

Section Sciences et Ingénierie de l'environnement Design Project 2012 (semestre de printemps)

Proposition n° 14

Gas Field Estimation - A Challenge for Mobile WSNs

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Descriptif du projet

In the context of the OpenSense project [1], we are looking into enabling air quality monitoring in urban environments using mobile sensing platforms anchored on buses provided by TL (Transports publics de la région lausannois). The sensor nodes are based on the Sensorscope wireless platform, originally developed for weather monitoring, with added capabilities for chemical sensing. Current measurements include CO, CO₂, and fine particles (PM).

Adding mobility to Wireless Sensor Networks (WSNs) can bring significant benefits to a monitoring platform: finer spatial resolution, coverage of wider area with fewer nodes, cheaper maintenance (nodes can be brought to a single site for inspection), etc. On the other hand, not much literature exists on field estimation for non-static sensor networks and the specific constraints of gas concentration mapping have been very little researched.

To what extent the techniques originally developed for the traditional static measurement setups can be applied to systems endowed with mobility is an open question.

[1] Nano-Tera OpenSense - <http://www.nano-tera.ch/projects/401.php>

Objectif

The main goal of the project is to study and implement different model-based algorithms to generate a 2-D real-time pollution map of the city based on the sensor network measurements.

Particularly, it requires first to survey the state of the art in gas distribution mapping and gas field estimation. Then, based in real data and/or simulations, to analyze how the particularities of a mobile sensing platform affect the applicability of the established methods. And finally, to implement the most suitable model(s) in Matlab to generate the interpolated 2D pollution map.

Descriptif tâches

The project tasks can be summarized as follows:

- survey the literature on techniques and algorithms for gas field estimation
- get familiar with the OpenSense project constraints regarding mobility models and chemical sensing
- analyze to what extent these constraints affect the applicability of the different estimation techniques considered
- implement a small selection of these techniques in Matlab using data gathered with the sensing platform provided by Sensorscope in a controlled environment (potentially using a wind tunnel)
- analyze and compare the performance of the implemented algorithms
- test the selected algorithms using real (if available) and/or simulated data of pollution over Lausanne imported in Matlab

Divers

Work breakdown: 40% theory, 40% programming, 20% experiments

Prerequisites: Knowledge of Matlab

Keywords: environmental monitoring, gas distribution mapping, chemical sensing, mobility, wireless sensor networks

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