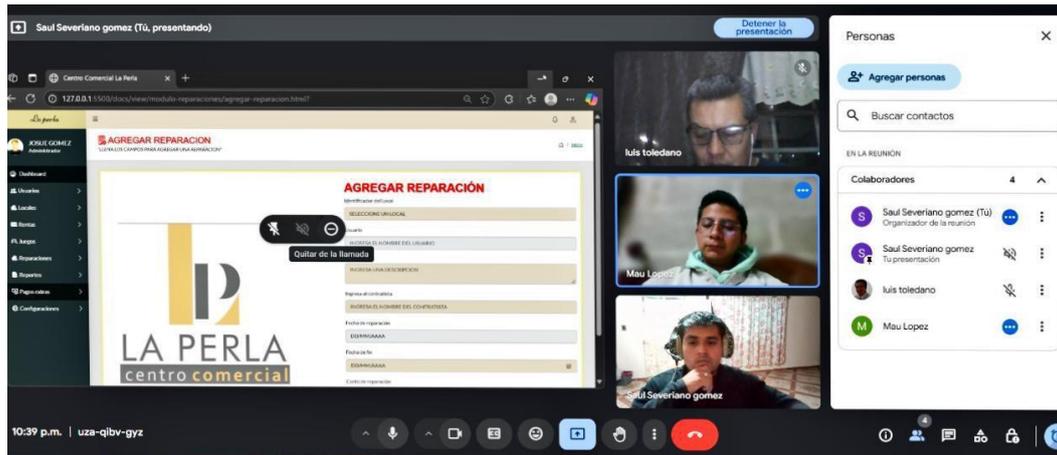
Analysis of existing documents and forms used in previous manual processes, such as Microsoft Excel spreadsheets and payment receipts created in Word, Figure 6.

Figure 6

Monthly breakdown of maintenance payments for 2018

A structured questionnaire administered via Google Forms to the selected sample of the board of directors and members, to assess the impact of the system on working times, error reduction, and usability.

For the technical validation process of the application, functional tests were carried out with the support of the Postman tool; these allowed us to verify that each module developed responded correctly to the expected HTTP requests, including CRUD operations, authentication, validations, report generation, among others. Figure 7 describes one of the tests applied to the "file management" module, detailing the operations verified (Santos López, 2025).

Figure 7

Image Upload POST
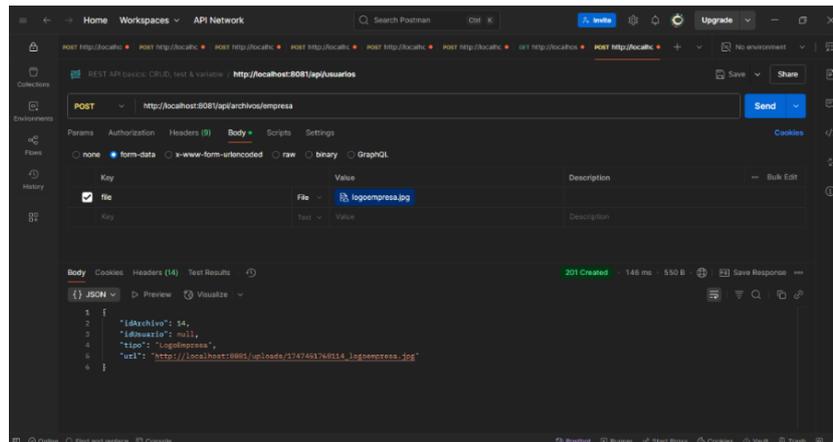
The shopping center's automation and financial control needs were identified, which made it possible to define more than 15 functional modules, from user authentication to report generation. Consequently, the system architecture was designed, including the database diagram, class diagram, and sequence diagrams for the backend API, which were shown above. Similarly, the navigation map shown in Figure 8 and the abstract interface design for the frontend were created, as shown it.
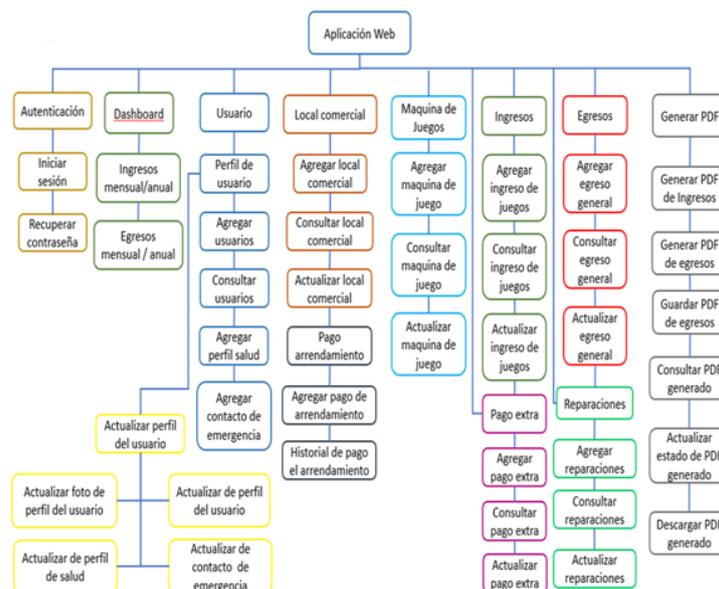
Figure 8

