

SMART FACE

Smart Micro Factory for electric vehicles with lean production planning



Cyber-physical systems and "Industry 4.0"

How production, products and services operate in the multidimensional internet of the future.



www.smartfactoryplanning.de

"SMART FACE"—The production of the future is customized, decentralized and self-organizing.

Research-project "SMART FACE"

Present production planning with an available multi-variant flow production consists of a combination of highly efficient assembly lines and a comprehensive IT infrastructure for central planning—a decentralized control system of material flow is currently not provided. Especially the upcoming production of electric cars is placing demands which can no longer be met by present production planning:

- Shorter production cycle times
- Increased individualization
- High adaptability due to volatile markets and unforeseeable technological developments in e-mobility.

Though simultaneous or linked information processing of highly diverse sensors is a present research area, mechanisms enabling the interaction between sensors, information and process management are still missing. The new approach of this interdisciplinary research and development project therefore consists of a decently controlled production system based on the "internet-of-things" concept where installation parts and parts to be assembled find a way from one machine to the next autonomously.

Cyber-physical systems enable a continuous data communication which guarantees a close, even external communication with suppliers on a global level.

For the first time SMART FACE connects the information flow with the actual material flow by using embedded systems, creates an easily extensible production process and enables a distinctly "leaner" planning.

"SMART FACE" within the future project "Industry 4.0"

After the first three industrial revolutions in the past, from mechanization of manufacturing plants up to the use of electronics and IT for further automatization of production, the German economy now has to prepare for the fourth industrial revolution based on cyber-physical systems.

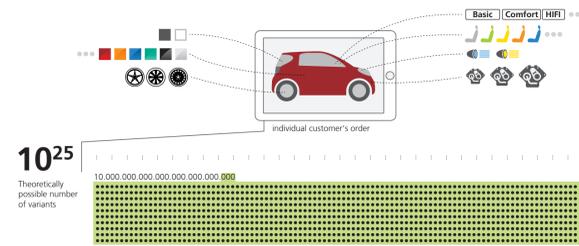
The initiative "Industry 4.0" of the German government aims at preparing the German industry for the future of production.

The term "Industry 4.0" stands for the fundamental paradigm change from a centralized to a decentralized, augmented control with the objective of a highly flexible production of customizable products and services.

So classic borders between sectors and industries disappear, while new, comprehensive action fields and forms of cooperation arise. Value creation processes change and the labor division along supply chains is getting reorganized. An increase of intelligent skills will enable the handling of complex tasks autonomously. The integration of new dimensions in the virtual reality of the internet will be of major importance: Intelligent, networked sensors and 3D-technology enable a reliable image of the environment and the communication among intelligent objects.

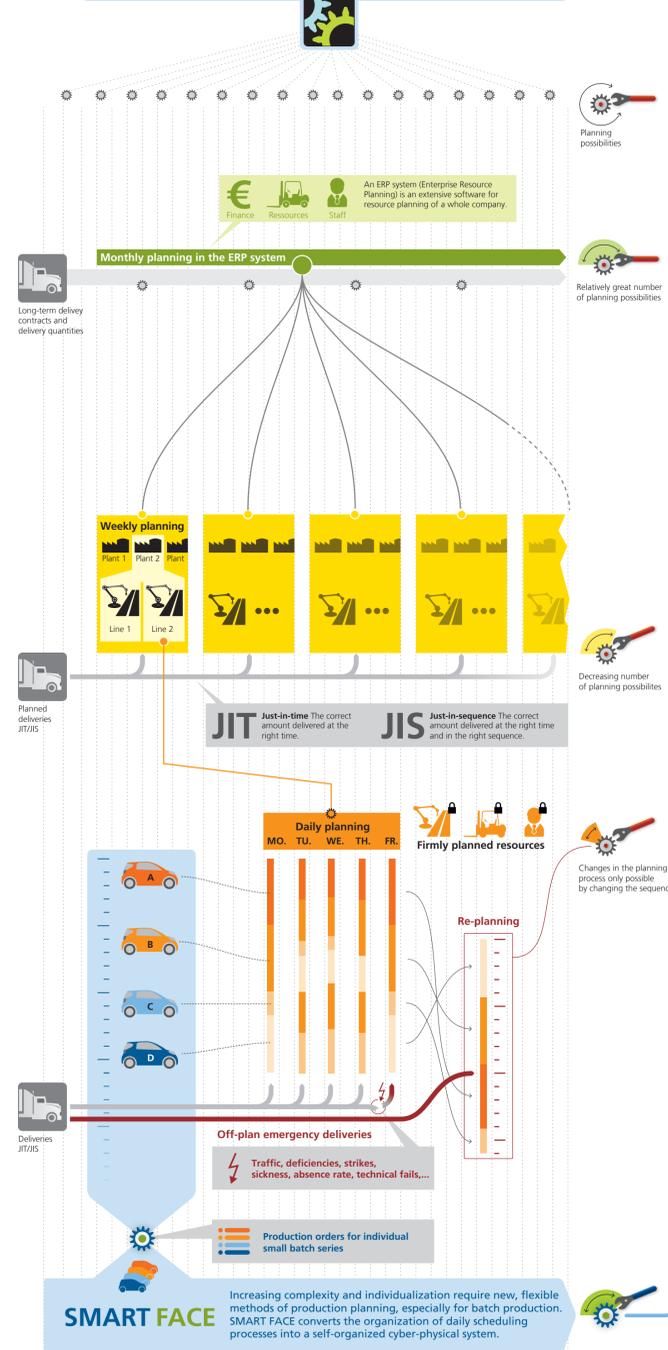
Shorter production cycles and more individualization

Shorter production cycles, more individualization and increase in production – these have been the main topics in production for many years. For a long time now no two vehicles in the automotive industry have been alike. Lot size 1 in assembly has long since become reality.



