

# CITI-SENSE

Development of sensor-based Citizens' Observatory Community  
for improving quality of life in cities

Newsletter N° 4



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Happy birthday CITI-SENSE!

Participants from 28 partner organizations from Europe, South Korea and Australia met at the University of Belgrade from 29.09.-02.10.2013, jointly hosted by Vinca Institute for Nuclear Sciences and NILU Norwegian Institute for Air Research, for attending the 1<sup>st</sup> annual meeting of CITI-SENSE project.



Preparations for field trials are on their way. In a trial period starting in January 2014, air quality in class rooms of the elementary school suited in residential area of city and in Belgrade shall be measured and provided to participants continuously. The data will be processed and transferred immediately and ready to be recalled via internet and mobile phones. Monitors in the class rooms, in fixed urban locations, and on personal body-worn devices will support real time measurements and data exchange.

All data will be stored in a data base that can be publicly accessed through computers and mobile phones. In collaboration with different users, CITI-



SENSE information will be designed to be easily accessible and understandable, and freely available to all interested parties. In this way, the project will allow people to track issues of importance to themselves, and to take steps towards improving their living environment.

The EU FP7 project CITI-SENSE has been initiated to improve quality of life in cities by use of mobile sensors and mobile phones. The Serbian capital, Belgrade, has been selected as one of the nine locations within Europe to test mobile sensors for outdoor air quality in the city and indoor air quality in schools. VINCA and DunavNET, the project partners from Serbia, and QUT, the project partner from Australia, are going to perform case studies in Belgrade. Thus team consisting of three partners already has multidisciplinary experience in area of indoor and outdoor air quality monitoring and exposure assessment at one side and application of such devices in mobile sensors and wireless networks. The main aim of the Belgrade case study is to constitute CitObs of human exposure pollutants based on mobile and static sensor networks of low-cost portable devices for monitoring urban air quality and physical activity. Added value will be establishing relation of human exposure with particular pollutants with biomonitoring, biomarkers and genomic data of participants. Recognizing the importance of ultrafine particles, as one of the major pollutants in urban environments, the team will employ novel sensors and develop predictive models to estimate exposure to nanoparticles.

*Milena Jovasevic-Stojanovic (VINCA)*

### **Barcelona: lights, bicycles, camera, action!** (Tom Cole-Hunter, CREAL)

CITI-SENSE was selected as one of three projects to be filmed by the European Service Network with the aim to put forward the principle/concept of Citizen Observatories (CO) projects (as a general approach) together with a few examples of CO application (currently pilot studies) of the projects financed by the European Commission under the 7<sup>th</sup> Framework Package (FP7). The commissioning of the film is by the Directorate-General of Research & Innovation (DG RTD), intended as a general short film (of several minutes) explaining to a broad public what CO could be and why this way of working could involve more citizens with newly adapted technology.

As showcased in the film, citizens (being the elements of the CO) will not only be helping to collect data, but also they will receive a beneficial product or service resulting from the collected data. An example of such a product or service proposed, coming from the CITI-SENSE project, is a real-time urban air pollution map that could indicate alternative travel routes for active commuters. A tool of this nature may help cyclists or joggers to avoid heavily-polluted zones while performing physical activity for utility or exercise, similar to the way that existing online maps may help commuters to choose the most direct route – another choice would be the most clean/green route. As well as shots of beautiful Barcelona being traversed with COs, the sensor technology development and testing behind the COs was showcased in the CRIC (now Ateknea) laboratories also in Barcelona.

The other two projects included in the video alongside CITI-SENSE were Omniscientis (of CO rural odour monitoring in Belgium) and Citclops (of CO marine water monitoring in Ireland). The DG RTD will officially premiere the “Citizen Observatories” video during the GEO Ministerial Summit that will take place mid-January 2014.



*CITI-SENSE volunteer with the pilot mobile sensor node attached to his chest, being filmed bicycling in Barcelona, September 2013.*

## **Integrating a wireless distributed sensor network for air pollution and exposures estimation with a citizen social network (David Broday – Technion)**

Due to Israel's vulnerability to climate changes, increased urbanization, fast population growth, constantly improving lifestyle, and unique geo-meteorological conditions (edge of the desert, semi-arid, high insulation, high summer midday temperature, etc.), the Israeli public faces deteriorating urban air quality, reduced visibility, increasing frequency of photochemical smog episodes, increased exposure to fine and ultrafine airborne particulate matter (PM), mild urban heat islands, reduced precipitation (and wet deposition), food grown with reclaimed water as a result of fresh water shortage (and resuspended dust from such fields), enhanced desertification, and severe predictions of climate change indicators. All these conditions contribute, and oftentimes synergistically exacerbate, environment-health relationships. Moreover, on top of these dynamic conditions the close proximity between people (the receptors) and pollutant sources gives rise to rather unique Israeli circumstances where people are routinely exposed to pollutant mixtures containing anthropogenic and biogenic, fresh and aged, organic and inorganic, urban and rural/agricultural, and toxic and harmless respirable pollutants. In particular, common ambient PM levels in Israel are much higher than those observed in Europe and North America.

As part of the CITI-SENSE project, the Technion team study exposure to traffic-related airborne stressors, and develop technologies and concepts that enable citizen participation in (a) air pollution (AP) research prioritization and design, (b) collection and analysis of AP data (e.g. by utilizing distributed computer resources), and (c) dissemination, adaption of personal choices and priorities for AP reduction, and building pro-active social networks that supports policy changes. Specifically, we study ways to turn the concept of wireless distributed sensor networks (WDSN) for AP monitoring into a viable citizen observatory framework; methods to handle, analyze, search and share Big Monitoring Data; tools for publishing apprehensible products (e.g. exposure maps, personal exposure tracking); and algorithms for field "on-the-go" calibration, error correction, and pooled inference. The Technion will be involved in integrating these components and address them within a comprehensive yet flexible multi-scale inter-connected phenomena and processes. The



sensor board holds several sensors for gaseous pollutants as well as other sensors for measuring different environmental parameters, such as temperature, relative humidity, location, acceleration, etc. The data are gathered by several wireless end-member nodes and can be shared, locally processed and transmitted to a central server for further pooled data analysis and interpretation.

Research activities will focus on exposure to urban air pollution using a citizen infrastructure platform, and include: a dialogue with the public to engage citizens to be active participants, dissemination of results and related information to the general public and to policy makers, enabling informed public discussion, empower citizens and encourage public participation in reducing their individual exposures (e.g. by changing individual/communal preferences; societal priorities regarding development, urbanization, and transportation means; emission reduction at home, from home, at work, during commute; etc.

To date, calibration of different sensors of the wireless distributed sensor network and comparison against data from a standard air quality monitoring (AQM) station have been performed. Preliminary field campaigns include studying small-scale spatial variations in pollutant concentrations using both stationary and mobile sensing units. We expect to deploy a convenient network of about 10 units in a central urban region towards the end of 2013. This field campaign will run for a few months, include several sub tasks, and will serve as the first phase of a much larger field campaign planned to take place in 2014-2015.

## Upcoming events

Activity/event	Where	When
ICT 2013	Vilnius	6-8/11/2013
Smart City Expo World Congress	Barcelona	19-21/11/13
European Symposium on Acoustic Comfort in Urban Design	Bilbao (Spain)	27-28/11/2013
6th call for GEOSS Architecture Integration Pilots (GEOSS AIP-6)	Geneva	17/01/2014
9th International Conference on Air Quality - Science and Application	Garmisch-Partenkirchen (Austria)	24-28 March 2014
EGU General Assembly 2014	Vienna	27/04/2014

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