



GENESI

Key Innovation

As wireless sensor network technology is becoming more mature many applications are emerging which demand for systems able to autonomously operate for decades or more. Energy consumption due to idle listening and limited battery life cycle prevent reaching the goal of long lasting or perpetual monitoring with current wireless sensor network technology. GENESI vision is that of filling this technological gap, designing and implementing a novel generation of “green wireless sensor networks” which can be embedded in buildings and infrastructures at the time of construction and be able to provide a monitoring and control intelligence over the whole structure lifetime.

Technical approach

To achieve the above objectives GENESI combines advanced HW components, novel communication paradigms, in-network distributed processing and reasoning mechanisms.

Key technical contributions of the project include:

- The GENESI sensor node which combines a low power node platform with a multi-source energy harvester, a small factor fuel cell, and an energy efficient RF front end with radio triggering capability;
- Energy-efficient interfaces with a variety of structural health monitoring sensors (vibrating strain gauges, displacement meters, pressure sensors, temperature sensors, soil moisture sensors);
- Novel communication paradigms which are able to exploit at best the availability of the harvested energy and the enriched GENESI node features, and that are able to provide the needed reliability and QoS support;
- Novel distributed adaptive sampling and data aggregation mechanisms handling the trade-off between the data granularity, energy efficiency, and applications' required quality of service;
- Innovative distributed mechanisms enabling online situation awareness and adaptive learning based on artificial intelligence;
- Extensive testing of the overall system in real life through two test-beds (underground and bridge construction). Tools to ease the deployment of the GENESI system, network management and re-programmability will be provided.

Contract number

257916

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Project website

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Community contribution to the project

2.000.000 Euro

Project start date

01 April 2010

Duration

36 months

Demonstration and Use

The project has a strong experimental focus. First prototypes of all the hardware components are already available, together with a first version of the protocol stack. Validation and evaluation of the performance of the proposed solutions is achieved by a combination of simulations, lab tests and real life test-beds. Specifically the GENESI system is already under test (in a preliminary version which integrates only some of the components) during the construction works of Rome underground B1 line. A more extensive and complete test of the GENESI system is envisioned in year 3 of the project during the construction works of Pont de La Poya, in Switzerland.

Scientific, Economic and societal Impact

The presence of two end users in the consortium (Solexperts and Tressse) operating in the field of geotechnical instrumentation and structural health monitoring and the extensive in field validation of the GENESI system envisioned as a core project activity will enable rapid commercialisation of the project outputs. GENESI has the potential to enable novel applications for structural health monitoring and to significantly widen the set of application domains where wireless sensor networks technologies can be adopted, as it provides the enabling technology for pervasive and long lasting monitoring.

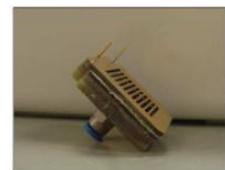
Project partners	Country
University of Rome La Sapienza	Italy
University of Twente	The Netherlands
University of Bologna	Italy
ST Microelectronics	Italy
Tyndall National Institute, University College Cork	Ireland
Solexpert	Switzerland
Tressse	Italy



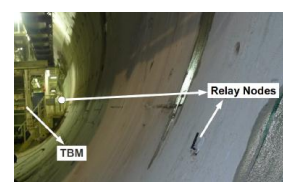
GENESI Node



Harvester



Small factor fuel cell



GENESI Test-Bed :
Rome Underground

First achievements

- GENESI platforms have been designed, and have been integrated with a variety of different sensors (vibrating strain gauges, displacement meter, pressure sensor, temperature), with the multi-source energy harvesting module and with a fuel cell;
- A first version of the system (integrating sensor nodes, vibrating strain gauges and an energy efficient protocol stack) is currently under test during the construction works of Rome underground B1 line.
- Algorithms for task allocation and selective node activation have been developed, together with accurate energy prediction models, network and data processing protocols.