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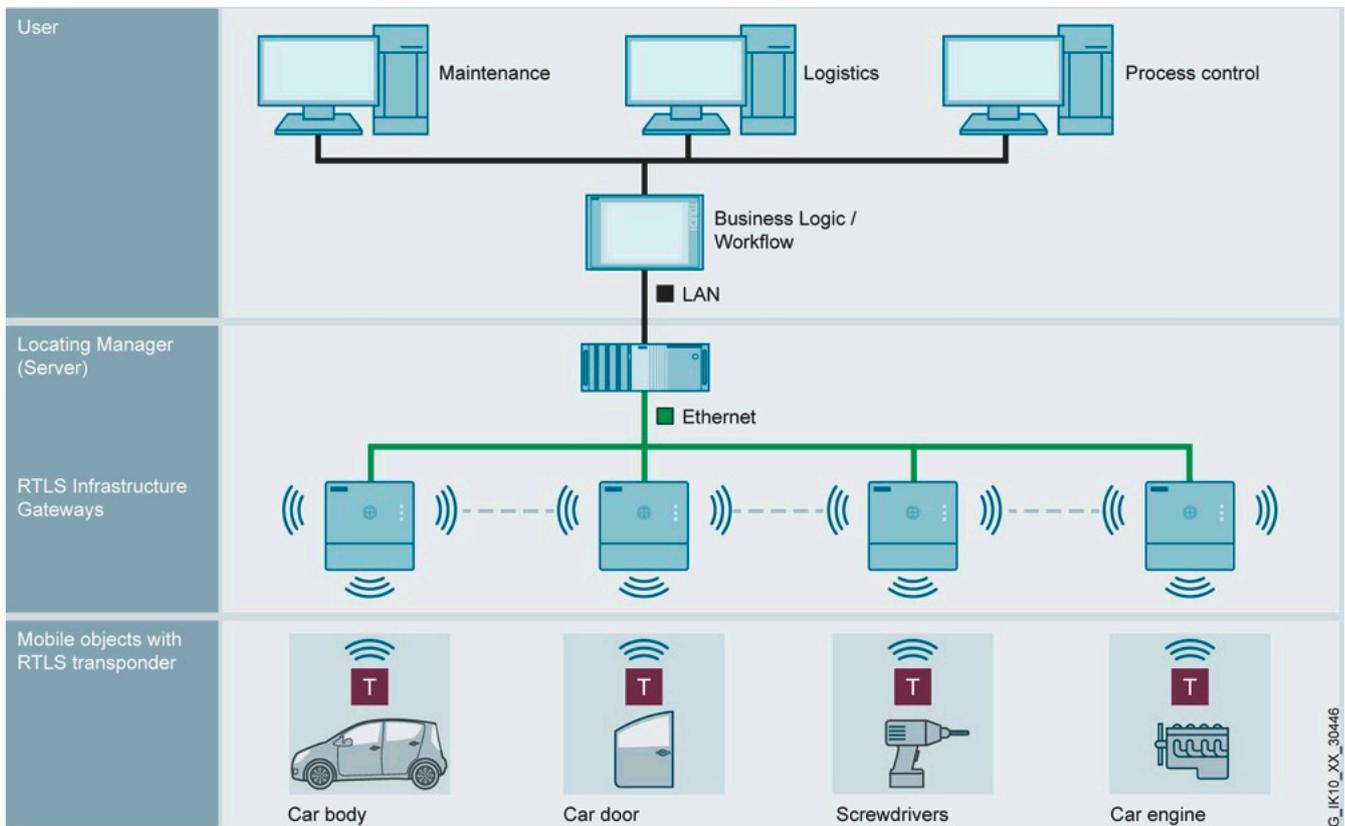
Efficient, reliable, paperless: Full transparency in the automotive assembly

A German carmaker relies on large scale, innovative, and high-performance real-time locating to precisely determine the position of car bodies, components and logistic goods down to an accuracy of ± 30 cm. Through this system, the carmaker realizes paperless pre-assembly and final assembly processes that are released automatically and only in their designated positions and with all correct combinations of parameter. The end result is a system that increases efficiency, reliability, and quality.

As a result of positive experiences from two preceding projects, a premium German automobile manufacturer recently optimized the pre-assembly and final assembly processes of a new plant with SIMATIC RTLS, the real-time locating system from Siemens. At the customer's proverbial greenfield, tailor-made processes based on Siemens' locating platform were implemented, some of them installed simultaneously alongside production setup. Specialists from Siemens Chemnitz planned, installed and commissioned this record-breaking sized installation.

What is real-time locating and what can it do?

The real-time locating system SIMATIC RTLS utilizes only a few and easy-to-use components. The first, known as "transponders," can be attached not only to workpieces, workpiece carriers, and tools, but also robots and automated guided vehicle systems. These transponders send position signals at defined time intervals to the second piece of SIMATIC RTLS, known as "gateways".



These “gateways” are higher-level infrastructure devices that capture the transponder signals and transmit them to locating manager software installed on a local server. The locating manager software calculates the positions (XYZ coordinates) of the transponders and makes this information available via defined interfaces and configurable rules to the user’s business logic. In real-time and accuracy down to a few centimeters, this system allows the user to track positions of up to several thousands of components at once.

Ultra-wide band technology (UWB) for reliable communication

SIMATIC RTLS utilizes ultra-wide band technology (UWB) for locating with a wide frequency range (3 to 7 GHz) and a bandwidth of at least 500 MHz. This enables short range communication with relatively weak wireless signals with a verified transmission reliability of 99.9996%. The 2.4 GHz range is only used for data transmission, such as updates of the transponder firmware or signals for time synchronization. Wireless LANs in the production are therefore not affected by the UWB technology of SIMATIC RTLS.

