**Route Selection of Mobile Sensors for Air Quality Monitoring**

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**Reference Stations**

- Precise pollution recordings
  - NABEL (National Air Pollution Monitoring Network): 1 station in Zurich, O\textsubscript{3}, CO, NO\textsubscript{2}, SO\textsubscript{2}, PM\textsubscript{10}, NMVOC
  - OstLuft (Cantonal Air Pollution Monitoring Network): 4 stations in Zurich, O\textsubscript{3}, NO, NO\textsubscript{2}

**OpenSense Nodes**

- NABEL station in Duebendorf
- OpenSense: Sensing the Air We Breathe

**Checkpointing Constraints**

- Two vehicles make a checkpoint if the distance between them is below a certain threshold. Checkpoints are used for
  - Relating measurements in space and time
  - Comparing sensor readings and sensor calibration
  - Recognizing faulty sensors

- X-Checkpoint - between two OpenSense nodes
- R-Checkpoint - between an OpenSense node and a reference station

Given the checkpoints between all pairs of sensors, it is possible to construct a checkpoint graph. If a checkpoint graph is connected, the set of selected vehicles fulfills checkpointing constraints.

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**Route Selection Algorithm**

Route selection problem involves high computational complexity even for a small number of OpenSense nodes

<table>
<thead>
<tr>
<th>City</th>
<th>Network</th>
<th>Routes</th>
<th>Vehicles</th>
<th>Stops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zurich</td>
<td>tram</td>
<td>13</td>
<td>260</td>
<td>187</td>
</tr>
<tr>
<td>Canton Zurich</td>
<td>bus</td>
<td>280</td>
<td>733</td>
<td>2743</td>
</tr>
<tr>
<td>Berlin</td>
<td>bus</td>
<td>149</td>
<td>1'300</td>
<td>2'634</td>
</tr>
<tr>
<td>Chicago</td>
<td>bus</td>
<td>352</td>
<td>2'000</td>
<td>12'000</td>
</tr>
<tr>
<td>NY City</td>
<td>bus</td>
<td>324</td>
<td>5'000</td>
<td>15'226</td>
</tr>
<tr>
<td>Long Island</td>
<td>bus</td>
<td>89</td>
<td>389</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Statistics on public transport networks in different cities

**SOLUTION: Evolutionary algorithm**

- Input: public transport network
- Output: a set of vehicles best suitable for the installation

**Algorithm parameters:**
- Number of measurement stations
- Locations of the reference stations
- X-checkpointing or R-checkpointing constraints
- Maximum execution time

**Fitness:** inverse to coverage of the city center

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OpenSense Website: http://opensense.epfl.ch, OpenSense Zurich Deployment: http://www.opensense.ethz.ch