Case Study
NGK Ceramics

Location Intelligence for Asset Tracking: The NGK Ceramics Case Study

INTRODUCTION

NGK Ceramics[1] is a global specialist in the manufacturing of ceramic substrates used in catalytic converter applications for automotive, truck and off-road vehicles. The US manufacturing facility, located in Mooresville in North Carolina, covers more than 500k square feet and it is running 365 days a year, twenty-four hours a day.

The facility was initially designed in 1988 to serve a limited geographical area in the US. However, with the business growing faster than expected and more areas being served by the same production plant, NGK faced a major challenge: how to grow the capacity of the North Carolina industrial plant, in order to keep up with the market demand. Efficiency was clearly the answer. As a first step, ASRS (Automated Storage and Retrieval Systems), together with AGV's (Automated Guided Vehicles), were introduced to move pallets and materials in the shop floor without human intervention.

[1] https://www.ngkceramics.com/

Even if this mitigated the problem, it was still not enough to manage high, yet variable, production demands in the long run. As a result, during production peaks, the pallets transporting both raw materials and semi-finished goods were temporarily stored all around the shop floor according to specific procedures. While this addressed the problem of lack of (ASRS) storage space, it introduced a significant new one, the additional time spent finding and moving pallets from one production phase to the next. At least two workers per shift were assigned to this task: just searching for and moving pallets.

In addition to this, at least once a year a complete plant inventory is required to verify all materials stored in the facility, but not yet shipped or sold. During this activity, the entire plant was surveyed, and all pallets were identified and verified against the data registered in the internal ERP system. This activity could take up to one week, with the slow down (if not interruption) of the production activities. Inevitably, any items lost or duplicated created an impact on the bottom line.

Figure 1: AGV in NGK factory and "*focusing*" activity by ThinkIN team

In order to deal with these issues, and with the continuous increase in production demand, in 2017 NGK Ceramics decided to explore how solutions based on a Real Time Locating System (RTLS) could help by providing a Digital Twin of the manufacturing plant: the location of every pallet would be tracked continuously and that data would be synchronized with NGK's MRP systems. This tracking of pallets provides a real-time view of where they are located in the industrial plant, with a number of supporting services to easily and rapidly search them and manage the production cycle. After an evaluation of more than eight solutions, ThinkIN technology, together with the Quuppa Intelligent Locating System™, was chosen based on a number of criteria including: accuracy, maturity of the solution, total cost of ownership, infrastructural requirements and support for a broad variety of services.

TRACKING SOLUTION: REQUIREMENTS

NGK Ceramics decided to evaluate a number of different scenarios for implementing a RTLS to track the progress of material and semi-finished goods throughout the flow of its manufacturing process. The key requirements to be addressed by the solution were:

- **Configurable tracking accuracy:** since the industrial plant covers a large area (approx. 500k square feet), with different uses of the spaces within the plant (production area vs. stocking areas vs. corridors), the ability to vary the localisation accuracy of asset tracking was important. In some areas, where the density of pallets is typically high (such as the warehouse) sub-meter accuracy is required in order to easily locate a specific pallet among the many stocked there. On the other hand, a 10 metre accuracy is sufficient in corridors or transit zones, where it is sufficient to track the presence of the pallet in the zone;
- **Infrastructure cost**: as NGK Ceramics facility is rather large, the number of RTLS antennas required to achieve the desired accuracy was clearly an important variable of the solution to be adopted. This impacted both the cost of the infrastructure as well as the costs related to the cabling (e.g., connectivity and power). Another factor was the cost of the tags to be attached to the pallets. This extended beyond the capital cost to also include the cost of replacing the batteries in the tags.
- **Asset search and localisation functionally** : NGK wanted this Digital Twin to be used in a variety of ways, from centralized systems to hand-held devices using a Google maps style red dot metaphor, so how the system was able to process the information and extract actionable knowledge for the final user (the worker in the shop floor) was important. This required addressing issues related to the usability and ergonomics of the system, Machine-2-Machine (M2M) application integration, while delivering on its intended use and the need to facilitate the searching and localisation of assets.
- **Maturity of the solution**: an enterprise-ready solution was requested. This refers to the support for active monitoring services of both the platform and the RTLS infrastructure. Any device or software component deployed in the facility needed to be monitored, with notifications sent in case of anomalies in the system. This includes the battery status of the devices/tags used for tracking the pallets

DIGITISING THE PRODUCTION PROCESS

NGK retained the services of Statler Consulting[2] a specialist in the area of beacons and RTLS technologies, and issued a Request for Proposal (RFP) for a solution able to track in real-time the assets in their facility, and to deliver the necessary supporting services for the optimisation and real-time control of their production process.