Locating and logic for process-reliable assembly

The position data determined by the RTLS is an essential parameter for logical combinations at the interfaces of the pre-assembly to the final assembly. Likewise, at various workstations in the final assembly and beyond. In conjunction with geo-fences (virtual, freely definable work areas) around transponders and workstations, very flexible and high-performance processes can be implemented with relatively little effort.

E-ink displays replace routing slips

The use of real-time locating begins in the final assembly by putting a transponder on the painted car body. At this point, the initialization of the transponders takes place: the worker attaches a transponder to the hood and the fixed tag ID is linked to the vehicle data by the higher-level production control system. In an industry first, SIMATIC RTLS4083T transponders with a 2.7” e-ink display were utilized.

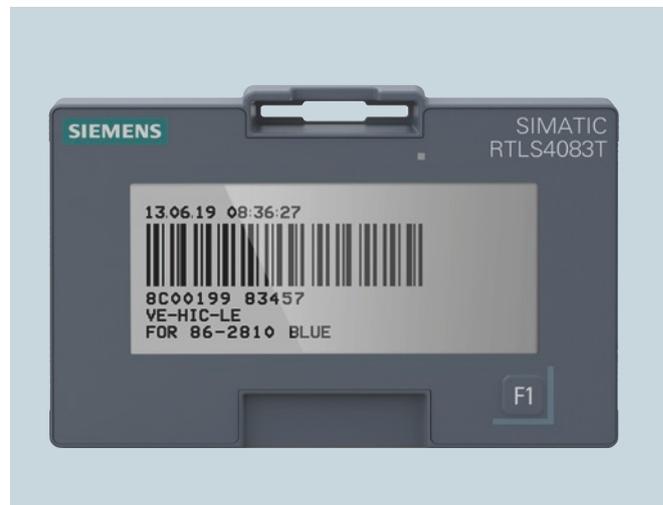
The e-ink displays on these transponders can show any barcodes and plain text the user wishes to display. The transponders with display are basically designed so that different, e.g., station-specific, content can be displayed. During the actual use case of the automobile manufacturer, the display remains the same throughout the entire run. Among other things, the display serves as a safeguard for the carmaker during the production process but is not absolutely necessary for the actual locating process, since relevant data can be assigned solely on the basis of the electronic tag ID and transmitted positions. Even in the case of an unlikely failure of the transponder, the information is retained on the e-ink display, meaning that for example a barcode, can still be captured by a handheld scanner for assigning components and processes to one another. In addition, the workers attaching the transponders onto car bodies receive a clear visual confirmation that the transponder was properly initialized.

At the end of the main assembly line, the worker takes the transponder from the hood of the car body and places it behind the windshield, so that the vehicle can pass through the various testing stations, e.g., the splash water tests, and afterwards still be automatically detected at the various reworking stations and be supplied with the relevant work instructions. In a last geo-fence area, the transponder is removed from the vehicle and all information – including that on the display – is automatically deleted. The transponder is thus ready for the next run.

Strategies for charging the e-ink transponders were clearly defined right from the start, so that the production would not be disrupted under any circumstances. The transponders regularly transmit their charge status so that they can be substituted, quickly charged, and then reintroduced to the production line.

Efficient control of all car parts in the pre-assembly and final assembly

Throughout the final assembly, SIMATIC RTLS and the higher-level production control system ensure that the components, such as cockpits, engines, powertrains, and front-ends always get to the right car body on the assembly line and are recognized at every point of the assembly line even when raised and rotated about the longitudinal axis state.



Several thousands of these new, approximately credit-card-sized transponders – SIMATIC RTLS4083T with 2.7" e-ink display and rechargeable battery – make the automotive pre-assembly and final assembly efficient and process-reliable.

Therefore, the respective workpiece carriers of the components are equipped with a transponder. Thus, the components can run through different assembly steps on separate lines and then be assigned to "their" car body again.

A special application is the locating of the car doors. The transfer of the data from the car body to another workpiece carrier system for the doors presented a particular challenge. Likewise, the deletion of the transponder's display information after the return of the doors to the car body following the completion of the doors, so that the transponder can be used again in the respective pre-assembly cycle.

Automatically verifying and releasing screwdriving processes with OEM transponder

So-called OEM transponders are used to increase process reliability and quality. At present, approximately 160 OEM transponders are integrated into screwdrivers. The configurable geo-fences make it easy to verify whether the right screwdriver or device is at the right place and car body. Only then does the higher-level system automatically release the screwdriving process, which reliably prevents the use of incorrect tools or screwdriving parameters.



SIMATIC RTLS4030T standard transponders are mounted to mobile screwing devices that do not offer the option of integrating a transponder but are to receive automatic releases.

Alternatively, SIMATIC RTLS4030T standard transponders are mounted to other mobile screwing devices that do not offer the option of integrating a transponder but are to receive automatic releases.

Targeting the first expansions

At full production output, more than 4,000 SIMATIC RTLS transponders (Tags) in three variants and in various applications on almost 60,000 m² will contribute significantly to process-reliable, (cost-) efficient, and paperless process sequences.

The automobile manufacturer is completely satisfied with the SIMATIC RTLS solution and its implementation. This is also shown by initial requests for system expansions in the area of intralogistics. And those responsible are considering the use of Siemens' locating platform to standardize all production sites.

Security information

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions only form one element of such a concept.

For more information about industrial security, please visit

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