GENERAL INFORMATION

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- **Project Start:** September 1st, 2008
- **Project Length:** 3.5 years
- **EU-Budget:** 2.9 Mio. Euro
- **Coordinator:** Dr. Georg Gaderer
- **Partners:**
  - ConnectBlue AB (Sweden)
  - ICM Electronics doo (Serbia)
  - inIT – Institut Industrial IT (Germany)
  - ifak – Institut für Automation und Kommunikation e.V. Magdeburg (Germany)
  - Oregano Systems Design and Consulting GmbH (Austria)
  - rt-solutions.de GmbH (Germany)
  - Schneider Electric Industries SAS (France)
  - University of Catania (Italy)

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PROJECT DESCRIPTION

flexWARE
flexible wireless automation in real-time environments

Wireless LAN is a popular communication technology and widely spread in offices and households. Modern factory automation systems aim at using WLAN technology in order to combine the benefits of wireless communication with the low integration and production costs of consumer-grade technology. The main problems with adopting WLAN for real-time applications arise from the need to guarantee timeliness on each link, as well as seamless roaming between different access points.

The FP7 EU-project Flexible Wireless Automation in Real-Time Environments (flexWARE) aims at implementing wireless networks in factory automation systems. The architecture is designed to be independent of the underlying communication system. For demonstration purposes the project chose WLAN among other possible candidates like Bluetooth or ZigBee. The biggest advantage of having a wireless network is the resulting freedom of mobility, as no restricting cables are required. Controllers, sensors, and actuators can freely move within the coverage area and thus be applied in a more flexible fashion. Furthermore, it is possible to dynamically add nodes, resulting in a lot more flexibility compared to wired connections. By using flexWARE, whole factories can be controlled and supervised via wireless networks.

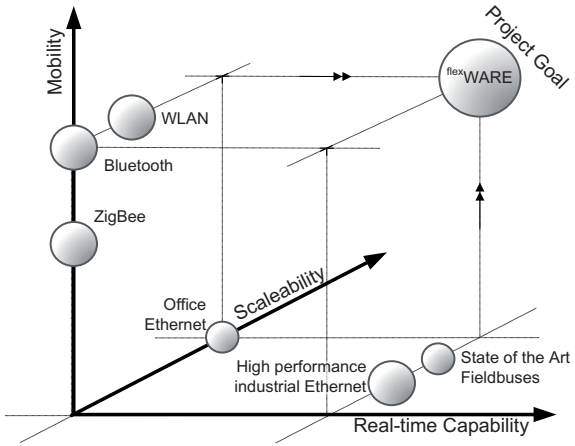
As factory automation systems require real-time communication, high-precision clock synchronization is integrated in the flexWARE system. This ensures collision-free data transmission (by defining time-slots for all nodes) and enables the inclusion of localisation, and thus location based services, like monitoring and path prediction of mobile nodes, or enhanced safety and security features.

PROJECT OBJECTIVES

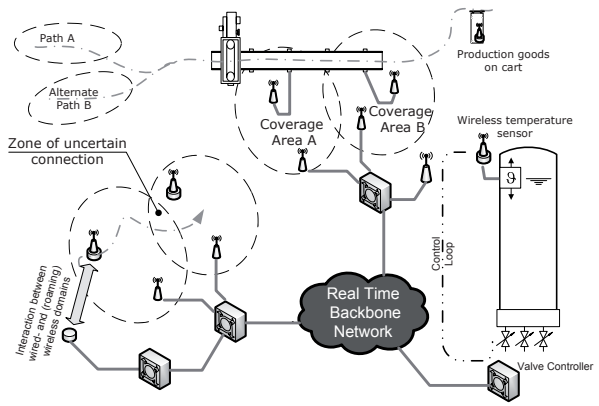
flexWARE's main objective is to set up a networked, embedded control system for the purpose of real-time factory automation based on wireless technology. In particular, sensor, actuator, and controller nodes are enabled to cooperate with other wired or wireless nodes in the system. This is especially needed for tomorrow's factories, where production lines are set up in a way that the path of goods through the machinery is not statically predefined.

A novel middleware between the physical communication and the application is designed with special respect to security, flexibility, and mobile, real-time enabled nodes that can roam between the access points of the system. In conjunction with localisation services this enables the dynamically reconfigurable factory of the future and opens new markets with revolutionary possibilities for applications. Standardised interfaces allow third party applications that can rely on a secure and predictable factory automation network.

The outcome of the project opens possibilities for more efficient production processes and plants due to its flexibility and scalability. Moreover, the project allows for savings regarding (re-)cabling and maintenance.



SYSTEM CONCEPT



Flexible Production Paths

The introduction of wireless real-time networks provides flexible factory automation with varying paths of production goods that are neither clearly defined nor fully predictable in advance. For example, in case of machine failures, production paths most likely have to be re-arranged on short notice, requiring a system supporting such flexibility. This use case is shown in the upper left corner of the figure.

Roaming Between Wireless Domains

In a harsh industrial environment it is unlikely that a single access point per network is sufficient to provide the required infrastructure for hundreds of mobile real-time clients. Thus, mobile nodes have to roam between different access points, which is shown in the lower left corner of the figure.

Network-Based Control

Another aspect to take into consideration is the usage for network based control and servo loops of an automated production system. Such a control loop can be seen in the lower right corner.