Navigation Design

Figure 9

Abstract Frontend Interface

Java 17, Spring Boot, Hibernate, and MySQL were used for the development and implementation of the backend API. The frontend was developed using HTML5, CSS3, and JavaScript, and implemented on a local server with an Intel Core I5 processor and 16 GB of RAM, using the Linux Ubuntu 24.04 LTS operating system and an Nginx web server. Testing and validation were performed using Postman to validate the API endpoints, and a questionnaire was administered to assess the impact of the system on end users.

RESULTS

Java 17 and Spring Boot were used for the development and implementation of the backend API. The results were grouped based on the nine modules contained in the system, plus the main control panel, reflecting the key functionalities of the system and including security and authentication with the implementation of a JWT token login system, which allows for financial data integrity for role-based access control (Internet Engineering Task Force, 2015).

Figure 10 shows how users can recover their password by providing their email address. They are then given a security token to complete the password recovery process and regain access to the system (Stallings, 2018).
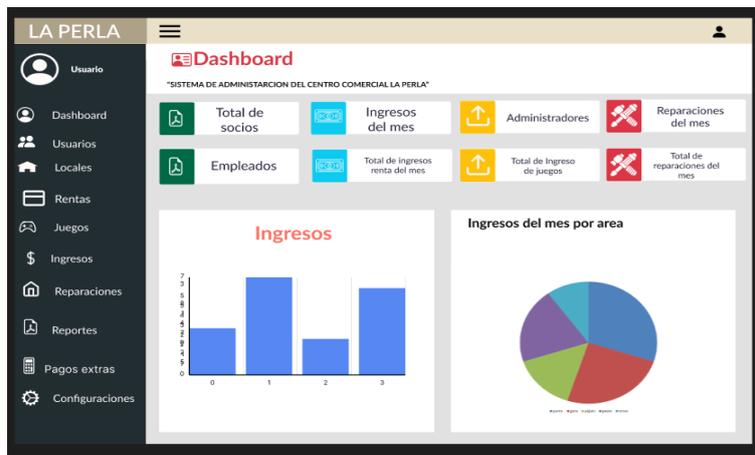
Figure 10

Login and/or password recovery
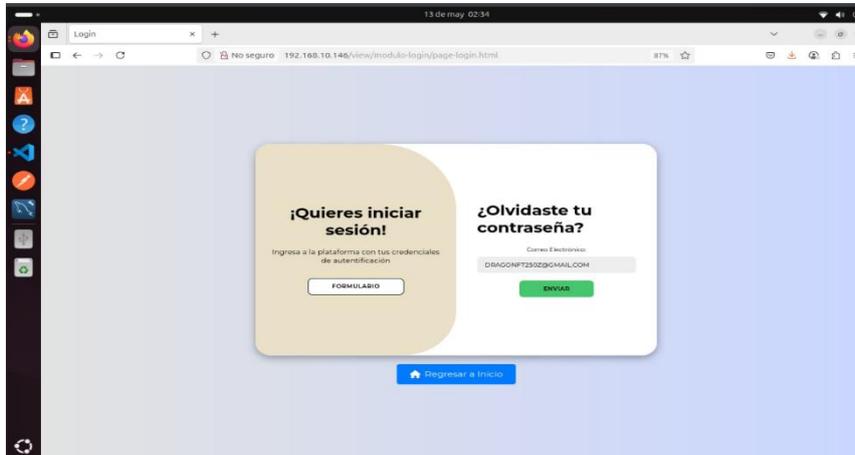
Control panel: Main area of the navigation menu for operations that can be carried out within the system; displays graphs with information on income and expenses, as shown in Figure 11.

