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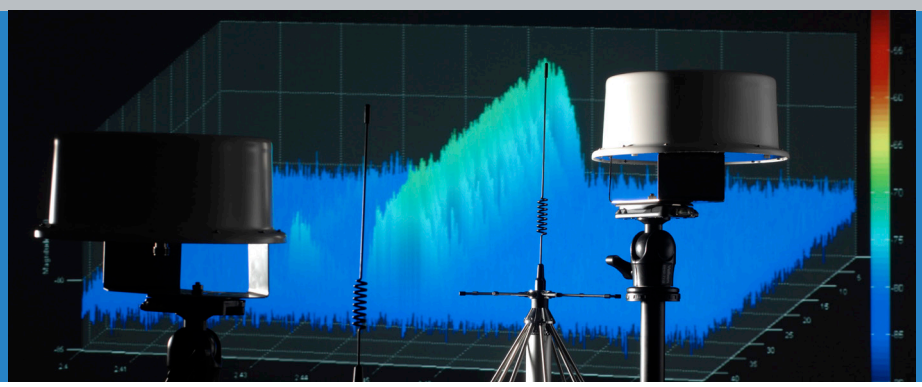

Reliable Adaptive Wireless Communication with Cognitive Radio

Thanks to their flexibility and cost-effective utility, wireless networks are gaining importance not only within the automation industry, but across the entire industrial segment. At the same time, this development is placing increasing demands on the underlying technology. In addition to providing time-critical sensor and actuator data, in the future these networks will transmit near-real-time data required to monitor and control various time-critical manufacturing processes.
Cognitive radio technology possesses the potential to meet these requirements. As part of the CAROUSAL project, Fraunhofer ESK is working together with the University of Kassel and the University of Duisburg to take current research results from this field, which to date are primarily theoretical, and develop them into prototypes that can be implemented in industrial application scenarios. Researchers will be focusing on demonstrating not only the technical, but also the economic feasibility that this innovative approach offers.

ISM Bands: Higher Utilization and Demand for Increased Quality

To ensure interruption-free, quality-assured communication processes, any solution must exhibit key data transmission characteristics such as real-time capability and a high level of availability. However, the growing demand for quality will extend beyond these aspects. Another key issue is the increasing concentration of heterogeneous wireless technologies competing for common radio communication media, which depletes the available resources and as a result reduces transmission quality.

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The Cognitive Radio Approach

The only way to meet these growing requirements while dealing with increasing loads on wireless communication media is to implement adaptive radio systems capable of recognizing the environment and adjusting the communication behavior accordingly. This is the core idea of cognitive radio (CR) technology, which relies on four key features:

- Spectrum sensing: detecting unused frequency ranges
- Spectrum management: selecting the unused frequency best suited for the application requirement
- Spectrum mobility: ability to switch frequencies without data loss and additional delay, such as when the system detects a range with less interference
- Spectrum sharing: intelligent, multiple access to the spectrum within a network

Current research knowledge in this field is based to a large extent on theoretical simulation results, in addition to the practical implementation of some of the individual CR functions mentioned previously. Even in industrial environments where it has the potential to solve existing issues in M2M (machine-to-machine) communication, the use of CR technology still has not been fully examined.

Prototype for Testing Industrial Suitability

The goal of the CAROUSAL project is to develop a prototype that will be capable of transparently tunneling a wired field bus system over a wireless network, to name one application. The components of the system include the detection of unused frequency spectrum, adaptive signal transmission and intelligent access to unused frequency ranges.
In addition to overall coordination of the project, Fraunhofer ESK is also responsible for developing the intelligent and adaptive channel access mechanism, which involves implementing adaptive mechanisms to handle the spectrum management, spectrum mobility and spectrum sharing functionality.

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