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Development of a grocery POS system for local businesses: "El manantial" case study from Santiago Centro, Tamazunchale, S. L. P.

Desarrollo de un sistema de punto de venta de abarrotes para los negocios locales: caso de estudio "el manantial" de la localidad de Santiago Centro, Tamazunchale, S. L. P.

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Abstract

The main characteristics of grocery establishments are to fulfill the needs of customers related to basic goods basket. The process of the establishments operates as follows: At first, someone acquires the products (supplier), then the products are exhibited (warehouse) and finally the stock is sold (customers). In Mexico, there are two distribution channels which are Self-service (Retail) and Wholesale Channel (Abarrotero.com, 2017). Companies with a wholesale channel are established in large populations and strategic places, while self-services are established in places with little attendance; especially in rural communities. The management and strategies of companies depend on the technological tools and instruments they have. Computer systems allow these companies to have useful, fast, fluid information focused on their tactics and strategies, information that allows a timely change of course in a changing world. In this sense, information is a main weapon that helps management, products, and services to enter a competitive world. This work is the result of the development and implementation of a computer system according to the conditions in both infrastructure and level of computer knowledge of the grocery establishment located in a community.

Point of sale (POS), Information system, Management

Resumen

Las características principales de los establecimientos de giro abarrotero son satisfacer las necesidades de los clientes en cuanto a productos básicos. El proceso de los establecimientos, opera de la siguiente forma: Adquieren los productos (proveedor), se exhibe (almacén) y se vende (clientes). En México existen dos canales de distribución que son Autoservicio (Retail) y Canal Mayoreo (Abarrotero.com, 2017). Las empresas con canal de mayoreo se establecen en poblaciones grandes y en lugares estratégicos, en cambio los autoservicios en lugares con poca concurrencia; sobre todo en comunidades rurales. La gestión y estrategias de las empresas dependen de las herramientas e instrumentos tecnológicos de que dispongan. Los sistemas informáticos permiten que dichas empresas posean información útil, rápida, fluida y enfocada a las tácticas y estrategias de las mismas, información que un mundo cambiante permite un cambio de rumbo oportuno. En este sentido la información es un arma principal que ayuda a la gerencia, a los productos y a los servicios a entrar en un mundo competitivo. Este trabajo es el resultado del desarrollo e implementación de un sistema informático acorde a las condiciones tanto en infraestructura y nivel de conocimientos informáticas del establecimiento abarrotera ubicada en una comunidad.

Punto de venta (PDV), Sistema informático, Gestión

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Introduction

All companies have survived and prospered thanks to the good management of their accounting, some in a very rigorous way and other companies in a superficial way (especially micro-enterprises). Accounting is the financial information system that measures the economic activities of companies, processes this information into accounting statements (reports) and communicates the results to decision-makers (Llerena Cárdenas, 2013).

It has been observed that accounting information that is generated manually (calculator, cash register, Microsoft Excel) makes it difficult to generate accounting reports. In an increasingly globalised and competitive market, it is very important for SMEs to have reliable, complete, timely and connected information at all times in order to be able to provide immediate responses to changing situations (González Fernández, 2015).

Currently there are countless computer programmes that help to keep financial control for any type of company, there is software that has an annual cost (licence) for its use, others with a single payment for installation and you can also find trial versions (usually test versions).

Despite the fact that it is easy to obtain a dedicated computer system, there are many companies that have not managed to implement it in their administrative processes. This is the case of the company "EL MANANTIAL", a grocery store located in the community of Santiago Centro in the municipality of Tamazunchale, San Luis Potosí.

The establishment "El Manantial" does not keep accounts in its inventory nor in the sales it makes. Sales operations are carried out with the help of a calculator, which is why there is no inventory control (stock, expiry date, etc.), nor is there any record of sales, and therefore no statistics (total sales per day, products with the highest turnover, etc.).

From this perspective, it is evident that the company requires a computer tool to be able to keep an accounting control in a more efficient way and to achieve an adequate financial management in income and expenditure.

