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OpenSense II | RTD 2013

FNSNF

The Lausanne Deployment – Progress, Lessons, and Goals for OpenSense II

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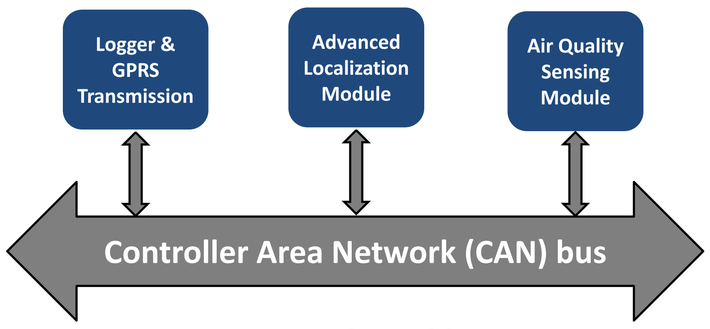
ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

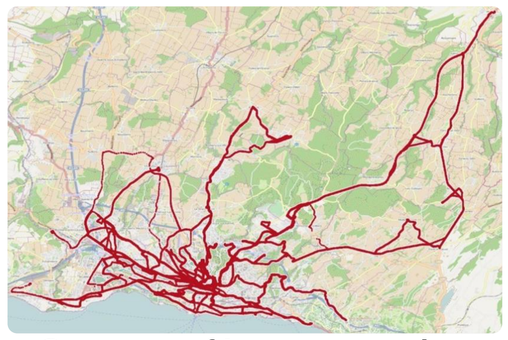
In OpenSense

We developed a robust and modular **mobile sensing platform** for air quality monitoring



Lausanne node architecture

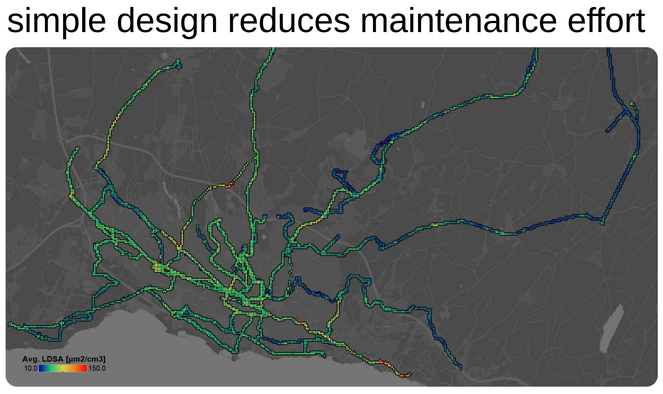
We deployed on **10 Lausanne city buses** covering the city and neighboring regions



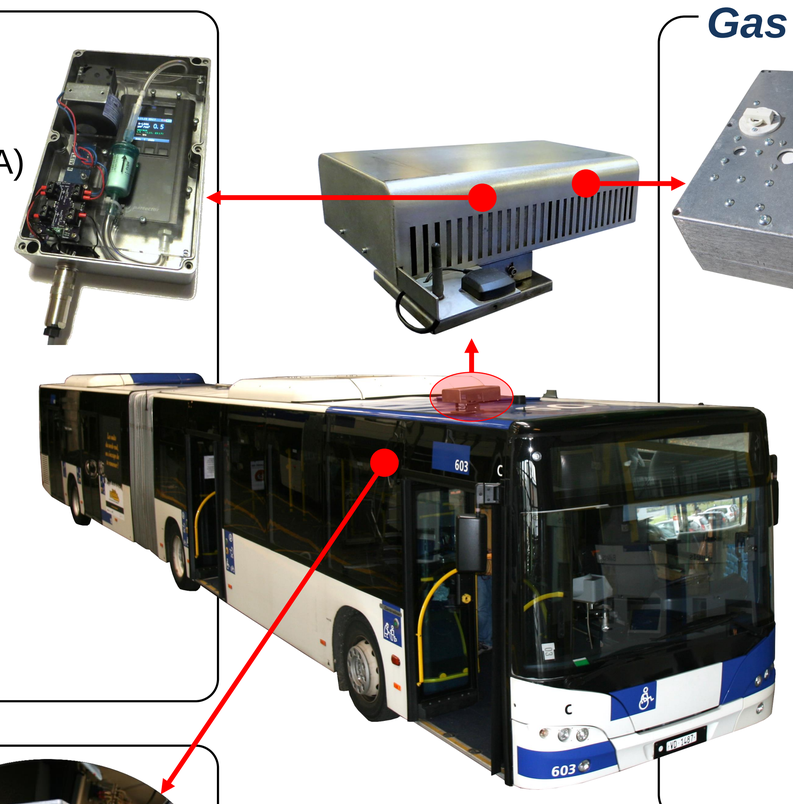
Coverage of Lausanne region

Nanoparticle Measurement System

- based on state of the art Naneos Partector instrument
  - ❖ measures lung-deposited surface area (LDSA)
  - ❖ **world smallest nanoparticle detector**
  - ❖ wide particle size range: 10nm to 10µm
- simple design reduces maintenance effort

