flexWARE

Flexible Wireless Automation in Real-Time Environments

The project flexWARE aims at implementing a novel platform, which will offer real-time communication based on Wireless LANs (IEEE 802.11)

KEYWORDS: flexibility, wireless communication, factory automation, real time, mobility

At a Glance: flexWARE

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Duration: 36 *months*

Start: 2008.09.01.

Total Cost: 3.93M€

EC Contribution: *2,9M€*

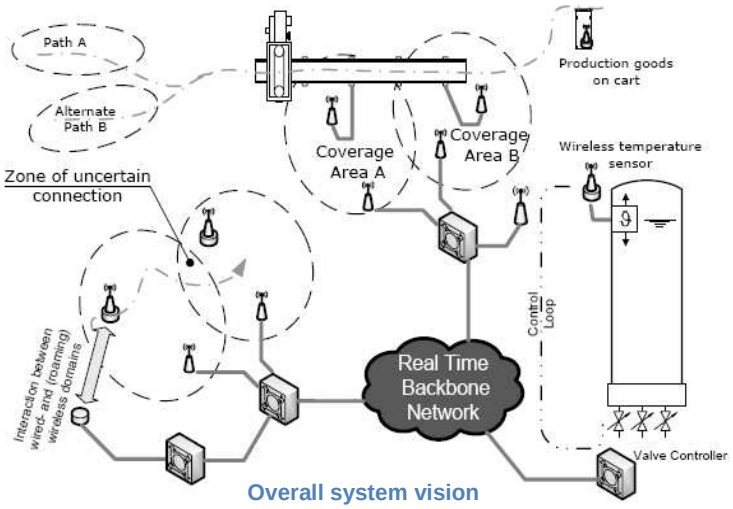
Contract Number: INFSO-ICT-224350

Main Objectives

To widen the control over a factory from purely wire-based to the wireless domain, both secure and reliable communication infrastructure with real-time capabilities is needed. Based on wireless communication technologies, such infrastructures may be used to gain new flexibility within any step of a manufacturing process hence enabling the development of revolutionary new applications. The international initiative flexWARE (**flex**ible **W**ireless **A**utomation in **R**eal-Time **E**nvironments) establishes such a new infrastructure in order to fill the technological gap in the market.

flexWARE will focus on a platform that fulfils the requirements of flexible wireless communication. The vision is to create a turn-key system that can overcome the restrictions of the state-of-the-art wireless real-time systems, which are bounded to single cell networks.

The main objective of the presented approach is to set up a networked, embedded control system, which is based on wireless technology, for the purpose of real-time factory automation. In particular, sensor and actuator nodes are enabled to co-operate with other wired or wireless nodes in the system. This is especially needed for the next generation's factories, where production lines are set up in a way that the path of goods through production machinery is not statically predefined. Moreover, existing production infrastructure will as well gain from the results of flexWARE. For example, to cope with quality issues caused by sudden parameter variations within the production path on any accessible point, information has to be gathered as fast as possible. This information, of course, has to be tightly time correlated with any existing process data. To this end, the only feasible way to enhance the process monitoring capabilities is by adding wireless data collecting nodes.



Overall system vision

Using flexWARE this can be done without altering existing infrastructure. The proposed concept is shown in the figure above. The infrastructure relies on a real-time backbone network. However, the backbone network is out of the scope of the proposed research and is considered to comply with the respective real-time Ethernet standards (RTE). Nevertheless, real-time controllers rely on deterministic data communication capabilities of the backbone network. Interaction between this generic backbone network and communication controllers requires an interconnection that is capable of re-scheduling real-time communication between domains in case of changes in the network topology.

Technical Approach

The particular strength of the proposed approach is the intrinsic ability to cope with complexity of multiple wireless access points in a holistic way. Moreover, the inclusion of localization services allows the monitoring and prediction of paths of mobile nodes and therefore copes with spatial uncertainties to schedule more efficient handover. For these distinct additional services to become part of today's wireless networks, high-precision clock synchronization within the whole network is mandatory. This real-time implementation will make sure that real-time requirements of a factory automation system are met. Also, temporal uncertainties may be reduced to a minimum due to a system wide notion of time. Moreover, it will ensure bandwidth guarantees for all nodes as well as safety and security features. Additional challenges are to design this middleware as secure as possible, and yet ensure real-time and QoS (Quality of Service) aware behaviour. In the case of automation of manufacturing systems, these distinct features will help in increasing the performance of the system and therefore will be mandatory in the system architecture.

Key Issues

- Flexible production paths
- Mobility and roaming between multiple wireless domains with real-time constraints
- Network-based control with cooperation of wired and wireless devices
- Network management to insure proper synchronization and communication between Access Points and reporting on system performances
- Safety and security
- Localization of people and goods

Expected Impact

The outcome of the project will open possibilities for more efficient production processes and plants due to the gained flexibility as well as scalability like flexible production paths, sensors on moving parts through the whole factory, and mobile context aware control stations supporting maintenance with location aware information.
The novelty of the proposed concept is to include technologies like IEEE 802.11f for inter access point communication, location based services, or network management approaches together with real-time approaches for wireless LAN. This approach is demonstrated on the basis of a concept and will be further investigated in the international project flexWARE. Next steps will be extensive investigations on the system concept and implementation of laboratory prototypes, which will be tested in an industrial factory automation test bed.

flexWARE Interest Group (FIG)

A major objective of flexWARE is the dissemination of all knowledge created within the project. To this end, a flexWARE Interest Group (FIG) has been established as an integral part of the project. Its function is to broaden the project scope by having direct contact to and feedback from potential users of the developed technology.

FIG members will have early access to the project results and will be involved in the review and discussion of the system requirements, specifications, implementation of the prototype platform, and the field test. The FIG is intended to be an open group; members can join at any time during the project. Membership is free.

If you are interested to become a member of the FIG, please have a look at the project web site where you will find an application form. We look forward to your participation.