

# Management of Hazardous Goods with Wireless Sensor Networks

Stamatis Karnouskos and Stephan Haller

*Wireless Sensor Networks (WSNs) are seen as one of the most promising technologies that will bridge the physical and virtual worlds, enabling them to interact. Expectations go beyond the research visions, towards their deployment in real-world applications that would empower business processes and future business cases, by delivering new innovative solutions that were not possible before, or enhancing old approaches. The EU FP6 project CoBIs (Collaborative Business Items – [www.cobis-online.de](http://www.cobis-online.de)) investigates how wireless sensor network technologies can help to manage chemical inventory, increase stock visibility, and reinforce business safety rules in the domain of the oil and gas industry.*

In the CoBIs project we develop a new approach to business processes involving physical entities such as goods and tools in enterprise environments. The ultimate goal is to enable enterprises to better understand the relationship between the state of their business processes and what is actually happening in the real world. We do realize this via the usage of networked embedded systems technologies by developing a platform for directly handling processes at the specific “point of action” rather than via a centralized back-end system. The innovation is to embed business logic directly into the physical entities.

We have used wireless sensors such as the one depicted in Fig.1, which not only monitor a number of environmental conditions like temperature and movement, but also are able to execute programmes and take local decisions, e.g. to raise an alert if a hazardous situation is detected. This can happen with or without enterprise infrastructure support. The sensors communicate with each other in a peer-to-peer way, but can also connect to back-end systems and use their services via a gateway.

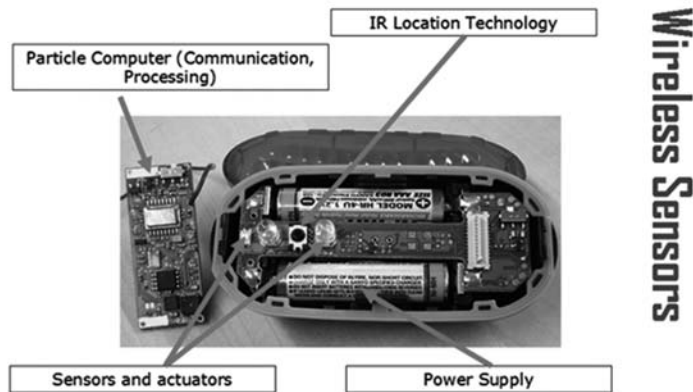


Figure 1: Wireless Sensor Network nodes

One set of the sample applications that were developed within the project deals with problems in safety-critical handling of dangerous materials in the Oil & Gas industry, as in Europe they account for a high number of injuries. CoBIs contributes technologies and services to help manage identified prime causes and to reduce the number of accidents. We implemented a solution that can provide in real time services like conflict detection and warn the personnel about possible safety dangers.

We have equipped drums containing different chemicals with wireless sensors and set up the necessary infrastructure for communication with a back-end system (SAP Environment, Health & Safety - EH&S), a standard enterprise application for managing hazardous goods installed and used by several chemical companies worldwide. The data stored in EH&S incorporate safety-relevant substance information, such as chemical features, handling and storage constraints for compliance with international or corporate standards, and others. The sensor nodes attached to the drums can communicate both peer-to-peer and via a gateway with SAP EH&S almost in real time; therefore we are able to have an always up-to-date model of the warehouse status in the back-end IT systems.

This service-oriented approach is novel and enables the seamless integration of the technologies into enterprise software systems like the SAP EH&S solution, thus supporting important business processes involving physical entities in large-scale enterprise environments. The distribution and execution of business logic locally at the “point of action” – coupled with the maintenance of a centralized management, control and monitoring functionality – offers great benefits to industry in terms of scalability and response time, as well as network and infrastructure independence. By delegating business logic functionality from resource-intensive back-end systems to relatively low-cost networked, embedded systems that run at the point of action in a collaborative way, we can realize a more resilient infrastructure and more flexible enterprise services. This technology-based approach can lead to increased turnover (because of higher process efficiency or quality or reduced loss) and / or lower operational costs due to the increased automation.

#### Contact:

Stephan Haller  
Senior Researcher  
SAP (Schweiz) AG, SAP Research, CEC Zurich  
Kreuzplatz 20  
CH-8008 Zürich, Switzerland  
E-Mail [stephan.haller@sap.com](mailto:stephan.haller@sap.com)  
Phone: +41 58 871 7845  
Fax: +41 58 871 7812