

The "Inari of Things" (IoT) at POK

The first step to reach a POK4.0



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Business background:

POK Corporation is a foundry and machine shop located in Guadalajara, Mexico; with over 120 years in the market (founded in 1894). The company has close to 450 employees. POK has one Sand casting foundry and one investment casting foundry. The company has two machine shops, one with conventional machines dedicated mainly for rough machining, and one CNC shop dedicated to finishing machined parts. With its machining capacity, POK is capable to deliver turn-key components to several industries.

The foundry produces approximately 150 tons per month of castings ranging in weight from a few ounces to 10,000 pounds, net-weight. POK produces several alloys such as high-strength steel, stainless steel, low alloy steel, carbon steel, ductile iron, cast iron, bronze and other specialty alloys such as Monel and Inconel. The melting equipment in the foundry consists of six induction furnaces ranging in capacity from 300 pounds to 7,000 pounds and 1 vacuum induction furnace with vacuum pouring capabilities up to 300 pounds. Most of the castings produced are finish-machined in-house by our conventional and CNC machine shops.

Background:

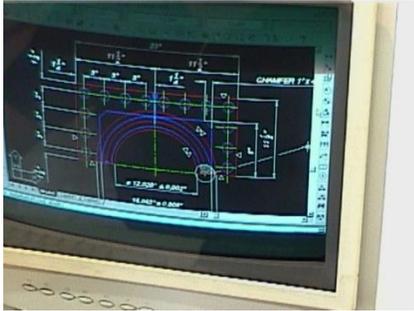
The arrival of the Internet 30 years ago involved a major watershed mainly in access to information, impacting not only on the communication industries but also on all societies around the world, generating a whirlwind of changes that have impacted even our way of life.

With the internet came:

-Immediateness of the information:	Implementation of electronic mail (e-mail).
-Community Networks:	News Groups (discussion forums).
-Social Networks:	First MySpace social network and evolution to the already known Facebook, Instagram, Snapchat, among others.
-Apple and Apps:	Presentation of the first smartphone "the iphone" and the creation of App Store.
-IoT:	The first object connected to the Internet was a toaster that turned on and off remotely.
-Big Data and IA:	The knowledge of customers both their preferences and their behavior to be able to show something that interests them, examples ads on the web.

And while all this was happening in our homes in POK we had this:

POK from 20 years ago:



Machine Interface.

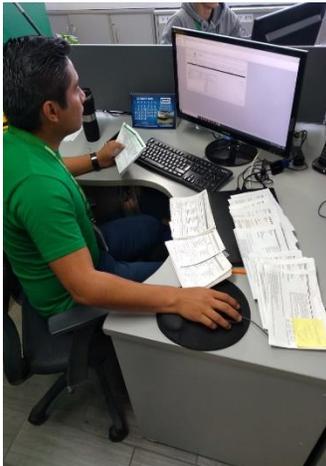


Engineering department.

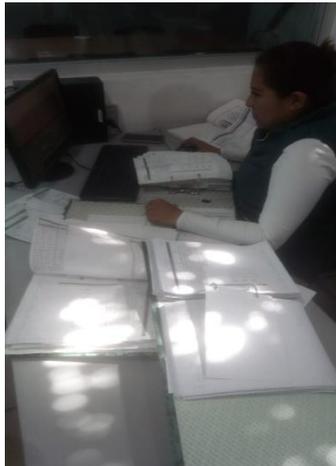


Machine operation.

POK 1 year ago:



NCR registration from paper to software.



Review of work routes and merger plans.



Machine operation.

This is evidenced by the technological difference that has been generated in recent years between the foundry industry and other more technologically advanced manufacturing industries. So, while we wonder where the defect of a piece comes from, out there they have Big Data and AI working for them. While we are looking for information between paper records, excel tables and databases or in the precarious and doubtful memory of the operator, on the screen of my smartphone and most cell phone users we get a notification to go see the movie that we were waiting for and with a single click will be responsible for buying the tickets, charging them to my favorite account, selecting the cinema we most frequent, the seats we prefer, choose our favorite snacks and drinks, and they know so much about me that only advertisement of things that I will consume appear on my screen. Of course, this can be seen as pure vanity, we have not mentioned topics of great relevance and none of this is a need that substantially helps humanity or business.