Among the many solutions proposed, ThinkIN[3] was chosen as it proved to be the best match to the requirements identified by NGK. ThinkIN is an IoT platform for real-time tracking, monitoring and control of assets and workforce in industrial environments. ThinkIN technology is based on Quuppa[4] RTLS for the high precision localisation of assets in the shop floor. Quuppa utilizes a unique combination of Bluetooth Low Energy (BLE) and the Angle of Arrival (AoA) methodology, as well as advanced location algorithms that have been developed over the course of more than 15 years, to calculate highly accurate, real-time indoor positioning, even in the most demanding environments, including inside warehouses and manufacturing facilities. The low-power system is a customizable, scalable solution for providing an accurate "dot on the map."

Figure 2: ThinkIN for Industry

ThinkIN platform provides a comprehensive set of services ranging from real-time support (e.g, asset search and localisation, alerts and geo-fencing, etc.), to Industrial IoT analytics. It also includes a number of tools to support the active monitoring of the infrastructure (both hardware and software) and a comprehensive set of user interfaces to explore the data collected and used to locate assets in real-time in the shop floor. In terms of tracking technology, Quuppa RTLS provided an optimal trade-off in terms of localisation accuracy, number of antennas required to cover the NGK facility and maturity of technology.

[2] https://www.mister-beacon.com/
[3] http://www.thinkin.io/
[4] http://quuppa.com/

Overall 95 antennas are used to cover the complete NGK facility, with a localisation accuracy of approximately one meter in the areas of interest and approximately 5 meters in other areas. Different tag form factors were evaluated. Eventually, a custom Bluetooth Low Energy tag with a slim badge form factor was designed and manufactured in order to optimally align with NGK's existing manufacturing process. The tag ensures 4+ years of life without battery replacement.

Pallets, carrying products or semi-finished goods, are identified by means of their Product Travel Ticket (PTT), which includes all the necessary information about the kind of product manufactured, together with information on production stage (e.g. forming line, firing in kilns, etc.). At the very beginning of the production process, an RTLS TAG is associated with the pallet Travel Ticket through a mobile application running on a Zebra scanner. The application allows the scanning of both the QR code present on the PTT and the QR code on the TAG. This association creates a Digital Twin of the pallet, which is now tracked in real-time throughout its manufacturing process. The pallets can now be easily located through the ThinkIN mobile service. Additionally, plant-level views allow staff to monitor the status of the pallets across the entire facility, maintaining an always up-to-date inventory of all pallets stocked or moving in the facility.

Figure 3: Tracking of assets in NGK facility

This system allows staff to maintain an always up-to-date plant inventory with precise information on where every pallet carrying product is located. Starting from ThinkIN open APIs, a dedicated mobile interface was created for an optimal utilisation of data over the shop-floor and to facilitate the work of employees in the search and localisation of pallets with a specific Travel Ticket.

Additional services delivered through the ThinkIN platform enable the quality control of pallets depending on their production stage, with alerts being triggered if the pallet moves into areas not allowed.

To prevent this, a specific geo-localised workflow is imposed on the travel path of pallets depending on their production process. Warnings are raised when the specific workflow is not adhered to.

LOOKING AHEAD

The project started in 2017 with an initial pilot phase, and is now scaling up to the entire production plant with a possible extension in the coming years to other NGK manufacturing sites.

NGK is planning to obtain a return on their investment in a 2 year time frame.

Today we are in year two and ThinkIN solution is integrated with the production control system adding value to the manufacturing process by making the pallet searching process more effective.

ThinkIN's platform has allowed NGK to digitize the shop floor by recreating the plant on screens accessible to all workers. Thanks to the data collected by tags and devices, workers can use the interface to find pallets around the manufacturing plant based on the information of the goods transported by the pallets, such as product type, bench number, kill cycle, and other key criteria for the production routing.

The efficiency of the shop floor was significantly increased thanks to ThinkIN for Industry. In the first year, NGK Ceramics reduced the costs of the wasted time searching for pallets and of the time spent doing the annual inventory. Thanks to the new solution, the inventory is constantly up-to-date. Moreover, the accuracy in tracking reduced the risk of accidents caused by the movement of pallets with forklifts in the shop floor searching for the needed pallet.

ThinkIN for Industry, therefore, is a location intelligence technology that by capturing data from the shop floor in a digital platform offers the chance to automate the real world in new ways that can enhance and optimise workflows in the shop floor.

In partnership with

Quuppa

ABOUT THINKIN

We are web analytics for physical spaces. We make a physical space smart where movements of people and assets are monitored in real-time, analysed, transformed into actionable KPIs and used to suggest interventions able to optimise the efficiency of processes and enhance customers experience.

ThinkIN for Industry 4.0, our product for industry, is an advanced IoT/Big Data solution for the Smart Factory. ThinkIN uses IoT technologies to monitor in real-time and with high accuracy the position of workforce and industrial assets in the environment. Such raw data is processed in the cloud to extract actionable knowledge on the execution of industrial processes and to optimise the factory efficiency.

Want to know more about how ThinkIN can improve your retail business?
Contact us for a live demo and a quote!

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