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Practical implementation of Industry 4.0 concepts

The path toward the Smart Factory involves fascinating interplay between digital transformation processes. AIM pools the necessary expertise and helps businesses with practical implementation.

As a professional industry association for automatic identification, data collection and mobile data communication, AIM-D e.V. encourages the market success of automatic ID solutions that are essential to the digital transformation of industry. The network used its presence at FachPack 2018 in Nuremberg to highlight trends and introduce potential solutions developed by its members. The series of presentations in the TechBox Forum gave visitors the opportunity to learn more about the range of technologies that can be used in digitalising the value chain.

Fraunhofer IPMS, for example, deals with questions such as the forms a Smart Factory can take in practice. The answers will lead to a networked model factory that contains, just like a real production unit, warehouse shelving, autonomous vehicles, robot cells, transport systems, temporary storage facilities, a CNC cutter and a manual workstation. The goal of the project is to create a manufacturing environment in which components communicate with each other and are ultimately able to manufacture autonomously. The entire manufacturing system uses end-to-end sensor technology to monitor material movements and record process and environmental data. Zero-maintenance RFID sensor transponders play an important part in recording this data.

RFID as an enabler for tracking & tracing

As part of a cooperative arrangement with Pepperl+Fuchs, Fraunhofer IPMS investigated how RFID technology can be used to automate material replenishment in production. The partner entities looked at the question of how a small materials warehouse can be made smart enough to ensure that the right material reaches the right workstation at the right time for assembly. The result was an example showing the implementation of an "e-Kanban" system based on RFID. Using this system, replenishments are ordered at the push of a button and delivered by autonomous transport vehicles.

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RFID tags on robot tools are another example of how RFID technology can make manufacturing smarter. These facilitate the automatic identification of tip-changing tools in the tool station and thus also the automatic tool-changing process.

IO Link reduces number of interfaces

Sensors and actuators would be unable to communicate without the right interfaces in place. In his presentation, Hartmut Lindenthal of Pepperl+Fuchs explained the benefits offered by IO Link in this regard. "IO Link lets us make full use of sensor intelligence and opens up new opportunities for automation technology," he noted. Using this technology, sensors can transmit diagnostic data on device status, ambient temperature and service life via a single link. Events such as contamination, overheating and device errors can also be determined, and countermeasures put in place as part of predictive maintenance.

Digitalisation in legacy systems

By integrating predictive maintenance, plant operators can make their production more efficient by avoiding production downtimes. Companies are always on the lookout for opportunities to improve their processes, observed Dr Philip Schmidt of Fraunhofer IMS. This includes optimised maintenance cycles, minimisation of power costs, and flexible production down to single-unit batches. But cross-vendor machinery fleets and a large proportion of legacy systems with long expected service lives demand simple and flexible solutions when it comes to retrofitting sensor/actuator systems and interfaces. A large number of sensors in a manufacturing facility, however, quickly makes the wiring overhead no longer practicable. According to Dr Schmidt, the answer could lie in wireless solutions. These systems can be integrated into moving machine parts without difficulty, and make it easy to retrofit into existing systems. This requires many different systems to communicate with each other, e.g. to ensure material replenishments.

Automated material supply

Peter Schmidt, a qualified engineer from consulting firm Cotecco, reported on trends and practical examples of digitalised replenishment systems. Cotecco supports its customers by providing cross-solution automation of the material supply in Industry 4.0 environments. Schmidt believes that fear of running out leads businesses to maintain excessive inventories, with all

the associated costs that implies. The answer is production on demand, e.g. via a call button or e-Kanban, or fully automated replenishment orders via sensor data. With the latter option, sensors identify which materials are present, and in which quantities. The goal is to request material replenishments at the place of consumption, and thus save costs and time, as well as increasing the information level at both the system and user ends. In an ideal case, the shelf would order its own replenishments autonomously using the appropriate sensors, or the load transfer devices would communicate with the user at a local level via electronic tags.

Hybrid electronics for smart packaging

Thin, flexible and in some cases transparent electronic components open up revolutionary application opportunities for labels and packaging components. Witte Group, with its core competencies in the areas of functional printing and finishing, presented solutions for products such as printed circuitry and functional surfaces, energy storage systems and printed solar cells, smart labels, and also fully printed electronic components. Smart Pack functions range from lighting with printed resistive, capacitive and inductive sensor elements to printed NFC interfaces. Printed elements in packaging serve as NFC sensors to record temperature to monitor the cold chain, for example, or measure pressure and humidity. Optical and digital security features can also be integrated. As an electronic anti-tampering device, they meet security requirements in the pharmaceutical industry.

The presentations by AIM show how complex the digitalisation process is in detail. Discussion between the various players, however, delivers practical and future-oriented solutions, as the collaboration between the network members shows.

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