Theoretical basis

Background

According to the history of POS systems, the first mechanisms that were created to streamline these business processes were mechanical cash registers, which date back to the 19th century. The main purpose of these machines was to prevent theft by company employees (User, 2018).

The incursion of information systems into administrative and accounting operations is not new, as mentioned by Ferran and Salim (2008), the first computer applications in the company for accounting management were introduced around 1960. In Mexico, it was in the 1980s when its use began to become widespread among companies and government institutions, thanks to the appearance and expansion of PCs (Mochi Alemán, P. O., 2006).

A PoS (Point of Sale) system is a set of hardware and software tools, which mainly allow businesses to invoice their sales, also facilitating the control of their cash flow, inventories, suppliers, purchases, accounts receivable and payable, expenses and fixed costs, profits and losses, among other functions (López Madueño, J. R., 2021).

Definitions and associated concepts

MSMEs

The Instituto Libertad y Democracia (2012) defines MSMEs as Extralegal Enterprises that have as fundamental characteristics, the absence of legal permits to operate as an organisation and therefore lack of control and organisation for their operation. On the other hand, Giles Navarro, C. A. (2020) mentions that micro, small and medium-sized enterprises could be defined as those entities recognised as such by the Ministry of Economy and the Ministry of Finance and Public Credit and that for the purposes of their stratification, the number of workers that comprise them and the economic sector to which they belong are considered.

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Grocery shop

A grocery shop or corner shop, as they are commonly known, has been a source of employment and income for decades in Mexico. They are businesses that have become a tradition in the idiosyncrasy of neighbourhoods in Mexico, regardless of their social status (comercialtrevino.com, 2022). According to the portal https://www.sysipos.com (2022), their main function is to supply first-hand products, but we must also highlight the good treatment they offer to the community, strengthening ties with their customers and creating a unique and very distinctive loyalty.

Sale

The Dictionary of the Royal Spanish Academy defines sale as "the action and effect of selling. Quantity of things that are sold. Contract by virtue of which one transfers one's own thing to another's domain for the agreed price.

Custom software

A custom software is a computer programme designed ad hoc for an entity, this type of software is created with the user, the company and the ways of working in mind; that is to say, it is a computer programme completely customised for a company and, therefore, it is designed to satisfy all the needs of that business (Immune, 2021).

Point-of-sale (POS) system

According to Gómez Conesa, M. J. (2013), the POS (Point of Sale) is the 21st century evolution of the classic cash register. A point of sale system is basically divided into two parts, the first is the hardware (tangible part), such as: computer equipment (computer, monitor, keyboard, mouse), barcode reader, ticket printer, cash drawer, electric scale, bank terminal. The software part (intangible part) is the specialised computer program to perform the inventory and sales operations. The software is designed to interact with the hardware mentioned above.

Software development methodologies

In Carvajal's 2008 paper, it is described as "A methodology is a collection of procedures, techniques, tools and auxiliary documents that assist software developers in their efforts to implement new information systems. A methodology is made up of phases, each of which can be divided into sub-phases, which will guide system developers in choosing the most appropriate techniques at each stage of the project and also in planning, managing, controlling and evaluating it".

Extreme Programming (XP)

Extreme Programming is undoubtedly the standard-bearer of agile methodologies. It was born as a fairly successful attempt to establish a set of practices that would facilitate the completion of projects. After a few successful tests, these practices were translated into theoretical form, giving rise to a methodology that maintained its main principles and practices (Carvajal, 2008).

Databases

Kendall and Kendall (2005) state that "databases are not just a collection of files. Rather, a database is a central source of data intended to be shared among many users for a variety of applications. Cohen and Asín, (2000) define a "database as a series of organised and interrelated data that are collected and exploited by the information systems of a particular enterprise or business".

Database management system (DBMS)

The DBMS is the software or set of programs that allow the creation and operation of a database; a set of programs that handle the creation of and access to databases. The DBMS is used to define the data, i.e. the types of data to be stored are specified; the DBMS is used to load the information and also includes modules to perform queries, update and generate reports (Cohen and Asín, 2000).

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Relational data model

For Groff and Weinberg (2003) a relational database is a database in which all data visible to the user are strictly organised as tables of data values and in which all database operations are performed on these tables.

