System of information for the management in the optics of the city of Riohacha la Guajira

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Abstract. The objective of the research was to develop an information system for the management in the optics of the city of Riohacha, which allows the information to be obtained in a reliable, timely manner, facilitating the whole process carried out in these companies, for the management and provision of services to their patients. The system includes an administrative management module and a sales and inventory module. This research is of applied projective type, with non-experimental, cross-field design, on the information management needs that are presented in the opticians of the city of Riohacha. The result of this investigation was the development and implementation of a system to strengthen the process of administrative management of the optical of the city of Riohacha, this software is the result of an analysis of the prerequisites of the processes of the optics of the city, the design and development of the system, tests and finally the commissioning of the System in one of the analyzed optics: the Iris Optics of the Guajira.

1. Introduction
The theme developed in the present investigation has the title: Information system for the management in the optics of the city of Riohacha la Guajira, where they will study the requirements with which a system must comply to give an adequate management to the information that corresponds to the area of visual health in the city of Riohacha, to develop a software tailored to meet the standards and needs that are presented in the opticians, since it is very important for this type of companies to store and give a good use of the information of the patients they attend, treatments, formulas, data of the EPS and companies with which they have contracts.

During the beginning of the investigation, a background search was carried out related to the research topic, in the environment to which the proposed information system is directed, at the local level these types of projects have not been developed, which is why we take as references the data that we find corresponding to some information systems that exist in Colombia to carry out the tasks within clinics and opticians, such as AgilMED which is used in more than 400 optical and more than 30 clinics nationwide, Oftalvisión professional products Specialized software applied to Visual Health, of which we took into account the information shown in the documentation that describes the functionalities offered.

The criteria that would be taken into account to develop the information system and the main development tools that currently exist in the market were also observed. Likewise, the methodology of the basic life cycle for software development was applied: An analysis was made of the requirements of the process carried out in the optics, the design of the interfaces, queries, reports and databases for the process of management of the optics, the implementation of the information system, the realization of the tests of the designed system and finally the start-up of the management system for optics.
From the methodological point of view, the quantitative approach was used; the research is Projective, applied with a non-experimental, cross-field design. As you can see the results of this research, was the implementation of the Management System in the Optical in the city of Riohacha

2. Situation and Context
In this new knowledge and information society, certain traditional models and concepts are no longer valid, since the world is currently governed by a new order, the changes introduced by technology in our way of life make it necessary to rethink traditional models in all the fields being one of them the computer science and the systems, foundations of this process of transition [1].

All this has made the management of information is increasingly dependent on technology, as the increasing volumes of it are handled and its clearly multimedia nature require a treatment with increasingly sophisticated means. Access to networks such as the Internet via personal computers or the complexity of banking systems and fully computerized air reservations are clear proof that without technology, the use of information would be impossible at present. It is for this reason that software and Information Systems are important concepts when talking about Technologies. These are present in all information processes, since these functions are carried out with increasing intensity by computers.

Software is playing an increasingly innovative role in the Knowledge Society, enabling solutions for companies and introducing significant changes in the behavior of end users, both at home, at work and the implementation of information systems in the organizations, provide the possibility of obtaining reliable, timely, effective information and great competitive advantages.

According to the above, the opticians are organizations that are within the health sector, they provide care to people with visual problems, the lenses are diagnosed and prescribed according to the problem. Currently in the District of Riohacha there are around seven (7) Opticians, which provide various services to its users; some of them manage software tools, but they do not have information systems that allow them to have an integral treatment of the information. Because in some cases they have software created to handle the clinical part and that is not considered optimal for the management of the administrative part, sales and inventory; that is why some of these companies are looking for a way to obtain software that is useful for the management of all their areas.

With this research, we seek to create a customized information system that satisfies all the needs and requirements of the optical systems of the city of Riohacha, oriented to the web and adaptive or responsive.

3. Theoretical bases
3.1. The information systems
An information system (IS) is a set of elements oriented to the treatment and administration of data and information, organized and ready for later use, generated to cover a need or objective.

