Master in Smart Industry

Asset Management on IBM Maximo

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Contents

Table of Figures

Introduction

Nowadays, all companies invest time and money in trying to optimize the useful life of their assets. This is why a good maintenance plan for these assets has become an essential part of their business. As a consequence of the unprecedented technological progress of the last few years, new technologies capable of improving efficiency in the field of maintenance have emerged, as well as different software specialized in taking maintenance to other levels and, in this way, adding value to the company.

In this project, the IBM Maximo software, used worldwide, will be used to digitize and manage all the assets of a company in order to optimize their useful life.

This software will be used to create a system capable of managing different assets of an organization and their maintenance in a practical way. Different parts of Maximo, such as Escalations or Automation Scripts, will be used to manage the different work orders that the assets have, as well as processing the work orders generated due to preventive maintenance.

Objectives

As already mentioned, the project will consist of the creation of a complete system from scratch, containing assets and different elements with their own work orders, Escalations and Automation Scripts. All of this will be linked to the application of the software Preventive Maintenance. Therefore, the main objectives of the project will be the following:

- Create an organization with all the necessary elements to be able to automate work orders and preventive maintenance (Storerooms, Assets, Items, Job Plans, Work Orders...).
- Create Escalations using conditions (SQuirreL) to change the status of Assets and Items work orders.
- Create Automation Scripts (Python/Jython) to generate the work orders and update the information of these. Automation Scripts are similar to Escalations, but they are used to manage more complex issues that Escalations would not be able to manage efficiently.
- Create the Preventive Maintenance Plan (PMP) by means of frequencies and measurements of the assets. In case of having more time, it could be simulated readings of different parameters of the assets and have them reach Maximo by another program.
- Create graphs of the different asset parameters so that the user can view them in the Start Center.

Design

For the realization of this project the example of a car workshop will be taken, in which the assets of the customers and the workshop's own assets must be managed. In this case, it will be necessary to manage 2 cars and a motorbike belonging to 3 different users and 2 machines of the workshop.

Organization, site and its elements

Before starting with the maintenance plan and all the automations required for it, all the elements and users that will participate in the system must be created:
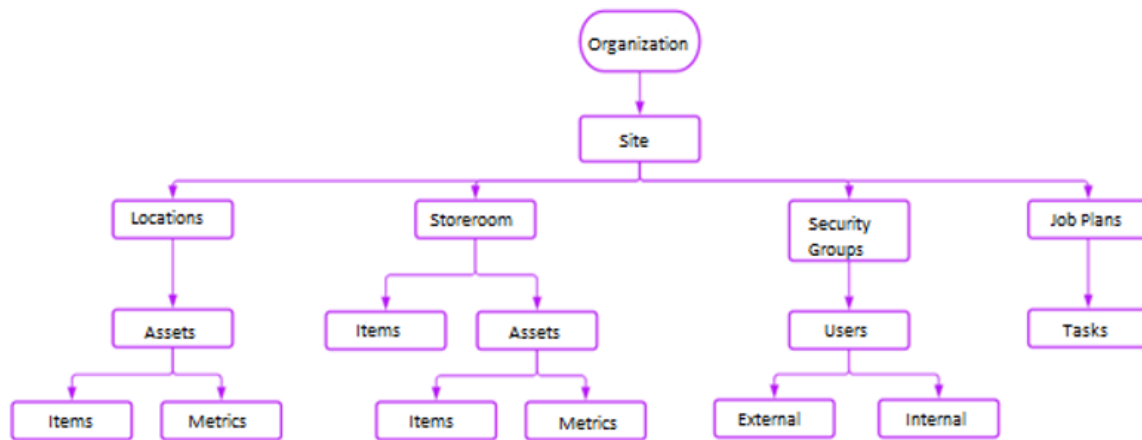

Figure 1: Organization, site and its elements

These elements are created from the different applications that IBM Maximo has.

There will be 3 locations, one for each place of operation of the customer's assets, and 1 warehouse, which will be the workshop itself. The cars and the motorbike will be made up of different items, such as wheel or the braking system. These items will also be in the workshop, to be used as spare parts in case of need.