XAMPP

Is an apache distribution that includes several types of free software (Bou, 2019). X indicates that it can be used for any operating system, A for apache, M for MySQL, P for PHP and P for Perl.

Apache server

The Apache web server is a free web server developed by the Apache Server Project whose goal is to create a reliable, efficient and easily extensible web server with free open source code (Díaz & Vargas, 2002).

MySQL/MariaDB

It is used for data storage for services. It supports SQL language and multi-user connection, but in general, it is used for small-medium sized applications (Pavón, 2014).

Phpmyadmin

It is a tool written in the PHP language and accessed through web pages that guarantees the control of our databases with a simple and intuitive yet powerful interface (Lozano, 2018).

Visual basic

Visual Basic .NET, then visual basic 2005, visual basic 2008 and now visual basic 2010, changes the idea of programming from the initial versions. Now object-oriented programming is required, which will force the developer to program in an orderly manner, with methodological programming rules analogous to those of other object-oriented programming languages (Sierra, 2016).

Methodology to be developed

The research covers from the analysis of the company's logistics to the development of a software application (applied technological research).

For the development of the software, the extreme programming software (XP) methodology was used. The methodology consists of 4 steps: Planning, Design, Coding, Testing.

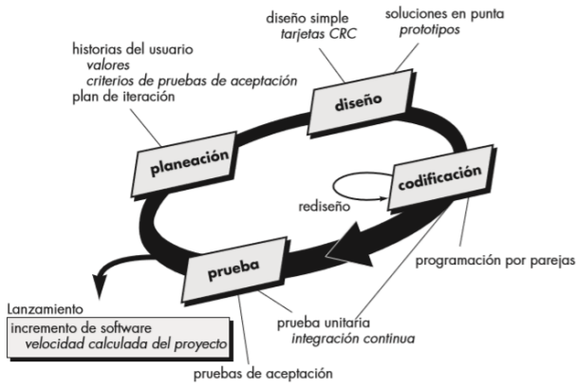

Figure 1 Extreme programming process
Source: Pressman. (2010)

Phase 1: Planning

A visit was made to the company to meet with the owner of the company and observe the company's logistics (input, process and output), and with the information obtained, a diagram of the company's logistics was drawn up.

Once the result of the analysis of the company's requirements was obtained, the user stories were developed.

Phase 2: Design

Second phase of the model, for the development of the project, the recommendations proposed by XP were considered.

- Simplicity: For the design of the user interface, the Visual Basic 2010 language was used. The recommendations suggested by the methodology were followed at all times.
- CRC Card: In this section the database schema was designed.
- Refactoring: During the development of the project, it was necessary to make some adjustments.

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Phase 3: Coding

Client always present: During the development period of the application, there was constant contact with the client. Normally the meetings with the client took place on weekends and there was also contact via telephone (WatsApp).

Standards in the code:

- Standards in the Database: The database names were all lower case. The restriction and normalisation rule was applied.

- Standards in the code: Coding has a proper structure (tabular), understandable variable name handling and at all times the code was commented.

Phase 4: Testing

The XP methodology focuses on the execution of tests throughout the project, in order to ensure the realisation of what was planned at the beginning of each iteration. The development team participated in this process along with the client with their contributions, especially in the acceptance tests.

- Unit tests: Tests were carried out at all times, with the intention of eliminating any faults before presenting them to the client.

- Acceptance tests: Once the application had been integrated, the technical requirements and installation manual were completed, as well as a screenshot of the system and training was provided on how the application works.

Results

Result 1: Planning

Company logistics

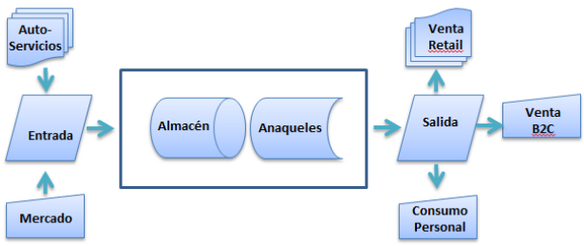

Figure 2 Logistics of the company "El manantial".
Source: Own elaboration, (2023)

Result 2: Design

For the design of the software, the most appropriate and functional tools were used, always seeking to optimise and minimise costs. The design is classified in two types: Database (MySQL) and User Interface (Visual Basic 2010).