These elements will be part of any of the following categories: people, data, activities or work techniques, material resources in general. Generally, computer and communication resources, although not necessarily.

"Information system is a set of interrelated components that gather, store, and distribute information to support the decision making and control of an organization" [2].

For [3] the information systems of an organization are made up of the human being and material things, in charge of the information treatment of a business through the access of data, its development, accumulation and subsequent exit.

It can be any organized combination of people, hardware, software, communication networks and information resources that store, retrieve, transform and disseminate information in an organization [4].

It is a conjunction of elements such as human talent, hardware, software, networks that work harmoniously, organized, synchronized and integrated to process data, ordering, transforming and analyzing them, through the different organizational subsystems to produce information.

It is important to clarify that in all the above definitions all the elements interact to process the data and give rise to more elaborate information, which is distributed in the most appropriate way possible in a given organization, according to its objectives, and this applies as much the manual processes as
well as the automatic processes. It is commonly believed that all information systems do their processing automatically.

Many information systems are initially manual systems that are then converted into computerized systems. In this research, when we talk about Information Systems, we will always refer to computerized information systems, so our concept of this type of system is: "Automated information system, is a set of elements, such as: software, hardware, database, telecommunications, people and procedures specifically configured to collect, store, and process data to be converted into timely and relevant information for decision making ", [5].

3.2. Components or elements of an information system

The information systems are composed of the following elements:

Software.
It is the logical component, it is constituted by the computer programs, the routines and instructions that make up the information system.

Hardware.
Computer equipment used to carry out input, processing and output activities, and may be keyboards, devices among others

Database.
It is an organized set of data and information

Telecommunications.
They are the electronic transmission of communication signals that allow organizations to create networks of computer systems. Since they make it possible for people to communicate between different channels and media, and thus facilitate work and access to information

People.
They are the most important element of most computer-based information systems. Information systems personnel include all individuals who administer, operate, program and maintain the system. They are all those who use the system to obtain results, such as financial executives, manufacturing operators, etc.

Procedures.
They are the strategies, policies, methods and rules for the use of automated information systems.

3.3. Activities of the Information Systems.

[6], considers that: "the purposes of information systems, like that of any system within an organization are: process entries, maintain data files related to the organization and produce information, reports and other Departures".

According to Quintero & Romero, information systems perform the following main activities based on the computer:

- Information entry: process in which the system takes the data it requires to process the information, through work stations, keyboard, diskettes, magnetic tapes, barcode, etc.
- Storage of information: it is one of the most important activities that a computer has, since through this property the system can remember the information stored in the previous session or process.
- Processing of information: this feature of the systems allows the transformation of the source data into information that can be used for decision making, which makes it possible, among other things, for a decision maker to generate a financial projection starting from the data that contains a statement of income or a balance sheet in a base year.
- Exit of information: it is the capacity of an IS to extract the processed information or data of entry to the outside. Typical output units are printers, plotters, magnetic tapes, diskettes, voice, etc.
• Feedback: it is here, where it serves to make changes in input or processing activities. And it occurs when there is the presence of errors or problems, and you have the need to correct input data or it can also be when you want to modify or improve a process. This activity is of great importance for administrators and decision making.

3.4. Classification of Information Systems.
Consider that information systems are developed with different purposes, which depend on the needs of the company. Here is a table that summarizes all the categories according to their purposes [7]:

| Table 1. Classification of Information Systems. |
|-----------------------------------------------|
| **According to the organizational levels**     |
| Departmental Systems                           |
| Institutional Systems                          |
| Inter-Organizational Systems                  |
| **According to Functional Areas** (Central Mission Activities)** |
| Accounting Systems                             |
| Finance Systems                                |
| System of Manufactures (Operations / Production) |
| Marketing and Sales Systems                    |
| **According to the type of support they provide** |
| Transaction processing system (TPS).           |
| Management information systems (MIS).          |
| Executive information systems (EIS).           |
| Decision support systems (DSS).                |
| **According to Computational Architecture**    |
| Centralized based on mainframes                |
| Centralized based on server network            |
| Distributed (Client-Server, Web-Intranet, Service-Oriented) |
| Independent PC                                 |
| **According to the Activity Level Supported**  |
| Strategic                                      |
| Tactical / Management-Medium                   |
| Operational                                    |

3.5. Software life cycle
Software life cycle. It is the process that is followed to build, deliver and evolve the software, from the conception of an idea to the delivery and withdrawal of the system. The different intermediate phases that are required to validate the development of a software are defined, that is, to guarantee that the software meets the requirements for the application and verification.