The assets will have different metrics that will be used to activate both the maintenance plan according to the mileage and the different automations that will be carried out.

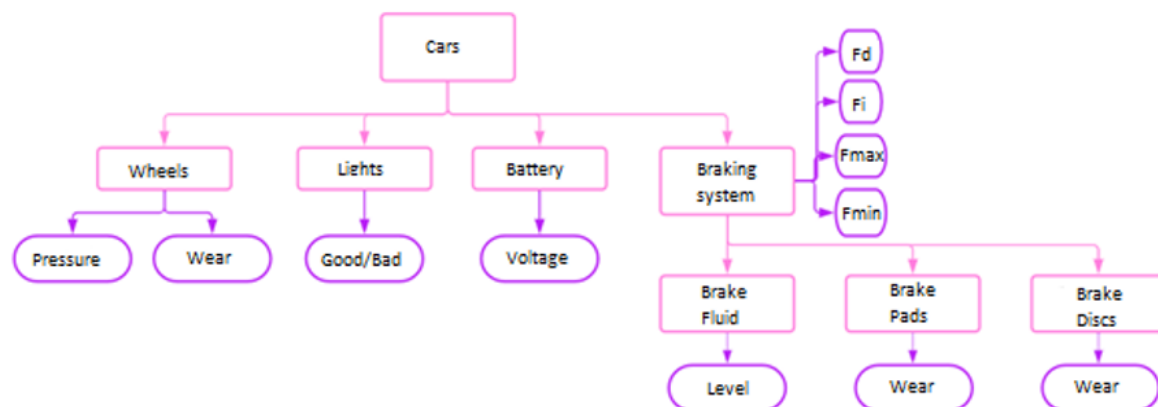This is the example of a car's subassembly with all its metrics:

Figure 2: Car subassembly

The motorbike will not have the battery item, instead, it will have oil and its chain system to maintain.

Apart from these metrics, 3 additional ones will be used to manage the braking system:

- **Efficiency:** $E = \dfrac{F}{M.M.A * g} * 100$, where F is the sum of all the forces, and M.M.A. is the weight of the vehicle.
- **Imbalance:** $D = \dfrac{100 * (F_d - F_i)}{F_d}$, where F_d is the force of the right Wheel and F_i of the left wheel.
- **Ovality:** $d = \dfrac{100 * (F_{max} - F_{min})}{F_{max}}$

In addition, 2 security groups will be created for workshop customers and workshop operators, and they will be given different permissions. In the case of the workshop operator, he will have access to his inventory, system assets, work orders, customer service requests and the new application that will be created to manage maintenance. Customers will have access to Service Requests, as they will be able to create them if necessary. They will also be able to view the data of the new application to know the status of their assets.

Finally, the different Job Plans will be created with their tasks, which will be used to automatically create work orders based on them. This is the list of all the Job Plans that will be used in the system:

1. Car overhaul
2. Motorbike overhaul
3. Change wheels
4. Inflate wheels
5. Change lights
6. Change battery
7. Check battery conditions
8. Change oil
9. Change braking system
10. Change motorbike chain
11. Vehicle Hoist's Maintenance
12. Wheel Disassembler's Maintenance

Preventive Maintenance Plan

There will be 5 preventive maintenance plans, one for each asset to be created. The 3 customer assets will be managed by time-based frequencies and metric-based frequencies. The metric to be used is the mileage of the vehicles. For the 2 machines in the workshop, only time-based frequencies will be used.

