Section Sciences et Ingénierie de l'environnement
Design Project 2014 (semestre de printemps)

Proposition n° 31

Fine Particle Distribution Estimation in Lausanne Using the OpenSense Network

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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 Lausanne deployment consists of 10 buses equipped with sensors for measuring CO, CO_2, NO_2, O_3 levels and, more recently, particle matter (PM) using the Naneos Partector [2].

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 air composition mapping have been very little researched.

In order to get a better understanding of the principles by which the activities of such a mobile sensing network should be controlled we are currently developing an integrated simulation framework consisting of three layers: one for mobility, one for networking and another one for the environmental field.

[1] Nano-Tera OpenSense - http://www.nano-tera.ch/projects/401.php
[2] Naneos Particle Solutions GmbH - www.naneos.ch

Objectif

The main goal of the project is to focus on a specific aspect of the environmental simulation layer: the particle matter field and to select the appropriate spatio-temporal techniques for the estimation of this field.

Using lung deposited surface area (LDSA) measurements from the OpenSense deployment, together with additional sources of information (e.g., vehicle mobility data, traffic count data, weather data, land-use maps) the students will have to derive an air pollution simulation model for the city of Lausanne. They will then evaluate the capacity of this model to predict measured concentration levels.

Descriptif tâches

The project tasks can be summarized as follows:

- get familiar with the OpenSense project constraints regarding mobility models and particle matter sensing
- get a working understanding of the existing simulation framework
- analyze the different available sources of information and their utility in deriving a usable particle matter concentration model
- derive the model
- analyze and evaluate the predicting performance of the model

Divers

Work breakdown: 25% theory, 40% data analysis, 35% programming

Prerequisites: Matlab programming

Keywords: environmental monitoring, air pollution modeling, mobility, wireless sensor networks

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