ITEA
INFORMATION TECHNOLOGY FOR EUROPEAN ADVANCEMENT

PROJECT RESULTS

Making a business of wireless sensor networks

Developing an open-source approach to flexible and robust sensor applications

The ESNA project has resulted in a standard architecture, technology, application-development guidelines and proof-of-concept implementations for business-oriented wireless sensor networks. Open-source architecture supports off-the-shelf sensor network nodes, including applications, software development kits and middleware services, based on documented interoperability specifications.

Wireless sensor networks are based on the interconnection of matchbox-sized multifunctional devices using radio communications. The flexible, battery-powered devices can be equipped with many different sensor capabilities, such as temperature, humidity, movement, radiation, gases and light. Each node can be a platform for many different uses – opening up a very broad spectrum of applications. In addition, these devices establish their network dynamically so that if one node disappears, the rest reconfigure themselves and continue operations, making such systems highly robust.

Developing strong platform

ESNA provided a strong and multifunctional advanced software platform together with the necessary application frameworks and architectures to support needs in a range of sectors to enable Europe to master this technology. Nodes are widely available as off-the-shelf units; the added value comes from the software that creates the system out of the individual components. Potential applications include processing, surveillance, next-generation home devices, building automation, agricultural monitoring and high voltage electricity network monitoring.

The ITEA project innovated in several carefully selected technology areas. For instance, it developed the central generic platform – corresponding to the operating system in a computer – using 'protocol' stacks for IPv6, which is the new Internet protocol standard. Above all, it focused on being standards compliant but with innovative implementations – such as the world's smallest implementation of IPv6, ported to many different platforms.

Software technology was developed for very low power use, enabling devices to operate as long as possible on one set of batteries. This involved optimisation of communications between devices, as radio transmission consumes much more energy than computing. The new methods are the most energy efficient currently available.

ESNA (ITEA 05023)

Partners
ABB
Acciona Infraestructuras
CRL Sweden
Edosoft Factory
EGC
HEP-Operator prijenosnog sustava (HEP-OPS)
Intar
Kapion Senzor
Langmead España, S.L
Lansen Technology AB
Métodos y Tecnología (MTP)
SICS
Space Applications Services
Universidad Politécnica de Madrid
University of Osijek, Faculty of Electrical Engineering (ETFOS)
University of Oulu
Vendolocus Development
Vibrel
Vrije Universiteit Brussel
VTI Technologies
VTT Technical Research Centre of Finland

Countries involved
Belgium
Croatia
Finland
Slovenia
Spain
Sweden

Start of the project
July 2006

End of the project
December 2009

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Domain-oriented frameworks
ESNA worked on domain-oriented frameworks for a series of specific areas. As wireless sensor networks are not intended to operate as separate, stand-alone islands but rather as part of enterprise-wide IT environments, the ITEA project developed interoperation with other IP environments.

The ESNA system can now interoperate with a range of different environments with devices fitting smoothly into these environments. This involved supporting industrial standards in a variety of application areas – such as the WirelessHART open-standard networking protocol widely applied in industrial automation, and in building automation which has yet another set of communications standards.

Building European leadership
Development of a strong European lead in wireless sensor networks, while this field is still emerging globally, is a major achievement. ESNA also consolidated the open-source Contiki software. This highly portable, multi-tasking operating system is designed for microcontrollers with small amounts of memory. It enables the development of memory-efficient networked embedded systems and wireless sensor networks. A typical Contiki configuration requires 2 kb of RAM and 40 kb of ROM.

The Contiki software, consisting of a set of tiny light-weight elements, has now been extended and consolidated. The open-source outcome is already being used by commercial actors who see this as a very usable system for small devices.

Overall, ESNA has been highly successful in delivering elements that are either being used as open source or are being marketed by specific partners. On the applications side, the GAIA sensor system for precision agriculture was launched in Spain in 2009. And a spin-off – Ingeniería de Sistemas Intensivos en Software – also emerged in Spain using the technology developed in the ITEA project to target energy monitoring and management in the construction industry. The company is also looking at other new business areas based on the same technology toolbox.

In addition, several industrial components have been developed. ABB now has process-control sensors containing software solutions developed in this project. And several members of the consortium are working with new partners in a follow-up project which will reuse results and know from ESNA.

Major project outcomes

Dissemination
- 62 papers (including conference presentations
- 10+ presentations/demos at events
- 5 articles in journals
- 2 books
- 10+ courses and journals

Exploitation
- 5 new products
- 3 new services
- 6 new systems

Standardisation
- Contributions to WirelessHART and SDI-12

Patents
- 4 new patents

Spin-offs
- 1 spin-off - Ingenieria de Sistemas Intesivos en Software (ISIS)

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ITEA - Information Technology for European Advancement - is an eight-year strategic pan-European programme for pre-competitive research and development in embedded and distributed software. Our work has major impact on government, academia and business.

ITEA was established in 1999 as a EUREKA strategic cluster programme. We support coordinated national funding submissions, providing the link between those who provide finance, technology and software engineering. We issue annual Calls for Projects, evaluate projects, and help bring research partners together. We are a prominent player in European software development with some 10,000 person-years of R&D invested in the programme so far.

ITEA-labelled projects build crucial middleware and prepare standards, laying the foundations for the next generation of products, systems, appliances and services. Our projects are industry-driven initiatives, involving complementary R&D from at least two companies in two countries. Our programme is open to partners from large industrial companies, small and medium-sized enterprises (SMEs) as well as public research institutes and universities.

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