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

COST Action TD1105

1st EuNetAir Air Quality Joint-Exercise Intercomparison

Sensors versus Analyzers for Air-Pollution Monitoring in Aveiro City

Institute for Environment and Development - IDAD

Aveiro, Portugal, 13 - 27 October 2014

Action Start date: 01/07/2012 - Action End date: 30/06/2016 - Year 3: 2014-15 (*Ongoing Action*)

MSP gas sensors, EveryAware SensorBox, and electrochemical gas sensors

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Function in the Action: WG Member

VITO / Belgium

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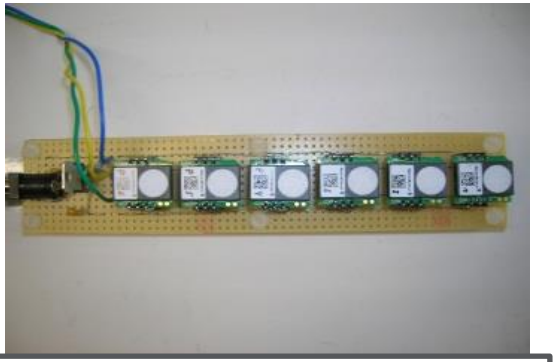
Scientific context and objectives

- Goal: Evaluation of low cost gas sensors in an urban traffic environment
  - Evaluation against reference devices
  - Evaluation against each other
  - Evaluation of influence of meteorological conditions and cross interferences

AppliedSensor gas sensors (MSP)

AppliedSensor NO_2 and VOC sensors



AppliedSensor IAQ modules with continuous and with pulsed heating

The sensors react rather fast on changes in NO_2

Low concentrations (e.g. 10 ppb NO_2) are well detected

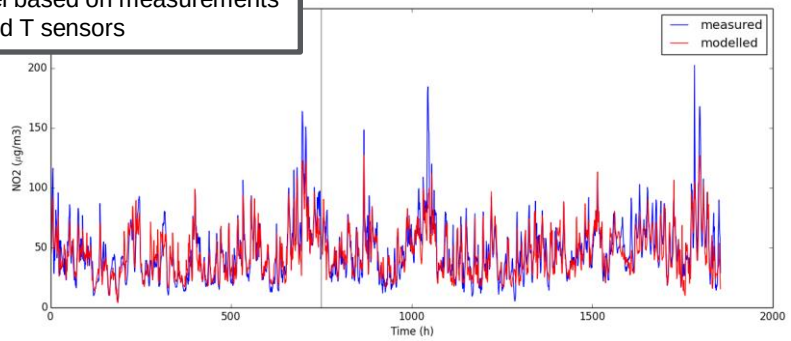
Large influence of T on the sensor signal might be present
(further investigation needed)

EveryAware SensorBox

The EveryAware SensorBox:

- **Goal: Detect exposure to traffic pollution**
- **Deals with low sensor selectivity by combining 10 sensor signals**
- **Has an open hardware design (feel free to copy)**
- **Devices are trained against reference with machine learning**

Result of NO_2 model based on measurements of NO_2, NO_2, O_3, and T sensors



Sensor name	Component to measure	Power usage	Measurement range	Indicative price
Alpasense CO-BF	CO	0 mW	0-5000 PPM	180 Euro*
MiCS-5521	CO	76 mW	1-1000 PPM	3,4 Euro
MiCS-2710	NO_2	50 mW	0.05-1 PPM	3,7 Euro
MiCS-5525	CO	76 mW	1-1000 PPM	5 Euro
Figaro 2201	Gasoline exh. (CO, H2, HC)	500 mW	10-1000 PPM	15 Euro
"	Diesel exh. (NO_x)	500 mw**	0.1-10 PPM	"
MiCS-2610	O_3	95 mW	10-1000 PPB	3,7 Euro
AS-MLV	VOC	41 mW	NA	15 euro

Sensors able to detect presence of traffic pollution

O_3, VOC, T and RH sensors added for correction purpose

* 60 Euro for sensor and 120 Euro for sensor electronics

** This is the same heater as for the gasoline sensor. The total usage of the dual Figaro sensor is 500 mW.

Electrochemical gas sensors

Alphasense CO-B4, NO-B4, and NO2-B4

SensorIC NO2 3E 50

- Require high sensitivity sensor electronics
- Require equipotentiostat
- Typical price (with sensor electronics): 200 Euro/piece
- Low power usage
- First (lab) tests show good sensor sensitivities
- Alphasense B4 series have Auxiliary electrode which allows to compensate for meteorological influences on sensor baseline signal

CONCLUSIONS

Expected outcome:
- **Plenty of low cost gas sensors are sensitive enough to detect low gas concentrations present in ambient air**
- **We expect a strong influence of meteorological conditions (T, RH, and wind)**
- **We expect cross interference**

Our goal:
- **Sensor evaluation**
- **To be able to overcome the sensor shortcomings by combining them**