Let's talk about other topics. Now we can know not only what I am sick of, but what you can get sick of in the next 10 years, how I can prevent it, what hospitals and doctors are indicated near the area where you are and they do not have to walk finding out your history, wherever you go everyone can know your complete medical history. We can know in which season our employees are more productive and what motivates them to do so, what are their concerns and what detracts from their development in such a way that we can encourage them based on their needs and this therefore drives the growth of the entire company.

Overview:

One of the headaches for POK has always been the complete piece-by-piece monitoring that we offer our clients without the proper system for it, causing mountains of paperwork, lost documents, work records and damaged and illegible processes, for such a lot rework in generating the damaged documents again. To this we must add that we had a variety of support software, one for production management, another for accounting processes, one more for purchasing and HR stores and one more for maintenance management, not to mention that Each machine brings a different control; All these systems without a communication between them and no web development. This meant:

- Pay multiple licenses.
- A lot of work on updates on each PC.
- Depend on many external for the maintenance of control equipment.
- Errors when copying data between one system and another.
- A lot of time spent recovering damaged or lost documents.
- Delayed communication of production failures.

For all this we designated a work team with the task of directing POK to the philosophies of Industry 4.0, having as a goal a plant with prediction and prevention of defects, real-time communication and in the whole process of casting and machining, as well as self-regulation of equipment parameters adapting to the circumstances of their environment. This would be a Bigdata / AI in a foundry and to get there, the first step that had to be taken is the IoT.

The procedure that is being followed to make POK an industry 4.0 is as follows:

1. Development of INARI

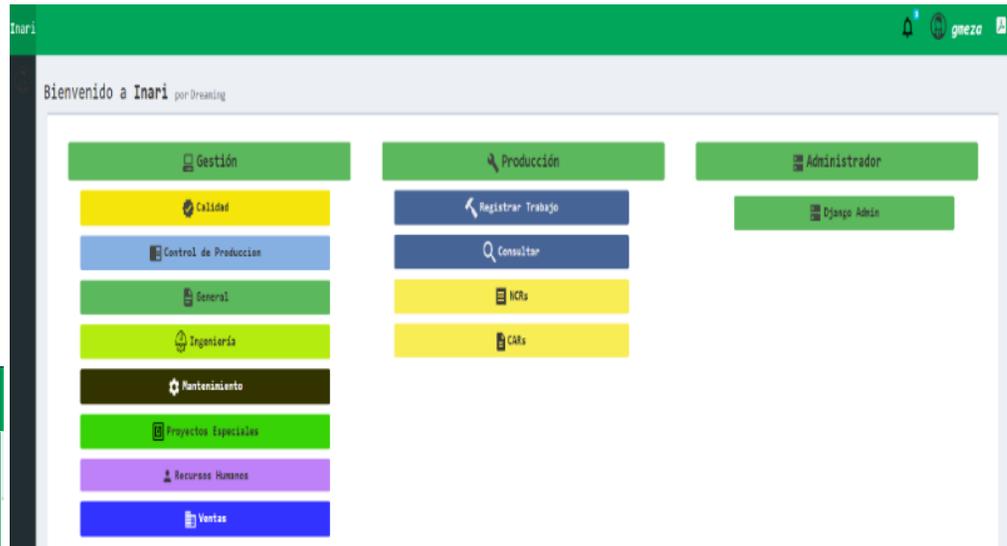
In POK, various platforms were used to meet the needs of the different work areas of the company, however, as stated above, this generated a lot of time and logistics problems, so it was decided to start developing INARI.

What is INARI?

INARI is an internally developed web platform capable of adjusting and modeling quickly and efficiently, to the needs of POK, even the most specific ones. This broadens the landscape for POK, since the benefits that INARI provides start with the savings in license payments and continues with:

- Having a work team dedicated solely to the development of INARI which allows a quick response to the innovations or updates requested by the different work areas.
- We eliminate the use of paper to track the processes of the pieces, NCRs or record of NDT results because the information flows in real time.
- INARI allows an operator-friendly working environment, so that anyone with minimal to no knowledge of computing or ERP systems can use it.
- Access through usernames and personalized passwords that provide control in the production process of each piece, improving traceability and even measuring the efficiency of operators.