Application architecture

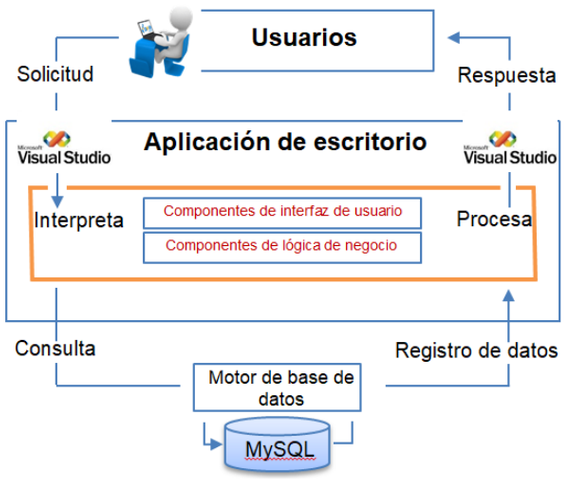

Figure 3 Application architecture
Source: Own elaboration, (2023)

User Interface

Access to the system

Figure 4 Access to the system
Source: Own elaboration, (2023)

Initial configuration

Figure 5 Initial configuration
Source: Own elaboration, (2023)

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- Main window.

Figure 6 Main window
Source: Own elaboration (2022)

- Printer configuration.

Figure 7 Printer configuration
Source: Own elaboration (2023)

- User administration.

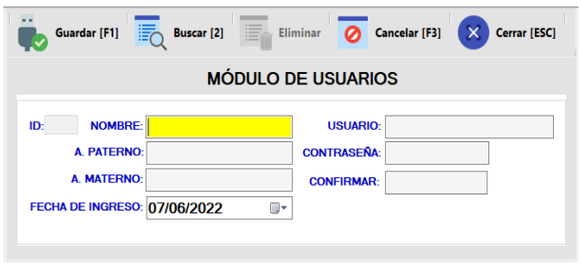

Figure 8 User administration
Source: Own elaboration (2023)

- Assignment of privileges.

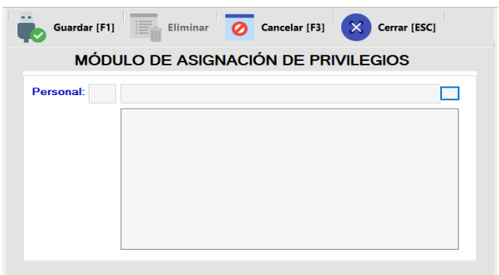

Figure 9 Assignment of privileges
Source: Own elaboration (2023)

- Database backup.

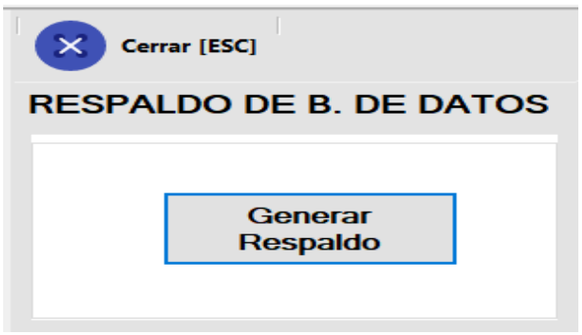

Figure 10 Database backup
Source: Own elaboration, (2023)

- Supplier management.

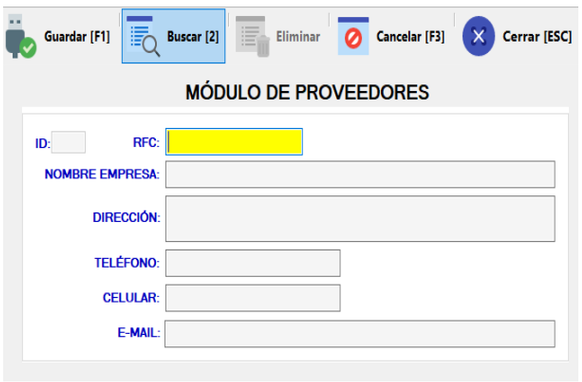

Figure 11 Supplier module
Source: Own elaboration (2023)

- Classification administration.