3.5.1. Types of software life cycles
3.5.1.1. Linear life cycle. It is the simplest of all models. It consists of decomposing the overall activity of the project into separate stages that are carried out in a linear manner, that is, each stage is carried out only once, after the previous stage and before the next stage. From the point of view of management, it also requires that it be known from the outset, with excessive rigidity, what will happen in each of the different stages before starting it. The latter also minimizes the possibilities of errors during coding and minimizes the need to require information from the client or the user.

3.5.1.2. Pure cascade life cycle. This model of life cycle was proposed by Winston Royce in the year 1970. It is a cycle of life that admits iterations, contrary to the belief that it is a sequential life cycle like the linear one. After each stage, one or several revisions are made to check if the next one can be passed. It is a rigid model, not very flexible, and with many restrictions. Although it was one of the first, and served as the basis for the rest of the life cycle models.
3.5.1.3. **Life cycle in V.** This cycle was designed by Alan Davis, and contains the same stages as the life cycle in pure cascade. Unlike the former, two feedback covers were added between the analysis and maintenance stages, and between the design and debugging stages.

3.5.1.4. **Classical systems development lifecycle.** According [8], the life cycle method for the development of systems is the set of activities that analysts, designers and users carry out to develop and implement an information system. The life cycle method for system development consists of the following Stages and each of them of different phases: Planning, Analysis, Design, Implementation, Testing, Implementation or Installation and Maintenance.

3.6. **Optometry.**
Optometry refers to the set of processes that allow measuring the limits of vision, visual acuity and chromatic sense. It also studies the retraction of the eye, that is, the deviation of the light rays. The objective of optometry is to allow a correction of vision through adapted glasses or contact lenses. All of these measurements are made through an optometer. In France, the practice of optometry is not defined by a legal framework defined in the Public Health Code. Opticians and professionals who make glasses use it illegally to adapt contact lenses.

3.7. **Optics.**
It refers to everything that is linked to the vision. An optician can be a store dedicated to selling products such as eyeglasses, whether for augmentation or sun, or a person who has a qualification that enables him to perform in this sector. Optics is, on the other hand, the technique for making lenses and other devices that allow people with conditions such as astigmatism or nearsightedness to see better.

3.8. **Management Processes in Optics**
In general, optics are set aside and appointments are canceled, patients are taken care of, their personal data and those of their EPS are entered, the patient's medical history is assessed by optometry, lenses and frames are prescribed and sold.

4. **Methodology**
In accordance with the objectives set and the intentionality of the researchers, this research supports their epistemological actions in the qualitative approach and the systemic approach; this agrees with what [9] says: In summary, the universe is the system of all systems. For this reason, it can only be understood and effectively controlled if a systemic approach combined with the scientific method is adopted. Consequently, the systemic approach provides an adequate analytical and conceptual framework for the study of systems, where interactions are the fundamental aspect for their understanding.

The type of research is Projective, since its main objective is to propose an information system for the management of information in optics [10], which tells us that projective research proposes to provide solutions to a situation determined from a process of inquiry, which involves exploring, describing, explaining and proposing alternatives for change.