These plans will generate different work orders, which can be viewed by the operator, based on the Job Plans already created and associated to them.
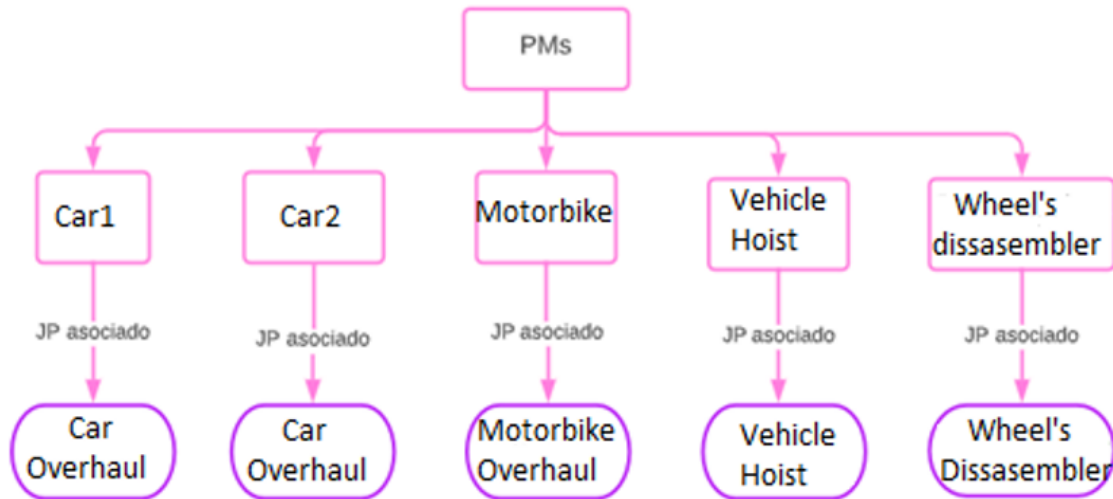
This is the scheme of all the PMs:

Figure 3: PMs

New application

A new application will be created for the operator to check the vehicles when the maintenance plan is triggered. This new application will take some data from the work orders created by the PMs and will have different fields to be filled in depending on the type of vehicles. The operator will have to fill them in, and, once this is done, different work orders will be created from the previous one, depending on whether the values entered are correct or not. In addition, if the operator enters excessive values, the application will warn him with an error message. To achieve this, some Automation Scripts are used.

To create the new application the following applications from Maximo will be used:
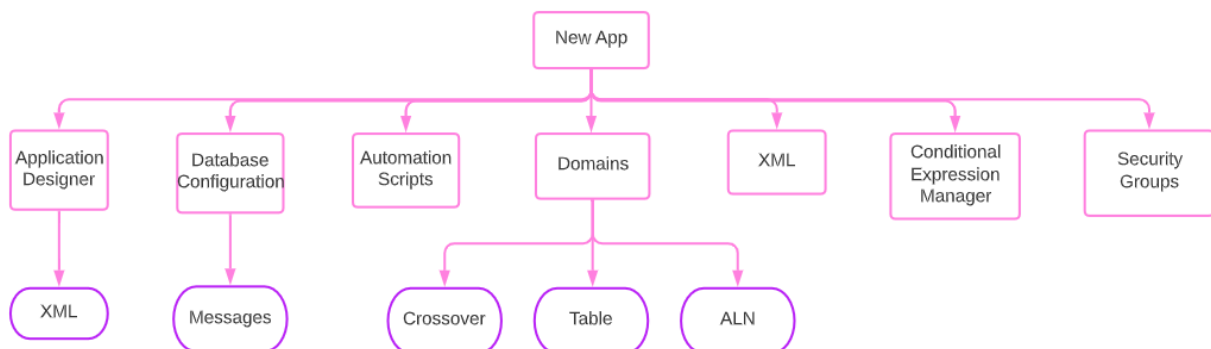
Figure 4: New application

