

Paradigm Shift in the Design of Complex ICT Systems

Development of Intelligent, Decentralized Sensor Systems

Fast Facts

1. Decentralized systems have valuable properties: They are scalable, robust, flexible, and can be parallelized.
2. They can greatly increase security and system integrity.
3. Distributed systems allow a fine-granular temporal and spatial resolution of measured values.

Decentralized systems with self-sufficient devices offer numerous advantages compared to established, centrally controlled approaches with dependent peripherals. Among other things, they enable less downtime and higher availability. In addition, security aspects and system integrity are positively influenced.

Advantages of decentralized systems

The distributed sensor nodes form an agile, self-organized network that can react flexibly to the current application scenario. The network size and coverage area can be scaled according to the requirements. Thanks to redundant components, the system continues to work reliably even if individual devices fail. Recurring processes can be parallelized and thus be carried out more quickly, which makes it possible to observe physical phenomena at several locations simultaneously.

By avoiding a detour via a cloud, decentralized, distributed edge computing can also minimize processing times.

The distributed structure allows operation in a wide variety of applications, especially where high reliability is required in harsh environments. There is no need for a centralized control system or database, which could imply potential security vulnerabilities.

Areas of application

- Distributed sensor networks for industrial use in production, process monitoring, and logistics
- Decentralized and networked monitoring of critical infrastructures (water, electricity, district heating)
- Synchronized edge computing in measurement and diagnostic technology to minimize latency

Range of services

- Requirements analysis, design, and specification of decentralized systems
- System design for wireless, networked sensor/actuator systems, selection of components and technologies, circuit design, and PCB design
- Firmware development focused on edge computing and machine learning on microcontrollers
- Energy balancing and high-resolution energy measurements of edge computing systems



Decentralized systems are particularly well suited for process monitoring and logistics

Fraunhofer Institute for Reliability and Microintegration IZM

Carsten Brockmann
Phone +49 30 46403-692
carsten.brockmann@
izm.fraunhofer.de

www.izm.fraunhofer.de