Likewise, the design of the research, refers to "where and when the information is collected, if they are living sources and is collected in its natural context the design is field", such criteria are Applicable to the present investigation, in which the information and data necessary for the realization of it, is collected directly from the opticians located in the city of Riohacha. Consequently, the research is of the field, that is, the data of interest are collected directly from reality through the specific work of the researcher. On the other hand, the design of the research is non-experimental, that is, it is an investigation where the independent variables are not intentionally varied, which for this research is the Information System for the management of opticians. At the same time, the study is of transactional or transversal design, since the observation of the phenomenon is carried out in a single moment, without evaluating its evolution over a period of time [11].
4.1. Población

Similarmente, la población de una investigación representa el unit de observación, por cuya información estadística se obtuvo dentro de la investigación y constituye el soporte fundamental a la sistematización de la investigación. Para la presente investigación, la población está constituida por ópticas de la ciudad de Riohacha en el departamento de La Guajira que están presentes como: Óptica Riohacha Ltda, Óptica Central IPS SAS, Linares Óptica, Órisica Iris De La Guajira, y Óptica Guajira. La tabla 2 muestra la composición de la población.

| Óptica                                | Location                  |
|---------------------------------------|---------------------------|
| Óptica Riohacha Ltda                  | Cr15 10-14                |
| Óptica Central I.P.S S.A.S.            | Cr6 Cl 7 Esq.             |
| Óptica Linares                        | Cl 2 6-43 L-103           |
| Óptica Iris De La Guajira             | Calle 14 10-27 Libertador|
| Óptica Guajira                        | Cl 7 9-36                 |
| Imagen Visual Moderna Óptica           | Cr15 9-63 Av. Los Estudiantes |
| Toro Eiler Optómetras                 | Cr 11 14-39 Consultorio 214 |

4.2. Estudio muestra

En este sentido, la muestra es esencialmente un subgrupo de elementos que pertenecen a la población definida por sus características, llamada población, contribuyendo al hecho de que la información recogida es exacta a lo que se obtiene del universo que comprende. En este caso, son todos los ópticos de la ciudad de Riohacha en La Guajira (Colombia).

Según [12], el uso de muestreos es recomendable cuando la población es infinita o cuando hay grandes poblaciones finitas. En la presente investigación, la población está constituida por (7) ópticos, que se considera una pequeña cantidad; por lo que se utiliza como muestra el total de la población.

Adicionalmente, teniendo en cuenta la naturaleza de las variables investigadas, el estudio considera a los optometristas, secretarios o asesores de los ópticos de la ciudad de Riohacha en el departamento de La Guajira. La tabla 3 es la siguiente:

| Óptica                               | Optometrist | Secretaries or advisors |
|--------------------------------------|-------------|------------------------|
| Óptica Riohacha Ltda                 | 1           | 2                      |
| Óptica Central I.P.S S.A.S.          | 3           | 2                      |
| Óptica Linares                       | 1           | 1                      |
| Óptica Iris De La Guajira            | 1           | 2                      |
| Óptica Guajira                       | 1           | 2                      |
| Imagen Visual Moderna Óptica         | 1           | 1                      |
| Toro Eiler Optómetras                | 1           | 1                      |

4.3. Métodos y instrumentos de recopilación de datos y procedimiento de investigación

Para el desarrollo del marco teórico, se realizó una revisión bibliográfica relacionada con la variable de investigación, a saber, sistema de gestión para las ópticas de la ciudad de Riohacha en La Guajira, con el fin de apoyar la investigación y los instrumentos de recopilación de datos utilizado en ella.
Regarding the instrument used to obtain the information, refer to the "tool used by the subject researcher to gather information about the event, event or phenomenon that investigates.

In this study, the interview was used as a technique to record the information and a questionnaire was applied as a tool, consisting of a series of questions with open-ended alternatives. In this specific case, the instrument is made up of 25 items, with an alternative of open response addressed to Optometrists and Secretaries or Advisors of the Opticians of the city of Riohacha. This interview allowed to have clarity about the processes, the actors, and the input and output information of the system and the relationships between them; it also made it possible to diagnose the current situation of the opticians in the city of Riohacha and to establish the requirements of the system in order to reach the final result.

In general, the interview answered the following questions:
What are the processes that take place in optics?
How does the process begin?
How does the process end?
Who are the actors in the process?
What standards and protocols related to the process?
What information enters and leaves the process?
What are the relationships of the process?

In the requirements analysis, a detailed description was made of the roles and tasks that each one of them must perform.

