

## WMS computer tool of the company "Comunicación Telefónica de Antequera"

### Herramienta informática WMS de la empresa "Comunicación Telefónica de Antequera"

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#### Abstract

The project presented is based on the implementation of an application for the management of the warehouse of the company Telefónica de Antequera Communication; that will allow to manage the inventory that includes: registration of entries and exits of products in a detailed manner through the PEPS method, logistics operations of suppliers and clients, the existence (stock) of articles guaranteeing the coordination of the actors of the process and the optimization of Your activities. It is integrated in this first phase in five modules: Products, Clients, Suppliers, Warehouse and Reports. The application requires a web server that will be in charge of storing the data and providing the interface within the network and the MySQL database manager. For the development, the incremental methodology was used, coding with JavaScript, with an execution environment in Node.js. PM2 was also chosen as the production process manager who will keep the services active. This application will have a positive impact on the company since it will improve warehouse operations from the purchase of the item to the final sale at the counter, including returns due to changes or damage to them. This will allow managers to make the best decisions through relevant consultations

**Application, Coordination, Existence, Logistics, Methodology**

#### Resumen

El proyecto presentado se basa en la implantación de una aplicación para la gestión del almacén de la empresa Telefónica de Antequera Comunicación; que permitirá gestionar el inventario que incluye: registro de entradas y salidas de productos de forma detallada a través del método PEPS, operaciones logísticas de proveedores y clientes, la existencia (stock) de artículos garantizando la coordinación de los actores del proceso y la optimización de sus actividades. Se integra en esta primera fase en cinco módulos: Productos, Clientes, Proveedores, Almacén e Informes. La aplicación requiere un servidor web que se encargará de almacenar los datos y proporcionar la interfaz dentro de la red y el gestor de base de datos MySQL. Para el desarrollo se utilizó la metodología incremental, codificando con JavaScript, con un entorno de ejecución en Node.js. También se eligió a PM2 como gestor del proceso de producción que mantendrá los servicios activos. Esta aplicación tendrá un impacto positivo en la empresa ya que mejorará la operativa del almacén desde la compra del artículo hasta la venta final en el mostrador, incluyendo las devoluciones por cambios o daños en los mismos. Esto permitirá a los gestores tomar las mejores decisiones mediante las consultas pertinentes

**Aplicación, Coordinación, Existencia, Logística, Metodología**

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## Introduction

Currently, throughout the world, most SMEs must store data so that the information generated can be used by managers for good decision-making, through executive reports that support them to implement optimal strategies for the management of your business activities.

Within this management, monitoring the warehouse is one of the priorities for any businessperson if it is carried out correctly, since it allows the value chain of a product to be maintained, costs are reduced, but mainly it improves customer service.

The warehouse area of the Telefónica Communication company in Antequera is in charge of keeping track of the products that the company physically has, which are offered for sale to the public or for the telecommunications services to which the company is dedicated (television, voice and data circuit installations and maintenance). Currently, the workers in this area carry out this control based on physical records to control the inputs and outputs of products from this area.

The problems identified in this area are the following: The control of inputs and outputs of products in the warehouse, whether by purchase, sale, transfer to another branch, or required as supplies for facilities, poses a risk if they suffer damage or total loss. of the document due to mishandling or an accident at work.

Obtaining information about what products are in the warehouse takes a long time since the search must be carried out physically, this includes what refers to the quantity (maximum and minimum stock) that could stop a sale due to lack of the product or knowing products have little stock in order to program the necessary purchases.

That is why, once the necessary requirements have been surveyed, such as the type of warehouse, classification techniques, inventory systems and their management indicators; It has been proposed as a general objective to develop an application for the management of inputs, outputs and stocks in the warehouse area (WMS) of the company Comunicación Telefónica de Antequera.

Respecting, at the request of managers, that the method for classifying inventories will continue to be ABC, since they are familiar with ordering their products through generated rotation and the benefits provided (A: Greater importance, B: Importance and Moderate Rotation and C: Low Rotation ).

The document that is presented is organized by integrating: the theoretical foundation and the activities carried out during the phases defined by the incremental software development methodology, based on the philosophy of building by increasing the functionalities of the program by applying linear sequences in a staggered manner as time progresses. in the calendar, result in several sequences that produce an increment of the software in a linear way.

Subsequently, the tools used in the development are evaluated and the data modeling is created in each of the phases, with their respective user stories and a MySQL GNU GP license as a database manager.

