

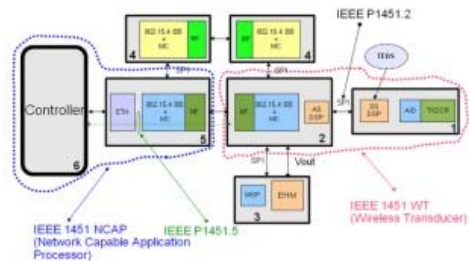
The Project memsense

MEMSENSE "Development of Innovative sensor systems offering distributed intelligence" is R&D project that aims at the development of new methods and products in the field of Intelligent Sensors. The importance of Wireless Sensor Networks (WSNs) technology for the shaping of the future is widely accepted and is expected to have a major impact on the way that we understand our environment and interact with it. Technology experts and analysts have identified WSNs as one of the "10 emerging technologies that will change the world". One of the main reasons for this growth is that WSNs provide exclusive and cost-effective solutions for several types of applications and in almost all aspects of everyday life from environmental monitoring to home-based medical assistance, and from building and appliance management to structural integrity monitoring.

MEMSENSE -by recruiting 8 high-tech SMEs and 6 Research and Academic Partners- aims at addressing the technological challenges upon which the development of the future Intelligent Sensors may stumble. Towards that goal, MEMSENSE has adopted a holistic approach, and targets at the parallel development of many facets that a Smart Sensor Network possesses:

- Design of on-chip sensing modules capable of wireless communication and signal analysis for the reduction of the Intelligent Sensors size
- Design of novel, more sophisticated embedded algorithms for data analysis
- Testing and optimization of communication protocols
- Use of renewable energy sources for the autonomous operation of the modules, which involve the development of novel MEMS-based vibrational energy harvesting generators and their combination with photovoltaics.
- Development of energy management modules for the reduction of power consumption
- Increasing the reliability of the systems
- Design algorithms for distributed intelligence in sensor networks

The developed systems will be applied to three major sectors, which will be used in order to demonstrate their great potential and versatility: Industrial Monitoring, Building Management/Home Appliances, and Medical Applications.



www.memsense.org



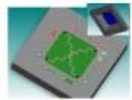
Capture - Process - Comprehend



MEMS capacitive 1-axis accelerometer, utilizing a surface micro-machining process of one SOI wafer and one standard silicon wafer



accelerometer



MEMS thermopile infrared sensor, utilizing a bulk micro-machined process on a standard Si wafer.

temperature

MEMS capacitive pressure sensor, utilizing a bulk micro-machining process of two SOI wafers.



pressure



MEMS resistive flow sensor based on hot film - anemometer principle of operation

air flow meter

**in Buildings
Industry
Medical**



MEMSENSE aims to develop innovative solutions in the field of home healthcare. A low cost, easy to use spirometer specially designed to be operated by patients at home and a web based remote monitoring system are being developed, aiming to the effective monitoring of COPD and asthmatic patients by clinicians and to the reduction of frequent patient visits to the hospital. Another medical application is the safe administration of drugs in the home environment. Patented automated safety checks and device programming based on RFID technology eliminate the possibilities of errors during the infusion set up. Moreover, therapy questionnaires on the infusion device and infusion pump distance monitoring guarantee therapy compliance and remote infusion pump control enables immediate regimen adjustment.

signal analysis



MEMSENSE mission is to create a range of innovating systems-platforms based on MEMS sensors for different kind of applications. All kind of sensors are developed utilizing state-of-the-art microelectronic processes of silicon wafers. The innovative smart sensor incorporates embedded DSP functionality and implements a variety of capabilities. The DSP functionality is segmented in 2 parts, one related to the sensing element and the second related to the targeted applications. The former consists of algorithmic blocks for multi-segment/multi-input linearization and frequency compensation of the sensor output so as to correct process-induced impairments. The latter contains logic for vibration analysis, higher-order statistics, FFT/IFFT, multirate filters etc and is complemented by an execution framework enabling the designer to create block interconnections that best suit the application.

application processing

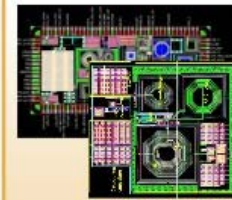


The MEMS are connected to a wireless sensor network with distributed intelligence and self learning algorithms. MEMSENSE aims to deliver new approaches to smart sensor architecture. Covered a wide area of applications in Industry, Medical and Building management, our research and developing efforts are:

- Implementation and testing communication protocols.
- Developing status monitoring algorithms.
- Decreasing power consumption.
- Implementation distribution analysis.
- Design enclosures for smart sensors

communication module

We have developed a transceiver front-end to enhance the performance of commercial ZigBee transceivers, in terms of power dissipation, transmission range and antenna matching capabilities. The transceiver is designed for low voltage operation (1.2V) in the TSMC 65nm technology. A library of characterized IP blocks (LNA, PA, VCO, duplexer, RF switches, ESD protection circuits) is also available for embedding within the design, to support further development. All blocks comply with the Zigbee standard thus reducing the overall time-to-market.



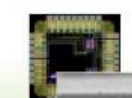
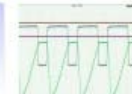
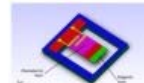
gateway controller backend



power management

Energy autarky is of paramount importance for truly wireless sensor networks. Further, energy autonomy reduces maintenance costs and facilitates "install and forget" deployments.

MEMSENSE adopts a holistic approach to the problem, improving energy scavenging techniques from one hand and reducing sensor and network energy requirements from the other.



MEMSENSE developed on-site energy estimation methodologies which, coupled with intelligent energy management algorithms, allow graceful degradation of the network operation under energy starvation conditions with safe operating margins.

MEMSENSE delivers advanced MEMS-vibration based-microgenerators, efficient energy scavenging ICs, intelligent energy estimation and power management algorithms to produce an innovative holistic solution to the problem of energy autonomy in practical sensor networks.