Subsequently, a specification of the scenarios was elaborated, which corresponds to the way in which the tasks for each of the established roles will be carried out; then use case diagrams were developed as a technique to specify the behavior of the system, continuing with the description of each one of the diagrams and after this analysis a conceptual design and model of the database was developed, later it was developed the information system, the respective tests were carried out before and after the implementation and finally, it was implanted in the Iris optics of La Guajira.

4.4. Development language
The information system for optics is developed in PHP and has a connection to a database in MySQL. When working based on PHP, the content and views of the system will be dynamic and will have an iteration with a database server designed for hosting, respecting the policies that exist for the access and development of the company that wishes to implement it. Tool for the storage and management of information.

4.5. Development tools
The development tools are open source, the information system design is made with the Laravel version 5.5 framework and the text sublime text editors in version 3, Visual Studio Code and Xampp local server version 7.2.1. The modeling of the system was carried out with the Balsamiq Mockups tool in its trial version.

5. Results
5.1 Requirements analysis
Based on the interviews carried out in the different perspectives, the identification of roles and tasks was carried out. The following describes the roles that will participate in each information exchange and the tasks that it will have to support according to the participation that each actor has on it.

5.1.1 Rol: administrator
• Authenticate as system administrator and have access to the privileges that this merits.
• See patients who are admitted to the system waiting to be seen.
• Attend patients and fill in the data corresponding to the procedure performed in the appointment.
• Consult patient data in the system corresponding to clinical history, previous consultations, and identification data.
• Formulate medications.
• Make glasses.
• Make and manage sales of products and services.
• View and manage inventory products.

5.1.2 Rol: advisor / advisor
• Log in with an advisor or receptionist and password through the authentication interface.
• Register new patients and update existing data in the system.
• Carry out the different queries regarding the information of the clinical history of patients through the information system.
• Print patient's medical records.
• Set appointments.
• Manage the status of appointments in the system.
• Enter patients to the system to meet appointments and make the corresponding payment to him or the services provided to the patient.
• Make sales of products or services.
• Enter new products into the inventory.

5.2. Specification of scenarios.
We will proceed to make a description of how the information system will be used from the tasks conceived for each role, in a specific way each of the scenarios that describe these tasks.

5.2.1. Administrator
• Authenticate as system administrator. To access the system as an administrator, you must Log in with a username and password, in this way you will have access to the privileges that this offers to insert, update, view and delete data that correspond to patient information, clinical history and sales.
• See patients who are admitted. The administrator can see the patients once they are entered into the system by means of a waiting list that indicates that they can already enter the office to receive the service for which they go to the Optician.
• Attend patients. The administrator will assist the patient and write the findings found in the patient's medical history.
• Consult patient data in the system corresponding to clinical history. After attending to a patient, the administrator will be able to make inquiries related to the patient's clinical history, last control, treatment, among others.
• Formulate medications. The system administrator after diagnosing the patient can order medications to treat their discomfort if necessary.
• Make glasses. If the patient requires it, the administrator will order medicated lenses according to the condition shown by the exams at the time of care.
• Make and manage sales of products and services. The administrator can make sales of the products in inventory and can also sell the different services offered by the optics.
• View and manage inventory products. The administrator can see the products with which the inventory counts, add new products, update and eliminate them if necessary.

5.2.2. Advisor / a receptionist
• Log in with an advisor or receptionist. To enter the system you must log in as an advisor or receptionist and the software will allow you to access the benefits that this type of user is assigned.
• Register new patients and update existing data in the system. An advisor or receptionist can create new patients in the system or update their data.
• Carry out the different queries regarding the information of the clinical history of patients through the information system. This user can consult the patient's medical records but only to see and print, you cannot modify or delete this information.
• Print patient's medical records. The consultant can make a consultation through which he will see the patient's clinical history and then print it.
• Set appointments. The counselor has the authorization to set an appointment once a patient arrives who requires it in the event that he or she comes in a particular way, this task will not be carried out.
• Manage the status of appointments in the system. When a patient needs to make some type of modification to their appointment, or failing to assist the advisor can make the relevant changes regarding this in the system.
• Enter patients to the system to meet appointments. When the patients arrive to meet their appointments, the advisor must make the respective entry and make the collection of the value of the service acquired by the patient if necessary, and then this will be placed on the waiting list to enter the office.
• Make sales of products or services. The advisor is authorized to make sales either of products or of the services offered by the optics to the public, or to the companies respectively according to the customer’s need.
• Enter new products into the inventory. When new products arrive, the advisor will register them in the system.