This is the mockup of the application, created in Excel:
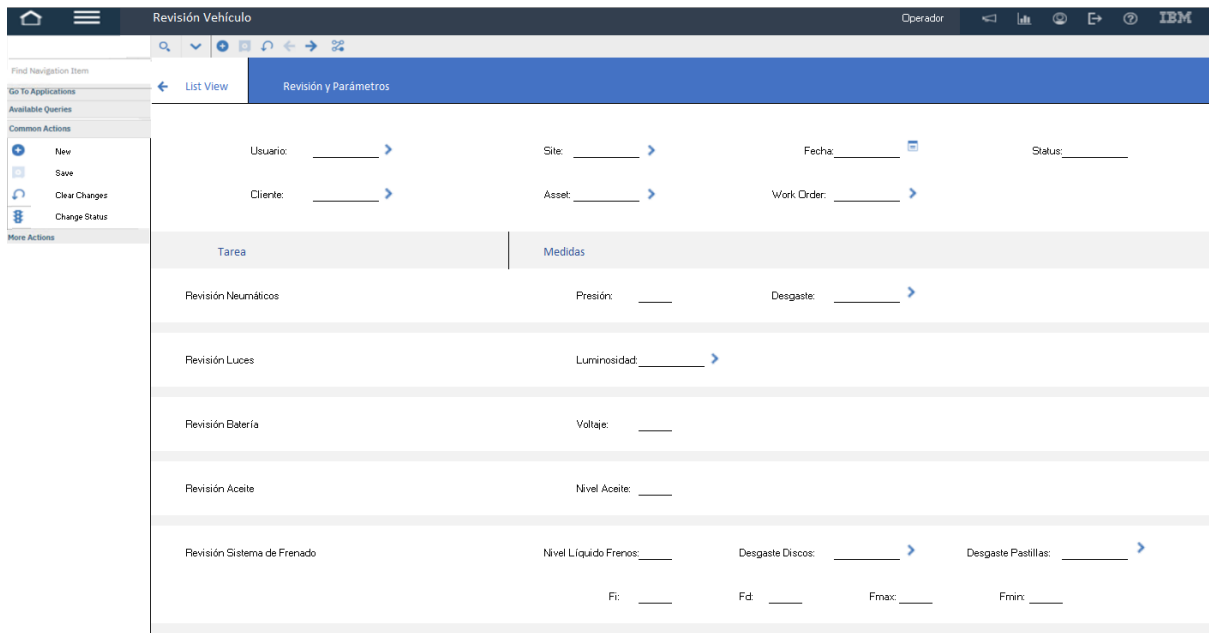
Figure 5: Mockup of the new app

Automation scripts

Three different scripts will be created to automate the management of vehicle maintenance:

1. **New application:** It will automate that, when a work order is generated from the PMs, a new revision will be generated in the new application that has been created. In addition, it will automatically fill in some fields of the review based on the work order, such as the work order number or the asset to be reviewed.
2. **Error messages**: It will automate the creation of different error messages in some fields of the new application when the operator adds values that are not logical.
3. **New work orders**: This will automate the creation of new child work orders once the operator has added the values requested in the new application.

Escalations

Two different Escalations will be created for other simpler automations:

1. **Service Request**: An automation is going to be created so that when customers create a new SR and the operator resolves it and changes its status to 'RESOLVED', a notification is automatically sent to the customers so that they know they can go and pick up their vehicle.
2. **Workshop machines**: When a work order is generated via PMs for any machine in the workshop, it will have 3 tasks, the first one is to analyze the machine. If the operator performs a favorable analysis and changes the status of the first task to 'TERMINADA', the Escalation will cancel the remaining 2 tasks and change their status to 'CAN'. In case it simply changes the status to 'COMPLETED', the operator will have to continue with the remaining 2 tasks.

Results

Work orders are created from the Preventive Maintenance application based on the Job Plan:

Figure 6: WO from the PM

At the same time, the revision is automatically created in the new application:

