The Sense-City equipment project: insight into the prototyping and validation of environmental micro- and nanosensors for a sustainable urbanization

Bérengère Lebental[1 3], Dan Angelescu[2], Tarik Bourouina[2], Frédéric Bourquin[1], Costel-Sorin Cojocaru[3], François Derkx[1], Thi-Lan Ha[4], Enric Robine[4], Henri Van Damme[1]

1: Université Paris-Est, IFSTTAR, 58 bd Lefebvre, 75732 Paris Cedex 15, France
2: Université Paris-Est, ESYCOM, ESIEE-Paris, 2 bd Blaise Pascal, BP 99, 93162 Noisy Le Grand Cedex, France
3: LPICM, UMR 7647 CNRS Ecole Polytechnique, Route de Saclay, 91128 Palaiseau, France
4: CSTB, 84 Avenue Jean Jaurès, 77420 Champs sur Marne, France
Contact Author: berengere.lebental@ifsttar.fr; jean.dumoulin@ifsttar.fr

While today's galloping urbanization weighs heavily on both People and Environment, the massive instrumentation of urban spaces appears a landmark toward sustainability. Collecting massively distributed information requires the use of high-performance communication systems as well as sensors with very small ecological footprint. Because of their high sensitivity, the wide range of their observables, their energetic self-sufficiency and their low cost, micro- and nano- sensors are particularly well suited to urban metrology.

A 8 years, 9 M€ equipment project funded by the French "Programme d'Investissement d'Avenir" starting in 2012, the Sense-City project will offer a suite of high-quality facilities for the design, prototyping and performance assessment of micro- and nanosensors devoted to sustainable urbanization.

The scientific program of Sense-City is built around four programs, environmental monitoring, structural health monitoring, energy performances monitoring and people health and exposure monitoring. We present the activities of the consortium partners, IFSTTAR, ESIEE-Paris, CSTB, LPICM, and the prospects brought by Sense-City equipment in terms of sensor prototyping, benchmarking and operation validation.

We discuss how the various sensors developed by LPICM and ESIEE (for instance conformable chemical and gas microsensors using nanomaterials at LPICM, miniaturized gas chromatographs or microfluidic lab-on-chip for particles analysis at ESIEE-Paris) can be integrated by IFSTTAR into sensors networks tested by IFSTTAR and CSTB in both lab and urban settings. The massively distributed data are interpreted using advanced physical models and inverse methods in order to monitor water, air or soil quality, infrastructure and network safety, building energy performances as well as people health and exposure.

We discuss the shortcomings of evaluating the performances of sensors only in lab conditions or directly in real, urban conditions. As a solution, Sense-City will provide an environment of intermediate complexity for the testing of environmental sensors, a realistic urban test space in climatic conditions, both far more complex than clean rooms and far more controllable than actual cities.