5.3. Design and Modeling

5.3.1 Diagrams of cases of use. This point consists of modeling the system from the use case diagrams that are the description of the actions of a system from the point of view of the user. It is a valuable tool given that it is a technique of successes and errors to obtain the requirements of the system, just from the point of view of the user.

The use case diagrams model the functionality of the system using actors and use cases. The use cases are services or functions provided by the system for its users.

According to the above, below will be seen in images the use case diagrams that specify the behavior of the system, which were designed with the modeling tool in the UML standards, StarUML which is a graphic language to visualize, specify, build and document a system. The version used was the test one, See the figure (1, 2, 3, 4, 5).

![Figure 1. Case of Use of User Entries to the System](image-url)
Figure 2. Patient Registration Use Case

Figure 3. Use Case Register EPS and Companies
Figure 4. Case Use Patient Affiliation

Figure 5. Use Case Sales and Inventory
5.3.2 *Design of the topic base.* The information system for opticians, aimed at the Opticians that are located in the city of Riohacha in the Guajira, uses a database developed with the MySQL engine in version 5.4 because it is a database management system relational developed under a dual license GPL / Commercial License by Oracle Corporation and is an open source database; which does not report costs or additional expenses for the company that wishes to implement the system. The use of MySQL allows the system not to have too many demands and does not generate additional costs since it is possible to use it in basic computer equipment that are currently the majority of the companies. On the other hand, the MySQL database engine is very complete and can store a large amount of information without causing disruption in the correct functioning of the information system. See figure 6.

![Database Model](image)

**Figure 6.** database model

6. **Conclusions**

Throughout the investigation, it was observed that in the District of Riohacha there are seven Opticians, which provide diverse services to its users; some of them handle software tools, but do not have complete information systems, which handle the clinical part and the administrative part, which allow them to have a good treatment of the information. As a main problem we determine the need that exists in these companies to have an integrated software that allows the reliable and timely management for the effective functioning as entities providing visual health services in Riohacha.

It also made it possible to diagnose the current situation of the opticians in the city of Riohacha and to establish the requirements of the system in order to reach the final result.
In the requirements analysis, a detailed description was made of the roles and tasks that each one of them must perform.

Subsequently, a specification of the scenarios was elaborated, which corresponds to the way in which the tasks for each of the established roles will be carried out; then use case diagrams were developed as a technique to specify the behavior of the system, continuing with the description of each one of the diagrams and after this analysis a conceptual design and model of the database was developed, later it was developed the information system, the respective tests were carried out before and after the implementation and finally, it was implanted in the Iris optics of La Guajira.

With a stable model of the database, we determined that the design of the system interfaces was made, for which the development language Php and the Laravel framework in its version 5.5 were defined as a development environment. to develop what we will see as the Information System for management in the optics of the city of Riohacha la Guajira, where we will find a patient module where all the necessary actions can be taken to give attention to any person or user of the services of some optician in this city, an inventory and sales module was also carried out where you can keep track of the products that are available for sale and the sales that are made.

At the end of the design and development phase of the system, the product was tested in an Iris de la Guajira optic in the city of Riohacha and training was carried out for 15 days so that the users of the system were familiarized with their functions and characteristics. in such a way that they could also say if it meets their needs or not, at this stage it could be observed that the system was accepted, since it meets the necessary characteristics to provide care to patients and also make sales using the same software. A solution was given to the needs that we initially observed.

At the end of the testing phases of the system and training to the end users, and with the approval of them for the implementation of the software in their company, we can conclude that this project had the impact that we expected when solving the problems presented by the users. to fulfill their work tasks on a day-to-day basis; It is also clear that the implementation in this company is intended to motivate others to try and appropriate the same system so that over time the impact of this is greater in the city and can meet the needs of more optical.

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