Figure 11

Dashboard or Control Panel

Users Module: Here you can manage processes such as user management, authentication and security, password recovery, and emergency contact information, among others, as shown in Figure 12.

Figure 12

User module process

Local Module: Manages processes such as adding and updating information about processes, and searching for specific processes.

Income Module: Includes processes such as payments and income management.

**Games Module:** Management of gaming machines and their income.

Income and Expense Module: Recording and control of income payments, gaming machine income, extra payments, and general expenses.

Repairs Module: Automatic notification system for payment reminders and repair records.

Reports Module: Generation of downloadable reports in PDF format and display of monthly/annual income and expense graphs, shown in Figure 13.

Figure 13

Report display interface
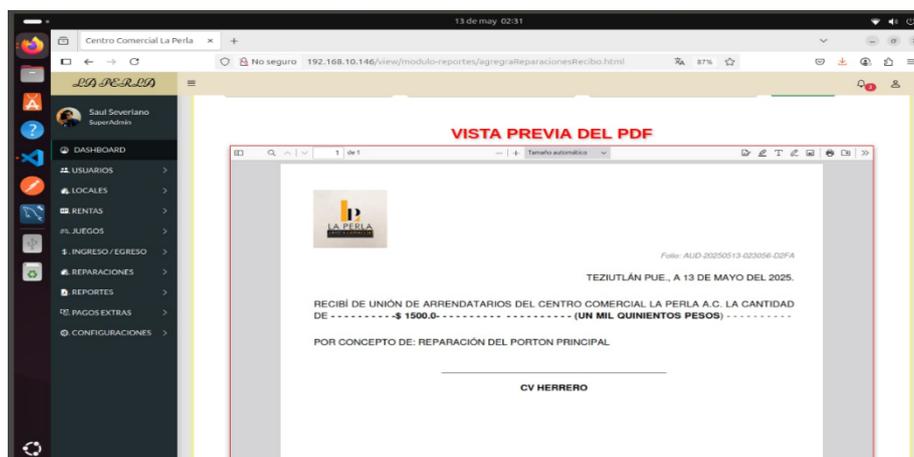
Comparative Analysis of the System Before and After Implementation

The study was conducted on a sample of six participants. Fifty percent of the participants are partners, followed by an equal representation of the board of directors: one president, one secretary, and one treasurer.

Time optimization was one of the most significant achievements of the system, as 83.3% of users are able to access the system in just one minute. Processes such as lease payment previously took up to 15 minutes; currently, they are completed in less than 5 minutes. Graph 1.

Graph 1

Time to make lease payments

4.- ¿Qué tiempo tardan en realizar un pago de arrendamiento?
6 respuestas
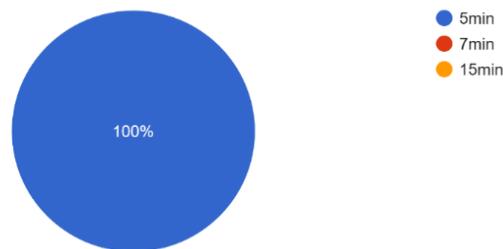
Regarding administration in general, 66.7% say that the system reduced the time spent on administrative tasks, while 33.3% believe that it did so only partially. Graph 2

Graph 2

General Administration

5.- ¿Consideras que el sistema de información redujo el tiempo empleado en la administración?
6 respuestas
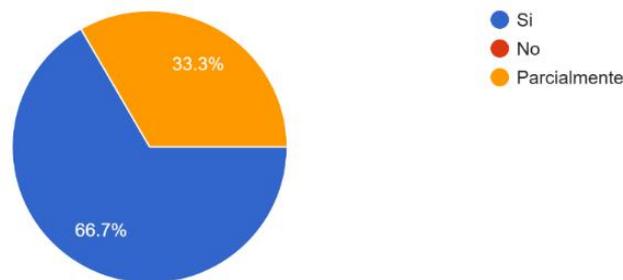
Another measurement parameter was process quality and, therefore, error reduction, since the system reports administrative accuracy, according to respondents, of 66.7% as a partial improvement, with the remaining 33.3% considering it very acceptable.

