CATRENE

Cluster for Application and Technology Research in Europe on NanoElectronics

CT204 | Perishables monitoring through smart tracking of lifetime and quality by RFID (PASTEUR)

PROJECT CONTRIBUTES TO

Communication	
Automotive and transport	
Health and aging society	
Safety and security	
Energy efficiency	
Digital lifestyle	
Design technology	✔
Sensors and actuators	✔
Process development	
Manufacturing science	✔
More than Moore	✔
More Moore	
Technology node	<or> 130nm

TECHNOLOGY PLATFORM FOR PROCESS OPTIONS

Partners:

Boschman Technologies
Centro Nacional de Microelectronica
Inkoa Sistemas
KU Leuven
NanoTecCenter-Weiz
Netherlands Packaging Centre (NVC)
NXP Semiconductors
Philips Applied Technologies
Philips Consumer Lifestyle
Philips MiPlaza
Prelonic Technologies
Royal DSM
Stichting IMEC-NL/Holst Centre
TNO/Holst Centre
TU Delft
TU Eindhoven
Verhaert New Products Services
Wageningen UR

Project leader:

Romano Hoofman
NXP

Key project dates:

Start: July 2009
End: June 2012

Countries involved:

Austria
Belgium
The Netherlands
Spain

Transporting and distributing perishable goods such as fresh foods, dried goods and pharmaceuticals, while ensuring that they remain in good condition, is one of the biggest challenges facing the logistics industry today along the complete supply chain. Damaged goods and spoilage remain obstacles to and financial drags on greater efficiency within the various sectors involved. The CATRENE PASTEUR project has set out to develop a new multi-capability wireless sensor platform that is not only able to monitor a far wider range of environmental parameters than at present, but could also extend environment monitoring for crates and boxes of perishable goods along the supply chain.

Market research indicates that the food industry discards €25 billion of spoiled goods every year, while €300 of bruised fruit, bad meat and other perishables are thrown away by each household every year. Similar figures can be found for other perishable goods such as blood products, pharmaceuticals and chemicals.

Unsurprisingly, there is huge interest across the logistics and distribution sectors in finding ways to reduce this spoilage. One approach is to monitor and control the environmental conditions of goods throughout the supply chain. The CATRENE CT204 PASTEUR project is therefore developing a new wireless-sensor platform to monitor these conditions.

The PASTEUR platform is based on a multiple-sensor package combined with radio-frequency identification (RFID) read-out. By adding such intelligent devices to the most common types of packaging – such as crates, containers and boxes – shippers, distributors and even the ordering company will be able to monitor the quality of goods in transit and ensure they arrive at their destination in good condition.

Expanding perishables monitoring

Cold-chain monitoring of perishable goods is already available. However sensor solutions available today either offer temperature monitoring only or are extremely expensive and bulky, serving limited numbers of high-end markets – such as pharmaceuticals – or large shipments of bulk products.

The solution envisaged is one that will be suitable for multi-market use. The sensor platform will not just monitor the temperature within a container, but also conditions within the immediate environment such as humidity, pH, oxygen and carbon-dioxide levels, and ethylene.

Such capabilities would enable much wider applicability, expanding into logistics markets such as the distribution of dried food or powders, pharmaceuticals, meat, fish and dairy products, and fruits and flowers. With the prices and size of sensor technology reducing all the time, an ultimate goal would be to enable sensing of the condition of individual items, for example a package of bananas.

A multi-capability sensor

PASTEUR is focused on the integration of all the technologies required – power, sensors, wireless communications and security – into a single package, which will be tested in demonstrators to prove integration, cost efficiency and application relevance.

A smart sensor tag will be fabricated with the following elements:

- Integrated sensor platform – multiple sensors and the associated low-power interface circuits;

- Power source – power management and a thin film battery fully integrated into the substrate;
- RFID functionality with integrated security protocols; and
- Adjustable package embedding all these elements.

The wireless sensors to be developed will be capable of detecting temperature, humidity, pH and relevant gases – that is oxygen and carbon dioxide for food packaging and ethylene for fruits and vegetables. Models for food quality predictions are being developed based on available sensor data and will be translated into algorithms that can be implemented on the smart sensor tag. In addition, technologies are being developed to reduce power requirements and boost read efficiency.

Two demonstrators will prove the feasibility of the project:

1. A first-generation demonstrator providing a stepping stone in which the feasibility of the technologies chosen is being tested. Gen1 will be a modular test platform consisting of an RFID integrated circuit with temperature and humidity sensors as well as analogue and digital interface connectivity to other sensors and an external microprocessor, implemented on a printed circuit board.
2. A fully integrated final demonstrator will be a battery-assisted RFID tag with full sensor functionality. This intelligent package should be able to sense a number of different parameters – such as temperature, pH and gas levels – and make possible accurate shelf-life predictions for an individual item. The Gen2 solution, if successful, should represent a major leap forward towards the ultimate goal of individual item management in the logistics cold-chain.

The potential variety of applications from successful development of a marketable platform is vast. They include supply chain uses such as traceability and quality management, domestic applications like detecting hazardous gases such as carbon monoxide, medical monitoring to ensure therapy compliance and construction – for example corrosion monitoring.

Major European players involved

The PASTEUR consortium includes major European companies, research institutes and universities which cover the trajectory from academic and industrial research through technology development, to packaging, manufacturing and the end-user.

Project partners view the exploitation and dissemination opportunities provided by the project as an activity that will be continuous throughout its duration. Primarily for the technology-based partners, miniaturisation, cost reduction and increasing functionality are the drivers for new market opportunities.

For the applications partners, the technology developed will enable them to develop new products that are derivatives of wireless intelligent-sensor technologies. Each operates in different market segments, and therefore their roles are complementary. The packaging and assembly partners will provide access and supply information to companies inside and outside the consortium.

Potential for transformation

RFID-based environment monitoring is a technology with the potential to transform the present-day supply and distribution chain. Not only will it improve cold-chain distribution quality and record-keeping, but it will also assist in pinpointing problems, assigning liability and ensuring earlier provision of preventative measures.

More and more organisations are turning to wireless-sensor solutions as a way of meeting regulatory demands, as well as meeting the quality and safety pressures from customers. Today, European companies are well able to meet that demand, thanks to a strong position in the entire wireless sensor market – Europe had a 30% share of a €1.5 billion global market in 2007.

This project will help European suppliers retain their position in the emerging domain of feature-rich wireless sensor systems. With a technology capable of seamless integration into existing systems, the participation of industry leaders and quality partnerships, PASTEUR will ensure European electronics suppliers stay at the top of this particular tree.