POK areas managed by INARI.



Users in INARI.

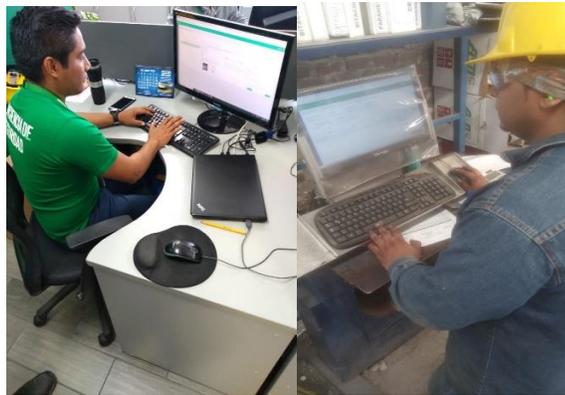
2. Network installation throughout the plant.

Firstly, a robust WiFi network was installed across the plant to access Inari (and later Groov) from any device throughout the plant.

In addition, to support the capture of real-time information and monitoring of the pieces, tablets, and workstations were installed that allowed the user to interact at any time with the process of the piece.

Installed workstations required minimal capabilities to access INARI:

- You do not need windows or any other type of software, only a browser and internet access.
- No type of license is needed.
- Because all the information is processed on the server, a PC with large capacities of RAM or powerful processors is not required.



INARI in HHRR.

INARI in floor.

3. Start the IoT implementation plan on machines (Groov).

Groov is a web tool that allows us to program and configure Human-Machine Interfaces (HMI) to control and monitor in real time the equipment, machines or production lines.

Groov, like INARI, allows anyone with a computer, tablet, PC or smartphone, with internet access, a username and password to access it.

Inari and Groov could be considered not-so-distant cousins, since while INARI helps us with the management of general information throughout the plant, Groov has a direct real-time connection with the PLCs that helps us assess the status of any machine connected to this system.

In Groov there are different levels of security that allow the operator and the supervisor to display different screens of the same machine, this allows controlling the content that will be shown to each person who oversees the same machine.

In POK most of the machinery already implements this communication system, however there are still equipment that in the future they seek to include in this same network.

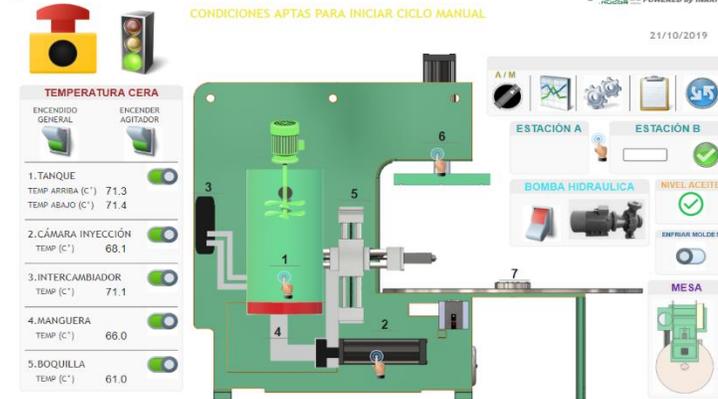
BEFORE GROOV:



Control of a wax injector and a vacuum induction furnace.

WITH GROOV:

← WAX01 - Inicio



HMI of a wax injector.



Operation of a heat treatment furnace.

4. Interconnection between devices with IoT. Opto22 with Inari (BD).

Opto22 allows to communicate with other databases thanks to its "OptoDataLink", making the connection with INARI even easier.

- The communication between these two systems allows the operator to manipulate parameters that directly affect the machine process from INARI, this has several advantages:
- Reduces the number of platforms used in the company.
- This connection allows INARI to obtain historical data of the process that could be used to evaluate the working status of the machine and that affects the parts produced in it.
- The parameters that INARI sends to the machine can be modified and approved by the relevant departments and thus avoid "finger errors" by the operators.