Finally, the results obtained are shown, through the interfaces, system tests, the conclusions obtained with the implementation of the system and the impact on the automated processes that contribute to the scope of the general objective when developing a management system entitled: WMS computer tool of the company "Comunicación Telefónica de Antequera", and the thanks given to the National Technological Institute of Mexico, the Technological Institute of Oaxaca and finally, the references consulted in the preparation of the following article.

## Statement of the problem

Communication Telefónica de Antequera is a 100% Oaxacan company dedicated to the field of Telecommunications and consolidated as leaders in the integration of alarm systems, radio communication, telephony, CCTV, access control and networks; in the state of Oaxaca and southeast of the Mexican Republic.

Due to its expansion, it currently presents a logistics problem in its warehouse and therefore in the management of its inventory, which causes a detrimental financial impact on the organization since it delays the shipment of products to the customer, or the product must be denied to the customer. not being able to verify stocks or on the contrary, having a large inventory of a product can be damaged over time and not be able to make the guarantees valid, among others, which is always reflected in losses for the company

## Development

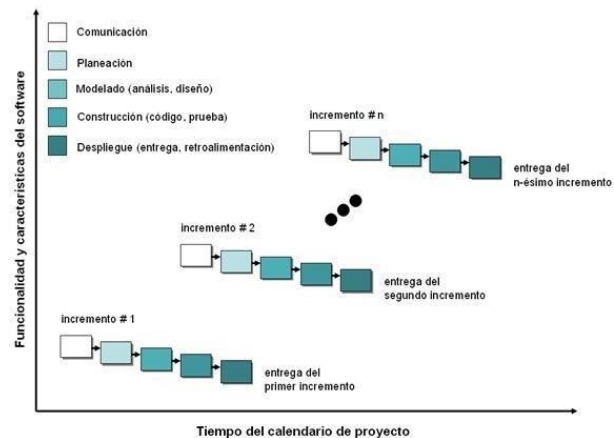
The WMS computer tool of the company "Comunicación Telefónica de Antequera" aims to solve the problems identified in the company's warehouse area as follows: Inputs and outputs will be recorded digitally in a database, which will reduce creation time and provide greater security in their consultation and updating.

Access to stock data with the application will be almost instantaneous, the same with the historical record of entry and exit transactions, being able to differentiate the entire process of entries (purchases and guarantees) and exits (sales, installations or transfers). The application will be able to warn the user about products with few stocks, which will help in making decisions for the purchase of products.

The inventory will be separated by areas, offering the above functions with equality for both areas, preserving the way of working that the company manages. For the articles, a random key (SKU) will be generated, taking into account the type of product, brand, model, purchase date, date of entry into the warehouse and the shelf in which it is located.

## Methodology

For this project, the incremental model was chosen under the Scrum methodology, which, as explained by Pressman (2002), combines elements of the waterfall model with the construction of prototypes. This methodology is based on the philosophy of building by increasing the functionalities of the program by applying linear sequences in a staggered manner as time progresses on the calendar. Figure 1 shows the incremental methodology process in which operational software is generated quickly and in early stages of the software life cycle.



**Figure 1** Life cycle by iterations

Source: Pressman, R.S. (2002). *Software Engineering: A Practical Approach*

For this project, the incremental model is used, whose stages in each increment are:

- **Communication:** Start of the project, the collection of information with the client is carried out.
- **Planning:** Estimation of resources and times, the requirements obtained are interpreted and validated.
- **Modeling:** The structure required for the increment is determined.
- **Construction:** Code development and testing.
- **Deployment:** Delivery of the product and recommendations for its operation. In addition, an initial planning is carried out, known as zero increment, to define the work plan and the characteristics of the project.

**Zero increment:** In this increment, the initial requirements gathering is performed. The planning of the activities and the increments destined to build the functionalities of the application. The technologies to be used are defined in common agreement with the directors of the company, taking into account time and experience in the development of applications, the following technologies are proposed:

Backend: Express.js and Node.js

Frontend: React.js and Node.js

Database: MySQL.

The general design of the application structure, such as user stories, is also carried out. Table 1 shows the master list of user stories grouped by category and broken down into each increment according to the increment plan shown in Table 2.