Graphic 3

Process quality

9.- ¿El sistema te permite obtener información para tomar decisiones más rápido que antes?
6 respuestas
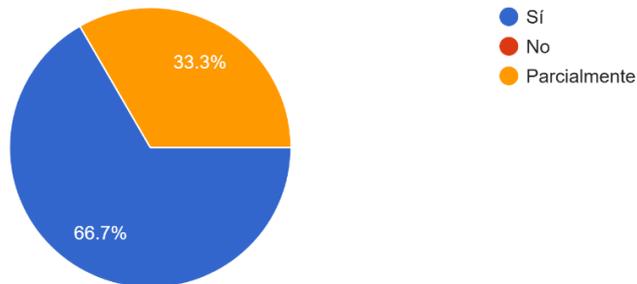
With regard to the degree of satisfaction and usability, the latter being defined as: "the ease with which people interact with a tool in order to achieve a specific objective" (Arenzana, 2022); in general, users say they are satisfied with the system, with 50% rating it as Very good and the rest as Good.

Graph 4

Level of satisfaction with the system

7.- ¿Cuál es tu nivel de satisfacción con el sistema de información implementado?
6 respuestas
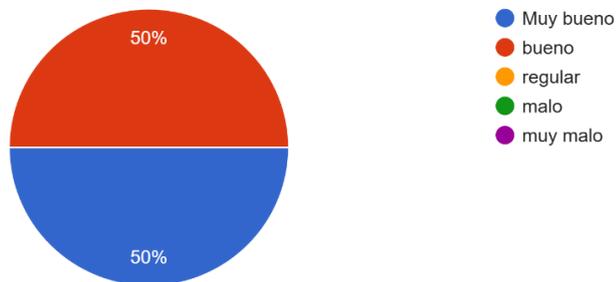
In terms of usability, Graph 4 shows user perceptions, with the majority of votes in favor and comments describing it as easy and very easy.

Graph 5

Perception of usability

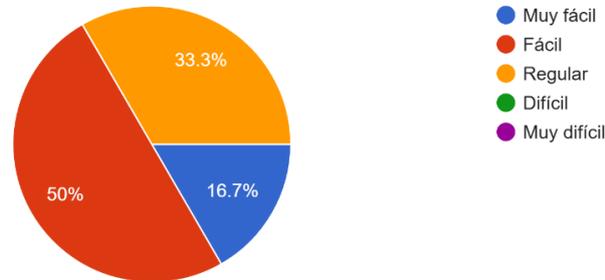8.- ¿Consideras que el sistema es fácil de usar?
6 respuestas

- Muy fácil
- Fácil
- Regular
- Difícil
- Muy difícil

33.3%
50%
16.7%

DISCUSSION

The implementation of the information system successfully achieved its objective of automating and modernizing the financial management of the La Perla Shopping Center. Survey results show a significant reduction in working time and an improvement in administrative efficiency. 100% of respondents consider the system to be too fast and are very satisfied. The automation of manual processes, such as recording and reporting income, proved to be a key tool for optimizing decision-making and increasing transparency (Severiano Gómez, 2025).

The transition from analog methods (such as Microsoft Excel and Word) to a centralized digital system improved accuracy and reduced error rates.

RECOMMENDATIONS

Although the system works, some limitations were found: it does not have multi-factor authentication, which can be a security vulnerability, and its performance depends on the specific server environment and database configuration. In addition, 50% of respondents never use the reporting feature, indicating a potential gap between the functionality developed and user adoption.

The association is advised to consider the following recommendations for the future within the framework of the system: Assign a technician for ongoing maintenance and updating of the system and local server; perform regular backups of information to ensure its integrity; Implement improvements such as electronic billing, email notifications, and connection to other external services to expand functionality and promote the use of existing functionality, such as reporting, through training or reminders to ensure that the system's full potential is utilized.

CONCLUSION

The system has important implications for business management in a similar context; it has been shown that technological innovations can positively transform the way traditional organizations operate, enabling more flexible decision-making and more efficient administration.

The project sets a precedent for other associations or shopping centers that consider automation as a tool to strengthen their competitiveness in an increasingly digitized market. The results obtained with the automated system were compared with previous manual processes. Responses to the

questionnaire were analyzed to evaluate speed, ease of use, and reduction of errors and administrative time, and collaboration with the shopping center's board of directors ensured that requirements were aligned with the organization's actual needs.

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APPENDIX

This research used artificial intelligence (AI) tools to assist with tasks such as the initial drafting of parts of the document and grammar correction. AI was only used for auxiliary tasks; decisions regarding methodology, as well as the interpretation of results and conclusions, were made by the authors. AI did not participate in the statistical analysis or methodological design.

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