Status quo: The classical, centrally controlled automobile production

High efficiency with simultaneous diversity of variants are already dominating the industry. Classical program-planning systems and assembly line production are comparatively complex, highly inflexible and require long lead times. Today's method of automotive production planning centrally controls the manufacturing process down to the smallest detail of the daily schedule.



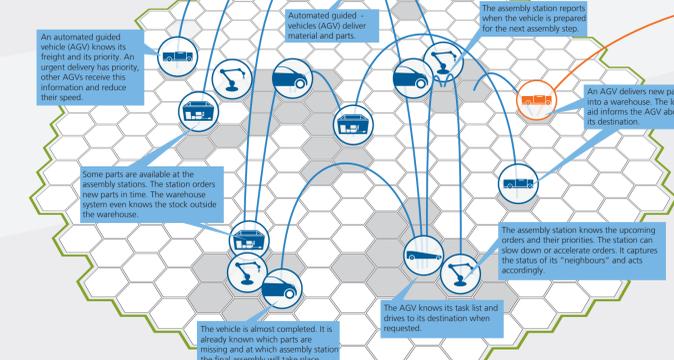
Decentralized control based on cyber-physical systems (CPS)

Future assembling is not controlled centrally and linear any more, but self-organized and decentralized. A CPS can support both highly automated and manual processes.



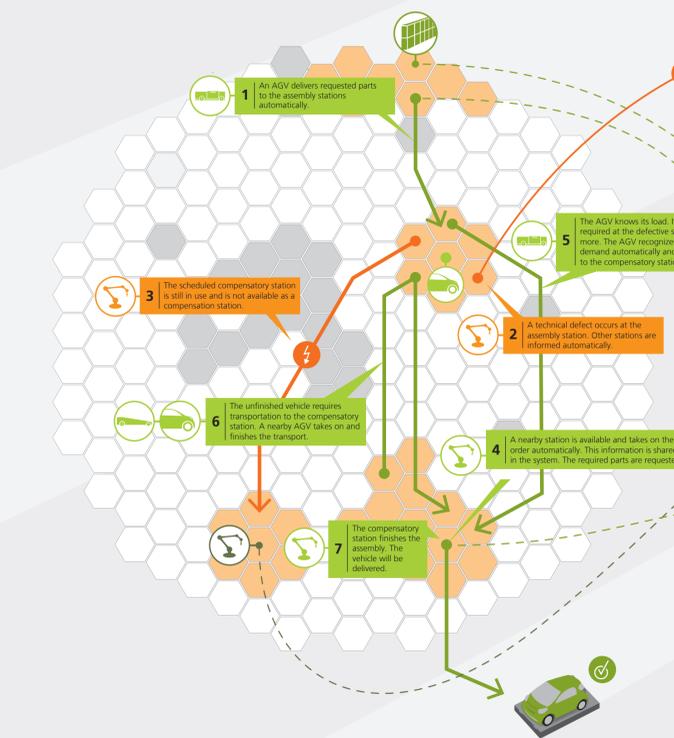
Information flow

Information flow in the cyber-physical system runs parallel to the material flow.



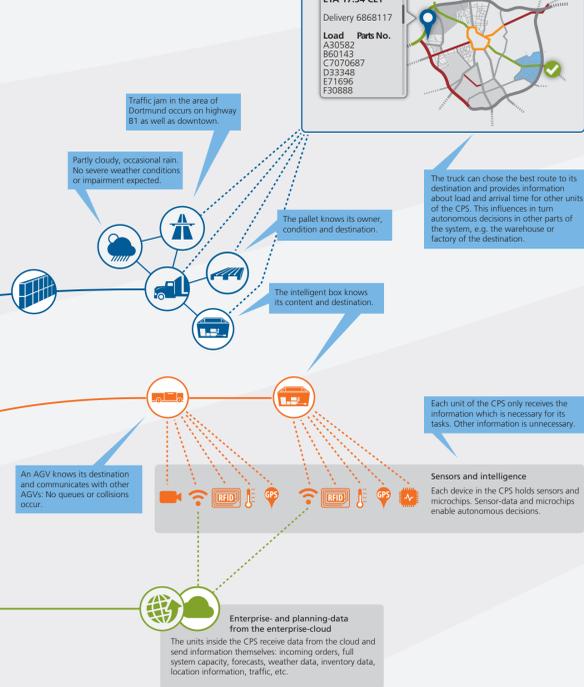
Decision paths in the cyber-physical system

What happens for example, if an assembly station becomes inoperative due to a technical defect? A centralized control-system and rescheduling is not necessary in a CPS. The system reorganizes decently and self-organized.



Intelligence and sensors integrated in all things – the »internet of things«

In the »internet of things« all things are provided with sensors and a certain degree of intelligence: cameras and motion detectors capture the surrounding area, RFID-chips carry and convey information about goods, quantity and destination. Loading aids inform vehicles about their destination and navigation systems process traffic information to create new routes and arrival times.



Who takes decisions in the CPS?

In the »internet of things« objects are equipped with a certain degree of intelligence. What exactly is this intelligence and how does it control the CPS?

