

Semester Thesis / Master Thesis / Group Work:

Visualize Volumes of Air Quality Data

Motivation: Urban air pollution is a major concern in modern cities. Atmospheric pollutants are responsible for a variety of respiratory illnesses (*e.g.*, asthma) and some are known to cause cancer if humans are exposed to them for extended periods of time. Traditionally, air pollution is monitored by a network of static measurement stations operated by official authorities. The extensive cost of acquiring and operating static stations severely limits the number of installations.

In recent years new gas sensors appeared on the market, which are inexpensive, small, and suitable for mobile measurements (see Fig. 1(a)). As part of the OpenSense project, we integrated several such low-cost sensors into compact air pollution monitoring stations, which are deployed on top of several trams in Zurich, as shown in Fig. 1(b). We daily gather megabytes of air quality data and store these in our database. Currently, we use only basic time-series plots and maps to visualize the data. These give little insight into the data and, thus, user experience with the web site can be significantly improved.

Task: The goal of this thesis is to design and implement a set of data presentation and visualization tools for our air quality data set. Your tools should include data summaries and statistical data properties of the real-time and historical data to improve user experience. You are welcome to suggest and implement your own visualization and data analysis ideas, but the web page must be robust.

This involves for you the following tasks:

- Design a set of *data summaries* that show interesting aspects of gathered data and suggest how to efficiently implement them for a big data set.
- Write software tools that *compute statistics and visualize the air quality data* for various time scales and locations, make use of *pre-computation and caching*.
- Integrate your tools in a *web-page prototype* and show a demo at your final presentation.
- (Master Thesis only!) Integrate your tools into an *augmented or virtual reality application*, *e.g.* for Google cardboard. We are of course also open for your own ideas!

OpenSense web page: www.opensense.ethz.ch

Requirements: Interest in data analysis and visualization of big data sets.

Interested? Please have a look at <http://www.tec.ethz.ch/research.html> and contact us for more details!

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(a) Low-cost gas sensors.



(b) Tram with a sensor node on top.

Figure 1: Air pollution monitoring on top of trams in Zurich.