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

COST Action TD1105

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Year 3: 1 July 2014 - 30 June 2015 (*Ongoing Action*)

Wrap-up of session WG2
Sensors, Devices and Systems for AQC

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ENA EuNetAir

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Current research activities of in WG2 (1)

- Gas Sensors for Environmental Monitoring (Sadullah Ozturk)
  - Overview of challenges: air, water, soil – gas sensors can be used for all
  - Low-power, i.e. low-temperature, low-cost sensors required
  - 3S: sensitivity, selectivity, stability
  - Example: room temperature hydrogen sensors
- Environmental Monitoring with RFID Tags (E. Llobet)
  - Semi-passive and passive tags (read-out with impedance analyzer?) - 2001
  - Low-cost paper/foil based devices, very simple sensor layout, short distance, but very low sensitivity (tested at 20% for ammonia) - 2009/2011
  - URIV: semi-passive tag with wake-up pulse and single measurement; tested with RT-measurement of ppm-level NO2 using CNT sensors; 10 years lifetime with a single 1000mAh battery @12 meas/h – 2014

Current research activities of in WG2 (2)

- New Sensor Principle w Graphene Nanoribbons (M. Voinova)
  - Main activity in WG2: modelling of QCMs, also for bacteria etc.
  - New project part of the flagship project graphene
  - Model of sensor nanosystem: suspended graphene membrane exhibits self-sustained oscillations due to non-linear effects (set-up published in 2008)
  - Could allow opto-mechanical transduction w external control for ammonia
- Particle detection w acoustic wave technology (F. Villa-López)
  - Target: particulate matter PM10, PM2.5, UFPs (<100nm)
  - Major concern for health (respiratory and cardiovascular)
  - SAW-Resonator, SMR (Solidly Mounted Res.) @ ~1GHz, diff. measurement
  - Mass loading: total number of particles with filters for size differentiation, tested with PM10: 580 kHz/ng
  - Challenges: reversibility, controlled deposition of particles

Current research activities of in WG2 (3)

- Modelling and Simulation Studies on IAQ (Ahmet Özmen)
  - Target: on-line evaluation of distributed sensor networks (i.e. in schools)
  - Sensor node with multisensor array; data transmitted to central server
  - Parallelized research: software simulator for distributed sensor network
- Automated Computational Model Selection (Roman Neruda)
  - Target: how to select the best performing method for a given problem?
  - No-free lunch theorem: no single method will outperfom all others!
  - Learn from previous experiments with statistical, NN, SVM, RBF models
  - Evolutionary search, combination (sum, product) of kernels

Suggested R&I Needs for future research to Action WGs/SIGs General Assembly

- Low-cost particle sensors are still elusive

  - But what do we measure: size, content, character (pollen, dust, ash, BC)?

- Focus on health effects: what is really important to measure?

  - Formaldehyde is often mentioned, but actually not critical

  - Avoid environmental hazards instead of measuring them

  - Study by VITO in Flanders; often super-critical individual houses

- Compare indoor/outdoor air quality: which hazard in more relevant?

- General: **ADVANCED HMI** for Environmental Sensor Data: Visualization of measurement (no ppb/ppm) and user feedback(!), e.g. for allergies, …