Figure 7: New application working

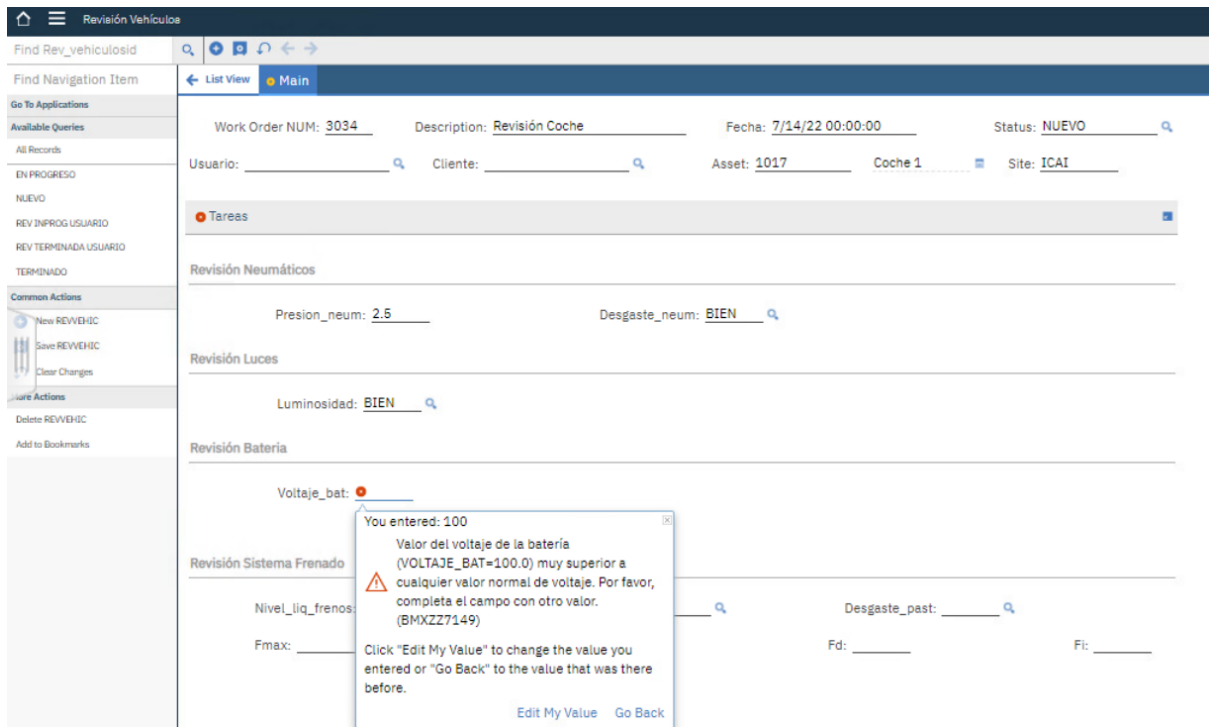When it is filled in, the error messages appear if a field is not correctly completed:

Figure 8: Error messages

Once filled in, 2 new work orders are automatically created, as the battery and braking system values are not correct:

Figure 9: 2 new WO Childs

On the other hand, the Escalation of the workshop machines automatically cancels the second and third tasks if the first one is set to 'TERMINADA':
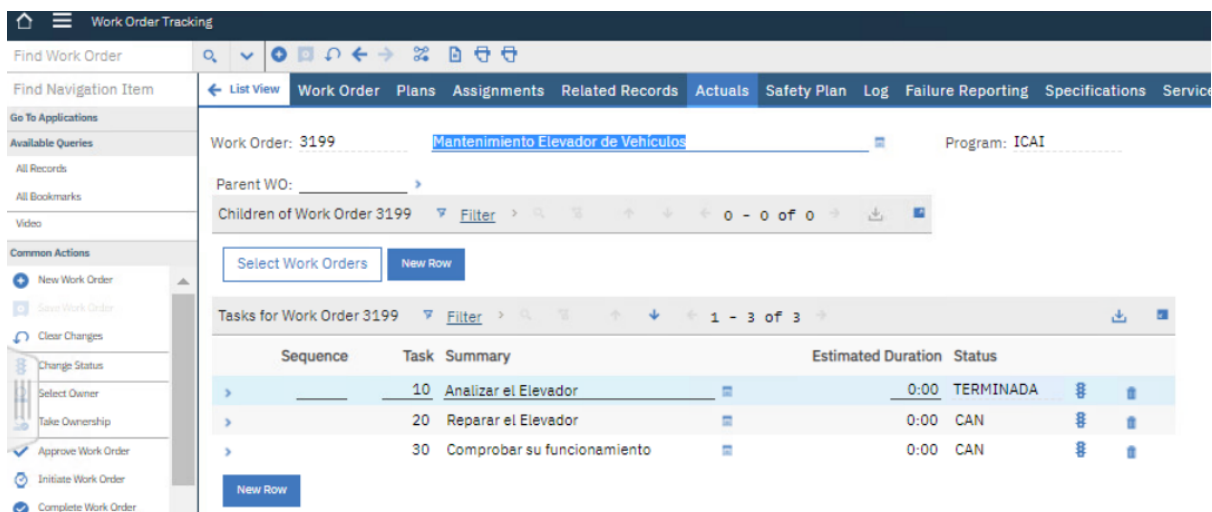

