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Digital connectivity at the Siemens plant in Karlsruhe

Competitive advantages from data

Generating new competitive advantages from data: The digital transformation in industry promises nothing less. Appropriate communication structures and technologies form an indispensable basis for making available the needed information from the field level.

"The complexity of production is ever-increasing, but with the help of digitalization we can handle this complexity well": Manfred Kirchberger, Plant Manager at Siemens Manufacturing Karlsruhe, is not worried when he talks about the growing demands on production. Three causes lead to this increasing complexity, explains Kirchberger. Firstly, the product portfolios are getting more and more extensive to meet the requirements of customers through more and more specialized versions and variants. Secondly, the volatility of demand is increasing at the same time – upswings and downswings are no longer exceptions, but the rule. And thirdly, the customer expectation has also changed, reports Kirchberger: "No industrial customer would understand why an industrial PC has a 3-week lead time while a normal standard PC is delivered the next day."

A core concept in the Karlsruhe manufacturing strategy is the use of automated guided vehicles (AGVs) for the material flow in the plant.

Unobtrusive but effective: The infrastructure with locating (by radio frequency) and network technologies supports a multitude of applications.

Flexible automation instead of rigid solutions

The answer lies in a further optimized automation of processes, while at the same time enabling a new measure of flexibility. This is because a major reason for delays in the production are manual intervention – either due to the automation not working or due to mistakes that need correction. But a tightly linked production is not the right solution to also increase flexibility and limit capital investment. Instead, dynamic structures are needed that can adapt to the respective production program and the current utilization. In Karlsruhe, the strategy implemented focuses on "matrix flow production," and for Kirchberger that is the key difference between a rigid and a flexible automation.

Technologically, the answer lies in a dynamic linking, for example, through the use of automated guided vehicles (AGVs), which serve different points in the factory based on demand. Other technologies include, for example, AI-driven (artificial intelligence) robotics which can solve certain tasks without a training phase, or the concept of additive manufacturing. The thorough planning of the layout and the processes in the factory is replaced by a self-organization, which is essentially based on communication between all systems involved.

Communication as basis for dynamic structures

However, this comprehensive, highly available, and flexible communication between the systems as the basic paradigm of modern production requires both new technologies and the development of a suitable infrastructure. Technologically, especially wireless communication is paramount. For one thing, this is about a high-performance and robust WLAN infrastructure, which is essential for the data exchange with AGVs and mobile robots.

To meet the demands of the manufacturing environment, Siemens has equipped its Industrial WLAN network components with important features such as the PROFINET Transparent Mode, which makes the configuration for AGVs particularly simple. In the future, Industrial 5G will also play an important role here. Technologies such as the real-time locating system (RTLS) also help to close the gap between real and dynamic processes on the one hand and the digital image on the other – automatically and in real time. For instance, SIMATIC RTLS is currently being tested at MF-K (Siemens Manufacturing Karlsruhe) as a replacement for the manual recording of barcodes and for the control of the material flow. The RTLS transponders with display in particular enable new types of communication between humans and systems thanks to the dynamic depiction of information.

But not only wireless communication is facing innovation. Wired communication focuses on end-to-end networking across all levels, while still addressing the specific needs of different segments. At the field level, the emphasis remains on the reliable provision of real-time communication for the control of machinery and equipment. However, more and more data sources are being created here, such as for video analysis or the transfer of information to the cloud. To meet both requirements, the new network technology of time-sensitive networking (TSN) offers options for graduated quality-of-services. Thus, some of the network resources can be reserved for real-time communication, while other services run at lower-priority levels. At the higher network levels, the spotlight is on reliability, for example, achieved through the use of redundant network structures based on the media redundancy protocol (MRP) and SCALANCE X-400 and X-500 Switches. Data security is also of the utmost importance and is realized, for example, through SCALANCE SC-600 Industrial Security Appliances.

Digital connectivity: The basis for advances in productivity

For Manfred Kirchberger, the digital transformation of the Karlsruhe plant is definitely a success story. In a separate innovation laboratory, new technologies are rapidly tested using small-scale projects. This allows a decision on the roll-out to be made in a short time. And the close involvement of the manufacturing staff also ensures that technology and people complement each other optimally. "We were able to realize significant advances in productivity on the basis of digital connectivity," says a satisfied Kirchberger.

Manfred Kirchberger, Plant Manager at Siemens Manufacturing in Karlsruhe.

In the innovation laboratory in Karlsruhe, the deployment of technology can be rapidly tested and then brought up for decision-making.

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 constitute one element of such a concept. For additional information on industrial security measures that may be implemented, please visit
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