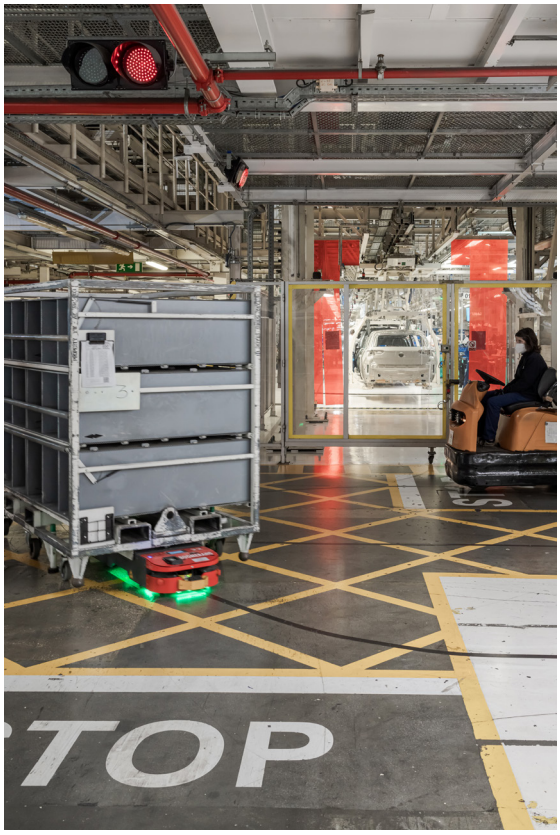
Reference

Can a real-time locating system teach automated vehicles to see traffic lights?

Volkswagen Autoeuropa is one of the most advanced production facilities of Volkswagen in Europe. Every day, more than 5,000 employees work on its premises. Every year, nearly 200,000 cars are produced in its assembly lines.

This means countless car parts, and countless vehicles transporting them, cross the labyrinthic corridors of the factory to make their way to the teams responsible for assembling them. And that causes traffic. The same amount of traffic that can be seen in any small city.

Volkswagen Autoeuropa increasingly relies on automation, so many of the vehicles crossing these paths are AGV's: Automated Guided Vehicles that take some parts to the assembly lines, while human piloted tugger trains transport others. Thus, to regulate traffic in the crossroads of the factory, a system had to be created so that AGV's could "see" traffic lights just like the drivers of tugger trains do.



To regulate traffic at the crossroads of the factory, a system had to be created so that AGVs could "see" traffic lights just like the drivers of tugger trains do. Diogo Graça sums up the customer benefits quite simply: "I go through that crossing everyday now, and I feel kind of proud with it."

Volkswagen Autoeuropa approached Siemens with the need for a solution that would grant higher safety and controlled flow at each crossroad of the factory, while laying the path for further automation.

The solution is a combination of the SIMATIC RTLS system and traffic lights, connected to industrial controllers and the Location Intelligence software, which allowed processing of traffic data as well as instant and flexible management of virtual geofences throughout the factory. It brought old and new technology together, and the rules of city traffic into the crossroads of a major automotive factory.

Focusing on higher safety standards

The following key numbers illustrate the amount of tugger trains and vehicles crossing paths in this exact point of the factory every day and every hour:

- Around 120 vehicles crossing per hour (AGVs and tugger trains)
- Prospect for the line, feeding process of the assembly line: over 200 AGVs and rising

According to Diogo Graça, Logistics Planning Specialist from Volkswagen Autoeuropa, "the focus here was less about an increase of efficiency or productivity. It was mostly about establishing a safe flow between manual operated assets (tugger trains) and Automated Guided Vehicles (AGVs). Long before the introduction of AGVs, the area was already known for its limited visibility and narrow corridors. Typically, the reaction of the human drivers on the tugger trains allowed accidents to be avoided, however, with the introduction of AGVs, it became impossible to assure a fluid operation between our logistics assets. It was clear that we had to plan a solution, which enabled safe crossing for both tugger trains and AGVs."

A system had to be designed to make vehicles stop whenever others were crossing.

A fruitful partnership beyond the pandemic

According to the needs of the factory, Siemens partnered with Introsys to design a system that would require the most secure, highly available, and reliable production network. It became an international cooperation among Portuguese and German engineers as well as technicians from Volkswagen Autoeuropa, Siemens, and Introsys.

Siemens provided the hardware and software as well as the RTLS solution expertise, Introsys the software development, programming, and implementation.

COVID-19 was a challenge all the way. Most of the development and implementation were made under the restrictions of the pandemic. According to Diogo Graça:

“Everything was put in place during the summer shutdown in 2021. And besides all the natural constraints brought by the pandemic, it also became a challenge to bring in technicians from Germany.”

“Working during the pandemic was a huge challenge, especially in the early stages of the implementation phase, where most of the staff had to work from home – you had to remotely manage hardware assembly in the shop floor (gateways, transponders, etc.) and also signatures/ approvals to move the project forward.”

The game changing combination: ultra-wide band gateways and RTLS software

Nelson Alves, Automation Engineer from Introsys, was one of the engineers with the responsibility of placing the system in the factory ground.