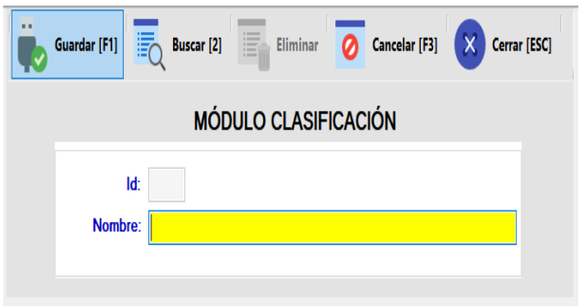

Figure 12 Classification administration
Source: Own elaboration, (2023)

- Customer administration.

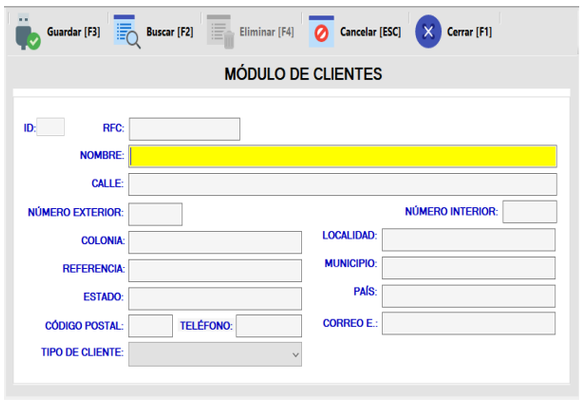

Figure 13 Customer management
Source: Own elaboration (2023)

- Product stewardship

Figure 14 Product stewardship
Source: Own elaboration, (2023)

- Purchasing administration (input)

Figure 15 Purchasing administration (input)
Source: Own elaboration, (2023)

- Point of sale.

Figure 16 Point of Sale
Source: Own elaboration, (2023)

- Search engine.

Figure 17 Search engine
Source: Own elaboration (2023)

- Extra expenses.

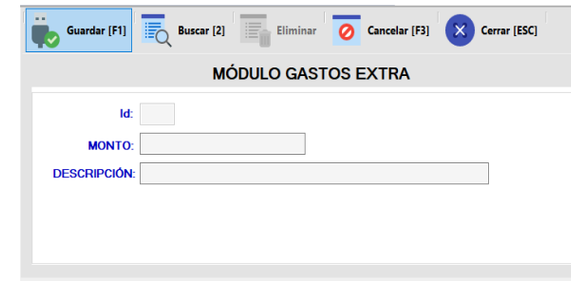

Figure 18 Extra expenses
Source: Own elaboration (2023)

- Box cut.

Figure 19 Box cut
Source: Own elaboration (2023)

- Customer credits

Figure 19 Customer credits
Source: Own elaboration (2023)

- Reports

Figure 20 Reporting module
Source: Own elaboration (2023)

Result 3: Testing

The application is developed in Visual Basic 2010, so it only works on Windows OS.

Hardware:

- Pentium IV 1GHZ processor. Or higher.
- Hard disk space: 100 MB
- Ram: 512 or higher.

Software:

- Operating System: Windows XP (Service Pack 2) or higher.
- Microsoft Excel 2003 or higher (for reports).
- MySQL Database Manager.
- mysql-connector-net-6.5.4 driver.

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Conclusions

The system was implemented using the appropriate tools and a friendly user interface was designed, so that it can be operated by people with few computer skills.

The software was designed to meet the precise needs of the company Abarrotes el Manantial, during the development focused on the requirements provided by the client but can be replicated in other businesses with similar activity.

Recommendations

It is recommended to look for new hardware alternatives to minimise costs, since replication in other businesses with the same line of business will not be able to absorb the cost.

Continue with the analysis of the processes (which could not be detected) in order to improve the system, especially the balance of its costs.

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