Figure 10: Escalation of the machines

The Escalation of Service Requests cannot be tested, as there is no mail service in the environment in which this system has been developed.

The customers and the operator of the workshop will see the following screens when entering the system:
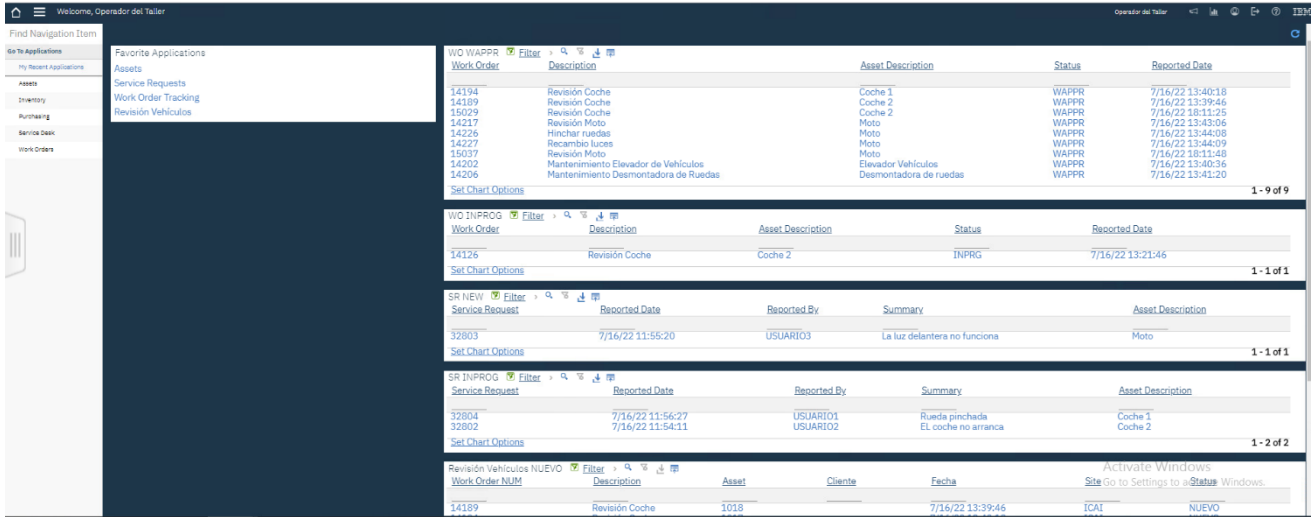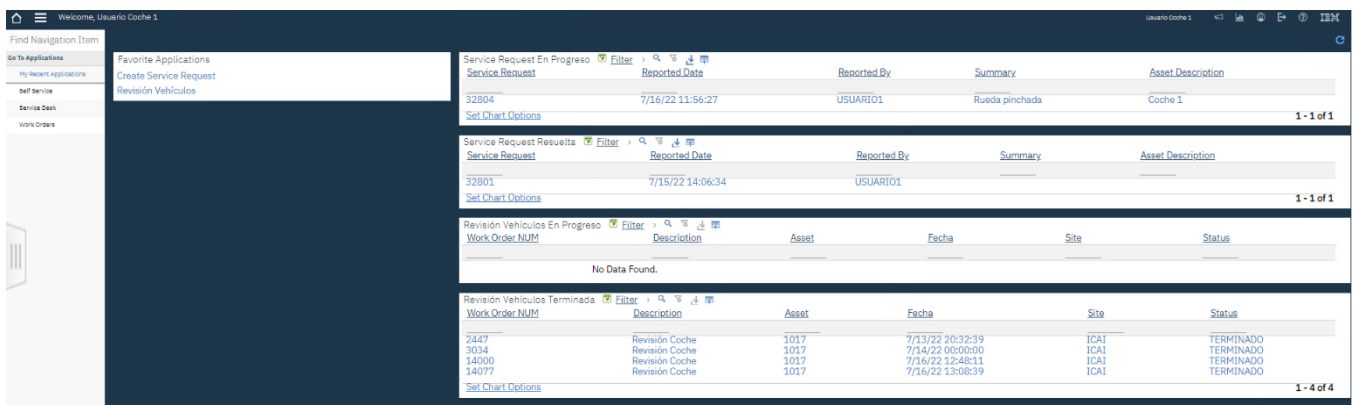