He points out the importance of the specific choice of the gateways: “The wireless locating network was to be placed in a factory environment and a production environment, where there is an overload of Wi-Fi signals and automated machines working at the same time. The choice of the Ultra-wideband (UWB) gateways developed by Siemens was key to render that interference null since they work on a totally different band. Any interference on the flux of the tugger trains or the AGVs would imply a stop in production.”

So, the UWB technology was a gamechanger in this project. And then, what about the rest? How do you teach an AGV to “cross the street”?

In this particular crossroad of Volkswagen Autoeuropa, where the solution was first tested, the amount of AGVs working right now is around 15 and counting.

According to Nelson Alves and António Ascenção Castro, Digital Connectivity Engineer from Siemens, it is all about sending constant commands telling it to move or not to move.

There is no key optical sensor, no optical reading of the traffic light. It is the geofences on each area that works as an alert whenever an object is crossing the area. The data is read by the system, and an instruction is transmitted back to the AGV, commanding it to stop.

The gateways must operate flawlessly. The software must be extremely reliable. Siemens' hardware, such as the RTLS4030G gateways as well as the RTLS4030T and RTLS4060T transponders on the vehicles, was a crucial part of the solution, as was the Location Intelligence software, to create the geofences, track the movement of the different vehicles in real time, and optimize the routes and processes.

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What had to be created from scratch? According to Nelson Alves, all the locating and communication technology had already been developed by Siemens. But all the programming for these specific systems at Volkswagen Autoeuropa had to be created from the root. Every second, there would be around ten telegrams being exchanged between all controllers and platforms that integrate the RTLS solution.

António Ascenção Castro evaluates the outcome of the project as an example for cooperation between local and international partners: "There was full cooperation from Volkswagen Autoeuropa, our customer; and the work made with Introsys is a model to follow. Without a doubt, our i-Experience Center partner ecosystem was crucial for the success of the implementation."

How fast did the staff adapt?
A smart solution is a solution that everybody understands quickly.

According to Diogo Graça, that was exactly what happened: "In half an hour, all movement was disciplined in that crossroad. Once the workers realized that the traffic lights were working, all circulation was regulated efficiently."

"Actually, the change was more meaningful than expected: workers were pleasantly surprised and welcomed a traffic authority to manage asset circulation, immediately recognizing the increase in safety when crossing the area."

People on the shop floor confirm that the situation improved outstandingly. Before RTLS, the crossing was disorganized and prone to accidents. But the general opinion now is that crossing this part of the factory has become a lot easier. Control of the quality of movement has been immediate. The teamwork between Volkswagen Autoeuropa, Siemens, and Introsys has become a widespread success.

In the end, Volkswagen Autoeuropa gained a new solution that allows production processes to become more efficient, safer, and faster in the years to come.

Optimizing the route and managing traffic lights are essential with the help of the virtual map and the analyzed data.

And from now on, a lot less or probably no incidents will happen at that crossroad.

According to Introsys: "The customer's feedback was excellent, and they are planning on expanding this solution from now on". Indeed, requests are being made to apply the system to other logistic areas of Volkswagen Autoeuropa, such as automatic unloading machines in the warehouses.

Future developments: a clear path for analytics
One of the most ambitious developments that can arise from this SIMATIC RTLS solution lies in the potential of all the data it produces.

It is raw material that can be interpreted by many different analytics tools, allowing monitoring, control, and even simulations – for instance, to plan better logistic routes for the tugger trains. Such routes can be planed, detoured, and changed almost instantly and with a single tool.

According to António Ascenção Castro and Nelson Alves, "The analytics of data produced by the system could be applied to all kinds of vehicles: Cleaning Carts, Support ... even bicycles that are used internally in the factory. Essentially, the tracking tools of these vehicles are constantly producing simple but extremely valuable data."

A speed limit all over the factory was successfully implemented thanks to this technology, as well as inefficiencies. These assembly lines work on a just-in-time basis, so the control of the whereabouts of each mechanical part is extremely useful. Also, suggesting alternate routes for the vehicles, whenever the need occurs, could be very important.

As long as the required ethical questions regarding the use of data are addressed, the potential of this data analysis for management purposes is unlimited.

Highlights of the solution

- Production processes become more efficient, safer, and faster
- A lot less, probably no incidents happen at the crossroad since implementation
- Digitalization and data recording adds transparency to the management process: it allows to keep a track record of every logistic vehicle and the car parts it's carrying
- The technology is adaptable to other safety matters: not only crossroads but, for instance, allowing the automation of warehouses to avoid collisions with the use of geofences

Volkswagen Autoeuropa

Founded on December 3rd 1991, Volkswagen Autoeuropa is a 2 million square meter production plant located near Setúbal, in Portugal. It has constantly been a beacon of innovation and a driving force for research and technology, allowing many other companies to flourish in the wake of its activity.

Like in any other automotive production facility, Volkswagen Autoeuropa is extremely focused on creating the highest amount of value in the shortest time possible and in the most effective way available.

Thus, a progression has continuously been made towards the automation of many processes. And, of course, the flux of parts for the assembly lines is a key part of the production operation.

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