European Network on New Sensing Technologies for Air Pollution Control and Environmental Sustainability - *EuNetAir*

COST Action TD1105

WGs and MC Meeting at Cambridge, 18-20 December 2013

Action Start date: 01/07/2012 - Action End date: 30/06/2016

Year 2: 1 July 2013 - 30 June 2014 (*Ongoing Action*)

Research and Innovation Needs of WG2

Andreas Schütze

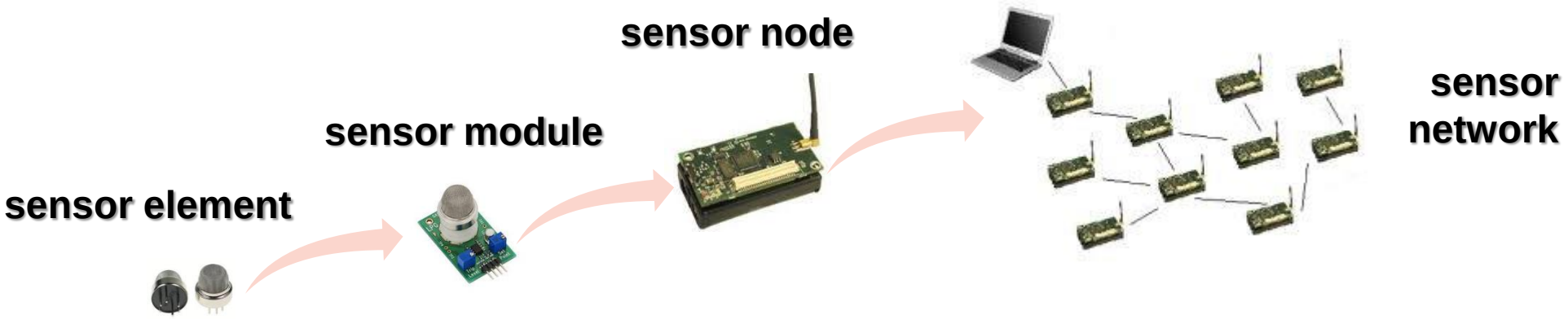
Action WG2 Chair

Saarland University, Lab for Measurement Technology, Germany

COST is supported by the EU Framework Programme

ESF provides the COST Office through a European Commission contract

Scope: from nanomaterials to sensor networks



- Integration of novel sensor materials and techniques into sensor elements for AQ Monitoring and Control systems
  - Closely linked to WG1 activities
- Integration and data evaluation on all levels:
  - Sensor module ➔ enhanced electronics (i.e. for self-monitoring)
  - Sensor node ➔ improved selectivity and stability via information correlation
  - Sensor network ➔ enhanced reliability, auto-configuration/calibration

Research Priorities (1/5): sensor elements

- Versatile µ-transducers for integration of various (nano)materials
  - Allow application specific adaptation and **low cost**
  - **Low power** (down to µW for single nanowire)
- **Selective filters** integrated in sensors or sensor modules
- Be open for novel sensing methods:
  - e.g. dosimeter approach: integrated sensor response
- MEMS and beyond:
  - low cost microstructured sensors
  - other sensor technologies, i.e. printed electronics
- **Nanoparticle detection** for dust and aerosols!

Research Priorities (2/5): sensor systems (1)

- **Combination of sensor principles:**
  - Temp., r.h., barometric pressure **plus** sensor correlation
- **Dynamic operation/self referencing of sensors** to obtain more than one signal from a single sensor (better selectivity and stability, self-monitoring/self-calibration) **at the sensor module level:**
  - Well known, but not standard: temperature cycling, EIS
  - New methods: gate bias variation for GasFETs, RF, optical excitation (gas sensitive solar cell!), pulsed polarization, surface ionization, mass and dissipation in QCM
  - Modelling and simulation of interaction between sensor/ sensing layer and gas/dust/aerosol

Research Priorities (3/5): sensor systems (2)

- **Optimized calibration:**
  - Simple calibration for manufacturers
  - Ideally no re-calibration in the field (self-calibration, cross referencing in networks
- **User and network interface** optimization:
  - Simple and easily understood feedback for citizen use
  - Qualitative display
  - Quantitative data with uncertainty estimate for sensor networks
  - Feedback channel for data input from the user
  - **Complex but easy to use systems**

Research Priorities (4/5): applications

- **Outdoor air quality monitoring** (imission control):
  - Better information for citizens and awareness of pollution
- **Indoor air quality monitoring** (imission control):
  - Controlled ventilation due to monitoring of hazardous VOC
  - Reduced health hazards plus improved energy efficiency
- **Outdoor monitoring of pollution sources** (emission control):
  - Identification of sources and minimizing of emissions
- **Closed loop process control** (industrial, transport, home use):
  - Minimizing emissions at source incl. active countermeasures

- **Identification of reference applications**
- **Sensors on/in smartphones with open data interface**

Research Priorities (5/5): overall target

- **Intelligent sensor modules** for NO_x, O_3, NH_3, H_2S, SO_2, VOC, PM
  - Electronics combined with sensor elements
- **Intelligent sensor nodes and (heterogeneous) networks**:
  - Data pre-processing and processing (in node and/or in network: parallel and distributed computing)
  - Energy efficient communication

Goal:

Demonstrate the potential of (micro) sensor systems in the context of environmental sensing (complementarity, added resolution - spatial and temporal, improved information to and feedback from citizens), **including an assessment of performance**