Example:

Bienvenido a **Inari** por Dreaming

Productos

Q p0597f

Producto	Apodo	Material
P0597F	Casting M1 Removable Coupler Mounting Plate	AP350-85

Características Especiales

Altura:

Volumen:

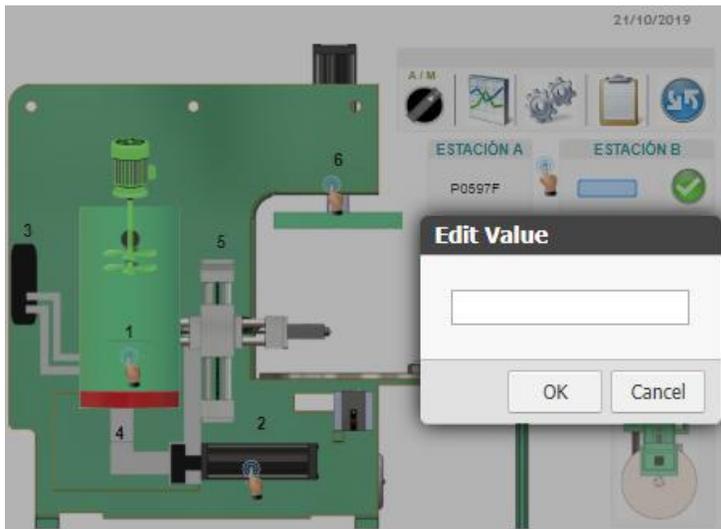
Tiempo de enfriamiento: min

Guardar

Registration of a new mold.

First, the molds to be injected into the machine will have to be registered.

In the case of POK this process can be done by the engineering department.



Production.

Meanwhile, the operator of the wax injection machine will only have to enter the part number you wish to inject.

This example is achieved because the mold records are stored in a database within the INARI server. Within the source code INARI only seeks to receive a part number with certain characteristics that allow it to be compared with the others it has already stored.

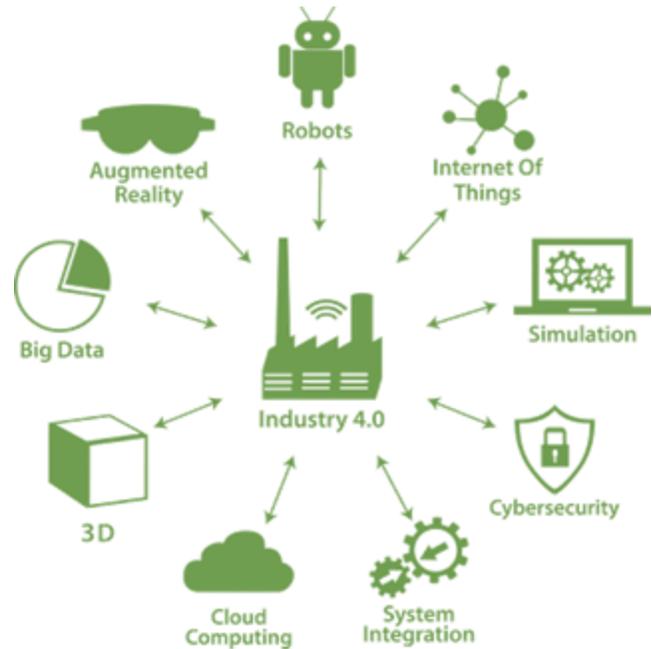
Once INARI finds the desired part number, it communicates with the machine's PLC to send the data assigned to that specific part number.

5. The future

In the future it is intended that all the critical production equipment be connected to the network, as well as continue increasing the modules that Inari can manage (either developing if they are very specific to POK or simply connecting to existing ERPs).

With this we seek real-time communication and regulation of parameters in all machines within POK, so that they can be able to adapt to the circumstances of their environment and thus achieve efficient molding, casting, shake-out, heat-treatments, NDT's and machining of parts, so as not to depend on expert operators and even help engineers in the work of defect analysis.

The final objective is to have a production platform as intelligent as the years of experience that man has in metal casting and thus be able to turn POK into a 4.0 industry.



4.0 Industry.

Conclusions:

- Evidence of lack of use of these technologies in the foundry.
- Real-time information that allows immediate action.
- The first step for a BigData / AI is the IoT .