Master user history list	
1	User Management
2	Product Management
3	Inventory Management
4	Customer/Supplier Management
5	Backup of records
6	Reporting

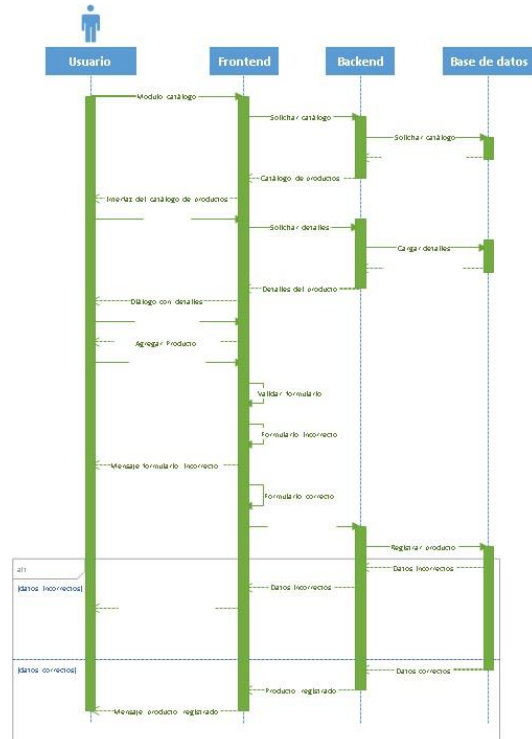
**Table 1** Master user story list  
 Source: Own elaboration

Incremental plan			
1 <sup>st</sup> Increment	2 <sup>nd</sup> Increment	3 <sup>rd</sup> increment	
Display login screen	Product Management	Generation of system reports and scheduled backup of information.	
Display user profile	Inventory Management		
Product registration			

**Table 2** Plan of increments  
 Source: Own elaboration

As indicated in the previous figure, three increments were programmed, of which only the most relevant of each of them will be indicated in this document.

**One increment:** Once the increment plan was designed, the sequence diagrams were defined that describe the activities that the user will carry out in the application, which are: Access Module, User Registration Module and Warehouse Product Registration Module as shown in Figure 2, which depicts the activity of querying and adding products.



**Figure 2** Inquiries and add products  
 Source: Own elaboration

The corresponding interfaces were modeled on increment one, as shown in figures 3 and 4.



**Figure 3** Edit user profile  
 Source: Own elaboration

ID	Nombre	Modelo	Categoría	Descripción	Acciones
ALABET0001	Detector inalámbrico de Rotura de Cristal / 3 en 1 / Soporta 2 Zonas Cableadas	HIBVISION DS-PD369-652-WB	Alarmas	Detector de rotura de vidrio inalámbrico con vidre...	
ALABET0001	Kit Inalámbrico de 7 Contactos 5816 y 3 Sensores de Movimiento 8209PB	HONEYWELL 5816 KIT	Alarmas	- 7 contactos magnéticos 5816 - 3 Sensores de movim...	
ENENCO0001	Modulo Solar ET-SOLAR, 450W, 50 Voc, Monocristalino, 144 Celdas grado A	ET-SOLAR ET1M57284450W/W/WB	Energía Solar	Los módulos Solares de ET-SOLAR, se encuentran...	
WATCO0001	Balboa de Cable Bineleto F/U/TP de 4 Pines, 2 MAX, CARA Volante	SEKON SAGL-A5	Materiales	El Cable F/U/TP Categoría 6A de Simon posee un re...	
RAOWEN0001	Kenwood Analógico	KENWOOD TK3320HK	Radio comunicación	45 WATTS, UHF 450-430 MHz, 16 canales	
RADRAD0001	Radio 800/900 MHz, 200 Canales, NXDN™, DMR-Analógico, GPS, Bluetooth, IP67, 2 Fieles	KENWOOD NX-3420-K3	Radio comunicación	Operación del equipo con encendido por voz, I...	
RADRAD0002	Radio 450-520 MHz, DMR-Analógico, 5 Watts, 300 Canales, Bluetooth, IP67, 2 Fieles	KENWOOD NX-1300-EX3	Radio comunicación	Opera protocolo digital NXDN™ o DMR. Modo memoria...	

**Figure 4** Product catalog  
Source: Own elaboration

In the field of validations and tests, the following were carried out: Registration, Duplication, Edition, Products.