Figure 11: Operator Start Center

Figure 12: Users Start Center

Conclusion

The project concludes having designed and created an asset management system with preventive maintenance. The final objectives that were proposed to create this system in Máximo have been met, and, in addition, more elements have been added to the system than had been proposed at the beginning. It was decided to create a system based on something real, such as a car workshop, and it has been a success, since, with this example, the functioning of the software itself and the entire system created is much better understood.

All objectives have been fulfilled, but, in addition, the objective of creating a new application to make the system more automatic and easier to use for the operator has been added. Thanks to the fact of creating this new car revision application, multiple Maximo applications have been used and interconnected with each other.

Bibliography

1. **Universidad de Alcalá.** LAS PRÁCTICAS DE DIGITALIZACIÓN IMPLEMENTADAS EN LAS EMPRESAS. *Revista Prisma Social.* [En línea] 21 de Diciembre de 2020. https://dialnet.unirioja.es/servlet/articulo?codigo=7742143.

2. **Martínez, Adriana Martínez.** Impacto de la COVID-19 en la producción, empleo y digitalización de empresas en Guanajuato: una primera aproximación. *SCIELO.* [En línea] 18 de Mayo de 2021. http://www.scielo.org.mx/scielo.php?pid=S2007-07052021000300201&script=sci_arttext.

3. **Delgado, Tatiana Fernández.** Taxonomía de Transformación Digital. *Revista de Transformación Digital Cubana.* [En línea] 30 de Marzo de 2020. https://www.researchgate.net/profile/Tatiana-Delgado-3/publication/341051958_Taxonomia_de_transformacion_digital/links/5eab007c92851cb26768fa55/Taxonomia-de-transformacion-digital.pdf.

4. **IBERDROLA.** OPTIMIZACIÓN DEL MANTENIMIENTO. [En línea] https://d1wqtxts1xzle7.cloudfront.net/36903895/_09__RCM_en_MAXIMO_IBERDROLA-with-cover-page-v2.pdf?Expires=1652864667&Signature=adQFDRZRXZDMvcz8xa8UXVuqgS8rs9VBlN7RwLv92S4csEvRkiCMo2J1ljF8iva1EEa4ytX5ibXmeOAIdtiu2rTRbembu24EHfvBd3f4h~WQGbOCqT6ZQI553N6Ouac.

5. **Grupo SANVALERO.** Gestión de Mantenimiento. *Estudios abiertos SEAS.* [En línea] https://d1wqtxts1xzle7.cloudfront.net/36903895/_09__RCM_en_MAXIMO_IBERDROLA-with-cover-page-v2.pdf?Expires=1652864667&Signature=adQFDRZRXZDMvcz8xa8UXVuqgS8rs9VBlN7RwLv92S4csEvRkiCMo2J1ljF8iva1EEa4ytX5ibXmeOAIdtiu2rTRbembu24EHfvBd3f4h~WQGbOCqT6ZQI553N6Ouac.

6. **Iberdrola.** Mantenimiento predictivo: la técnica basada en datos clave para anticipar errores. *Iberdrola.* [En línea] https://www.iberdrola.com/innovacion/mantenimiento-predictivo.

7. **IBM.** IBM Maximo Application Suite. *IBM.* [En línea] https://www.ibm.com/es-es/products/maximo.