PROJECT RESULT

Networked
ICE terminals

MEDEA+

2A204: Silicon platforms for wireless advanced networks of sensors (SWANS)

Combining wireless networking and sensing in one package

Wireless access to the Internet and wireless headsets for mobile phones are now established facilities. However, there are many other applications in which autonomous wireless networking has growing potential – from remote utility metering to stress monitoring in aircraft. The ability of wireless sensor devices to maintain connections to their networks and to perform sensing activities autonomously is an ever-increasing requirement that the SWANS project has successfully resolved with the development of technology that allows the wireless and sensing circuitry to be combined in a single package.

Smart sensors are now almost fully-autonomous components, performing measurements and converting elementary information into more complex data. As a result, sensor applications are expected to grow dramatically over the next few years. Key uses are expected to include remote utility metering, building automation and industrial control.

However, to be really smart, sensors need embedded intelligent data-processing capabilities and standardised communications connectivity. This can be obtained through the use of analogue signal processing, digital signal processors (DSPs) or embedded software. The first approach is the most promising in terms of reduced complexity, self-learning functions and power dissipation and is the approach that was investigated in the MEDEA+ 2A204 SWANS project. The objective was to develop a common toolbox to integrating analogue and digital blocks for future wireless sensor nodes.

The project consortium consisted of 18 participants from four countries, and included leading chipmakers, major integrators and end-users in the various application fields, as well as research institutes with state-of-the-art expertise. The project has enabled European industry to confront the needs of consumers for low cost autonomous sensor devices offering more security and more services in domains such as transportation, fitness, medical monitoring and treatment, the environment and homeland security.

Applications and connectivity

SWANS addressed two areas:

1. Low power, low cost sensor nodes targeting healthcare and fitness, transportation – automotive and aeronautics – and environmental monitoring markets; and
2. Wireless connectivity for more complex sensors such as those for security applications.

The project defined the architecture and identified the generic and specific building blocks for individual applications. All of the circuits required to perform analogue-to-digital conversion, auxiliary functions, interfacing with the sensors and digital signal processing related to sensor data were implemented on silicon and fully characterised.

Various innovative solutions and associated critical blocks that optimise power consumption of each sensor node were explored and implemented. They included low-power stand-by-mode, wake-up strategies and synchronisation functions. Battery handling was also optimised with the development of very low power DC/DC up and/or down converters.

Analogue and digital blocks for radio communications were developed and implemented using spread spectrum techniques in the 2.4 GHz

band, the 400 to 900 MHz low frequency band and the low data rate ultra wide band (UWB). SWANS had a significant impact on European UWB regulation, generated the birth of the Wavenis Open Alliance and had considerable exposure at prominent conferences.

The project facilitated major innovations in many domains, including:

- The world's first lead-free ball stacking board 3D-integration technology;
- Unique integration of building blocks for low power/high performance wireless sensor nodes;
- The world's smallest wireless motion-capture node with on-board processing;
- World-class energy-efficient radio building blocks;
- The world's most energy-efficient DSP and controller;
- The world's first application-customisable microcontroller; and
- The world's lowest cost, low power configurable multi-algorithm crypto-processor.

Developing individual solutions

Despite the relatively large number of partners, the successful conclusion was largely due to the sharing of complementary technology. MEDEA+ provided assistance in several aspects of the establishment of ground rules as well as identification of partners and funding sources.

SWANS partners are now developing their individual solutions to enter invidual markets. For example:

- Every Airbus plane will be equipped with a dozen sensors developed within the framework of the SWANS project. The number of systems is estimated at 7,300 units a year for new aircraft and 90,000 units to equip the current Airbus fleet; and
- Through work in SWANS, France Telecom R&D has now developed an activity involving a monitoring system that is wearable and usable for field trials. France Telecom will be able to collect significant field data to allow posture analysis, activity level and activity index computation software. This paves the way to the successful deployment of a real-world application and service representing a business in the tens of millions of euro initially and hundreds of millions within three years of deployment.

Similar opportunities exist in all of the other domains covered by the partners. This represents substantial earnings potential in fields where wireless sensors offer a unique means of collecting open or encrypted data in either fixed or mobile circumstances.

The forecast growth of applications around smart sensor technologies, combined with the emergence of innovative new services and applications, will promote the development of new business activities both through existing companies and through the creation of new start-up companies.

Reinforcing leading position

SWANS has helped European industry to keep or reinforce a leading position in the field of wireless technologies and related applications in an international environment where American and Asian companies are currently investing huge resources to meet consumer demands. SWANS also contributed to putting European industry in an ideal situation for the deployment of a pan-European and worldwide commercialisation of smart sensor systems and will also enhance employment opportunities across Europe.

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PARTNERS:

Airbus
AnSem
Atmel
CEA-LETI
Coronis Systems
EADS France
EADS SN
Energo Control
ESIEE (Engineering school, Paris)
France Telecom
IMEC
LMS Instruments
LMS International
NXP
Pro Engin
STMicroelectronics
Uni Bordeaux (IMS)
Verhaert

PROJECT LEADER:

Giuseppe Medulla
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KEY PROJECT DATES:

Start: March 2005
End: September 2008

COUNTRIES INVOLVED:

Belgium
France
The Netherlands
Poland

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MEDEA+ Σ!2365 is the industry-driven pan-European programme for advanced co-operative R&D in microelectronics to ensure Europe's technological and industrial competitiveness in this sector on a worldwide basis.

MEDEA+ focuses on enabling technologies for the Information Society and aims to make Europe a leader in system innovation on silicon.