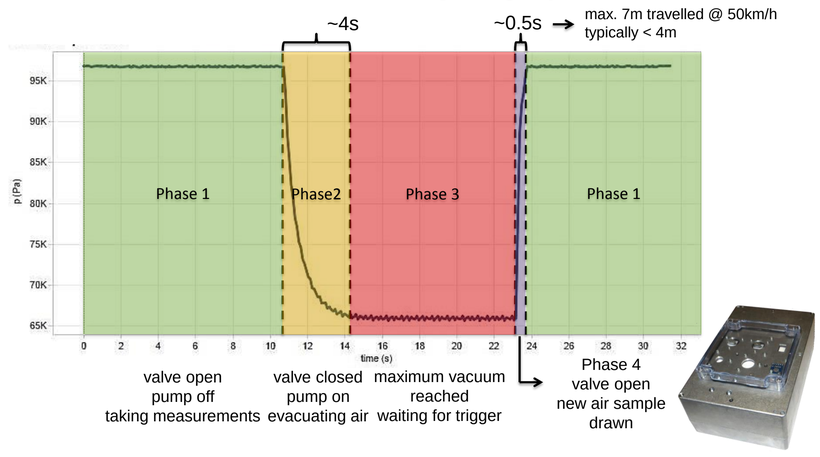


Average LDSA values for March 2014



Gas Sampling System

- integrates low-cost electrochemical, metal-oxide & non-dispersive infrared sensors
- measures **CO, CO_2, NO_2, O_3,** temperature & humidity
- design of current passive system upgradable to **closed-chamber sampling** system



Working principle of closed-chamber sampling system

Logging & Localization

- GPRS link to back-end server
- local storage on SD card

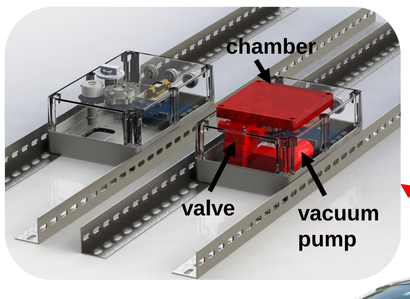
The logger (blue) and localization module (red) are inside the vehicle

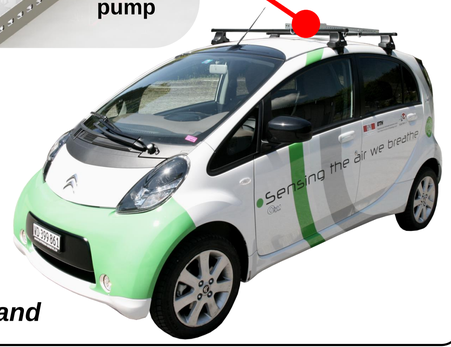
Robust localization – prerequisite for adaptive sampling

- exploits commercial state of the art u-blox LEA-6R GPS + dead reckoning (DR) module
- augmentation:
  - ❖ additional sensor modalities
  - ❖ public transport context

eVehicle

- going **beyond public transport mobility** constraints:
  - ❖ measuring in otherwise unreachable areas
  - ❖ increasing sample rate on particular links
- **common platform** for parallel testing:
  - ❖ passive vs. active, open vs. closed gas sampling
  - ❖ evaluation of different localization methods



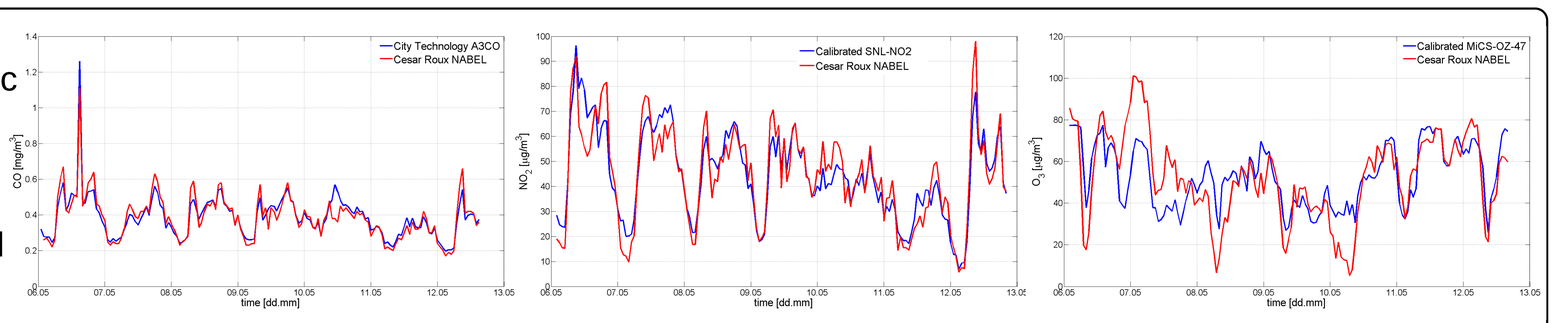


Citroën C-Zero electric car – donated by the EPFL Transportation Center in collaboration with Citroën Switzerland

Sensor Calibration

- calibration is currently static
- based on federal NABEL station in Lausanne
- due to sensor drift, on-the-fly calibration needed

César Roux NABEL station, Lausanne



From left to right: CO, NO_2 and O_3 sensors after static calibration

In OpenSense II

Deployment Management
- Maintain OpenSense infrastructure
- Upgrade to closed-chamber sampling system

Pollution Maps
- Exploit long-term deployment for deriving data-driven pollution models

Sampling Strategies
- Solve time budget optimization problem introduced by closed-chamber sampling

Pedestrian Mobility
- Solve challenges in localization and mobility modeling introduced by this new mobility vector

In collaboration with: Transports publics de la région lausannoise | naneos particle solutions gmbh | SGX SENSORTECH | CITROËN