# CityAir app: Mapping air-quality perception using people as sensors

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Outdoor air pollution is a major environmental health problem affecting all people in developed and developing countries alike. Ambient (outdoor) air pollution in both cities and rural areas was estimated to cause 3.7 million premature deaths worldwide in 2012.

In modern society, people are expending an increasing amount of time in polluted urban environments, thus increasing their exposure and associated health responses. Some cities provide information about air pollution levels to their citizens using air quality monitoring networks. However, due to their high cost and maintenance, the density of the monitoring networks is very low and not capable to capture the high temporal and spatial variability of air pollution. Thus, the citizen lacks a specific answer to the question of "how the air quality is in our surroundings".

In the framework of the EU-funded CITI-SENSE project the innovative concept of People as Sensors is being applied to the field of outdoor air pollution. This is being done in eight European cities, including Barcelona, Belgrade, Edinburgh, Haifa, Ljubljana, Oslo, Ostrava and Vienna. People as Sensors defines a measurement model, in which measurements are not only taken by hardware sensors, but in which also humans can contribute with their individual "measurements" such as their subjective perception of air quality and other personal observations. In order to collect the personal observations a mobile app, CityAir, has been developed. CityAir allows citizens to rate the air quality in their surroundings with colour at their current location: green if air quality is very good, yellow if air quality is good, orange if air quality is poor and red if air quality is very poor. The users have also the possibility of indicating the source of pollution (i.e. traffic, industry, wood burning) and writing a comment. The information is on-line and accessible for other app users, thus contributing to create an air-quality map based on citizens' perception. Currently, 400 + Android OS and 180+ iOS smartphone users in 12+ countries have downloaded, installed and used CityAir.

The central advantage of the People as Sensors approach is that it can complement costly physical sensor networks. The observations made in smartphones are shared and other persons can consult those to take decisions as for instance choosing a cleaner route to bicycle to work or avoid exercising in certain areas that day. The drawbacks are limited comparability and interpretability, and the inherent uncertainty.

CityAir can be seen as a democratic platform for empowering citizens to contribute to environmental governance, facilitating the communication between the citizen and the decision makers. Citizens are encouraged to participate in sharing their perception on the air quality in their city. Citizens become agents of change by uncovering and sharing their perception of air quality in a place that matters to them.

We discuss the current challenges: how to involve citizens in the use of the app and how to communicate and visualize the information in a way that is useful for the citizens; point out possible solutions, and pin-point directions for future research.