Semester Thesis:

**Easy Breathe: Health-Optimal Routing in Urban Areas**

**Motivation:** Urban air pollution is a major concern in modern cities. Atmospheric pollutants considerably affect human health; they are responsible for a variety of respiratory illnesses and some are known to cause cancer if humans are exposed to them for extended periods of time.

As part of the OpenSense project, we build small sensor nodes to monitor different air pollutants, such as ozone, carbon monoxide, and ultrafine particles. The sensor nodes traverse the city of Zurich on top of ten trams. We use the collected measurements to construct high-resolution exposure maps of Zurich, as illustrated in Fig. 1.

![Road network graph + High-resolution pollution map + Shortest vs. health-optimal path](image)

Figure 1: High-resolution exposure maps can be used to find optimal routes with low exposure levels.

**Task:** The goal of this thesis is to use high-resolution exposure maps to find health-optimal routes between two arbitrary locations in Zurich. The route finding algorithms need to efficiently run on resource-constrained smartphones (Android or iOS). This involves the following tasks:

- Study related literature of state-of-the art route planning algorithms.
- Implement the most promising algorithm on a smartphone. Explore the trade-offs of the algorithm (e.g., computation time versus optimality) and come-up with an implementation, which is able to quickly compute least-cost paths despite a large road network graph.
- Benchmark your implementation on different smartphone models.
- Design an appealing smartphone application, which shows the user the shortest and the health-optimal paths for two arbitrary locations within the city of Zurich.
- Let your friends use your great application and collect some statistics for an anonymized user study, e.g., average path length, achieved reduction of pollution exposure, and average computation time.

**OpenSense web page:** [www.opensense.ethz.ch](http://www.opensense.ethz.ch)

**Requirements:** For this thesis, you should enjoy programming in C++ or Java and be interested in solving optimization problems efficiently.

**Interested? Please contact us for more details!**

**Contact**

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