**Two increment:** Dedicated exclusively to inventory management, the A, B, C method of inventory classification was implemented in it, according to the priorities of the managers; Its interfaces are adjusted to the registration of inputs and outputs of products corresponding to acquisitions, prioritizing that the user can register input orders of the return, guarantee or surplus type with different products as long as they are associated with an output folio, indicating the details corresponding to the entry, as well as the serial numbers of the products that are re-entered. As shown in the following figure:

**Registrar Entrada**

Fecha: 07/11/2021

Tipo de entrada: Devolución de venta

Folio de la salida: Selecciona un folio (dropdown menu showing '1')

Observaciones:

Busca productos por id o nombre:  **BUSCAR**

ID del producto	Nombre	Serial	Modificar
Añade productos			

**CANCELAR REGISTRAR**

**Figure 5** Entry and re-entry of products  
Source: Own elaboration

Finally, in this increase, when managing the number of items and to meet the requirements of calculating the minimum quantities of a product, the safety stock formula indicated by Robinson (2020) is used:

Standard deviation of demand \* root of average lead time.

To calculate the standard deviation of demand, you must first calculate the average demand, which is the total monthly demand / number of months. Also considered in this increment is the scheduled task on the Backend server to calculate low stocks, reviewing all output records to calculate the supply time.

**Three increment:** The user will be able to generate reports of inputs, outputs, and inventory management, organizing it by established time ranges, brand, model, priorities and warehouses among many options or filters, in order to provide a better perspective in decision making by managers. The interface designed for this purpose is shown in Figure 6.

**Seleccione las opciones para el reporte**

Seleccione las categorías:

- Todas
- Videovigilancia
- Telefonía
- Redes
- Radiocomunicación
- Señalización Vehicular
- Alarmas
- Energía Solar
- Materiales

Seleccione el almacén:

- CTA
- Don Francisco

Números de serie de los productos:

- Incluir

**CANCELAR ACEPTAR**

**Figure 6** Report generation  
Source: Own elaboration

For security and contingency reasons, a restoration module was developed, which works once a database backup has been made. it is recommended to do it daily and the last saved version can be restored. See figure 7.

**Restaurar base de datos**

No se puede acceder a la base de datos. Use un archivo de recuperacion para restaurarla

Seleccionar archivo: 破破破...1280.png

**Iniciar Sesión**

Si tienes algún problema para iniciar sesión o si no estás registrado Por favor contacta al administrador

No es un archivo de copia de seguridad

**Figure 7** Database restore  
Source: Own elaboration

**Results**

The results obtained from the inventory system for the company Comunicación Telefónica de Antequera are presented:

- Contribution to the work methodology implemented in the company, which did not include suppliers or customers.
- To meet the needs of managers and at their suggestion, the system integrated methods considered efficient. Such is the case with the A, B, C method of product inventory.
- According to the methodology used, at the end of each increment, the product was delivered for evaluation so that the client could guarantee its functionality (using it) once configured and validated.
- The inventory system for the Telefónica Communication company in Antequera. It has the requested modules, as well as the incorporation of established business rules, in friendly and intuitive interfaces.
- The system and its structure respond to a strategy that seeks to facilitate the activities of employees in the company, streamlining the internal processes of inventory management.

**Gratitude**

We thank the Instituto Tecnológico Nacional de México/Oaxaca Technological Institute for the facilities granted to carry out the project, mainly ROGELIO ERICEL ZARATE MENDEZ, student of the Computer Systems Engineering educational program, with his experience and time in carrying out the project in the course of your professional residency.

**Conclusions**

In conclusion and based on the information collected through the various interactions with the personnel designated by the company Comunicación Telefónica de Antequera. It was possible to identify the needs, as well as the strategies that would be necessary to be able to develop a solution that complies with the necessary standards to be considered optimal, safe and stable.

Before starting with the automation, consequences of poor warehouse management were detected, which in turn represent risks for the company, which are:

- Physical or virtual losses of the material.
- Risk of impact on customer deliveries.
- Incorrect material purchase planning due to inventory discrepancies.
- Affectation in the main indicators of the company.

Investigating and discovering new knowledge and techniques allowed us to achieve the planned objectives in a timely manner, always hand in hand with the directors who were true guides, people experienced in the organization's storage and distribution management and whose aspects had the greatest impact on the development of experience is reflected in the visible decrease in the financial costs of excess inventory.

From the above, it is concluded that it is recommended that all small, medium or large companies implement an inventory management system that can be custom or commercial. Because you will realize the great benefit, investing your time in other matters of the company or your personal life.

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