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Interactive Front-End for EV Traffic Simulation in Highways

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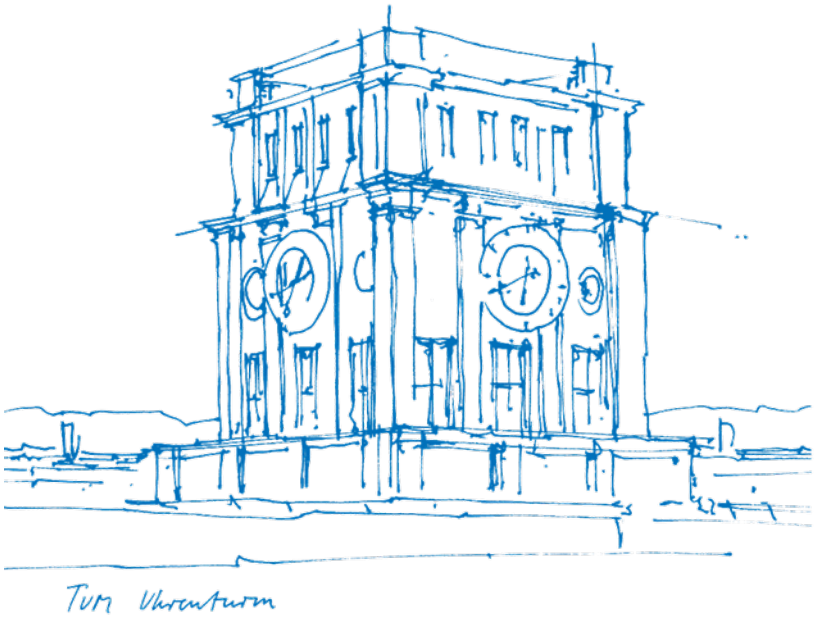

Smart scheduling approach for EVs

- **paper:** “Smart Charging Schedules for Highway Travel with Electric Vehicles”
  - authors: Victor del Razo and Hans-Arno Jacobsen
- **idea:** EVs determine their charging stops during a highway trip
- **goal:** reduce the total travel time for each EV
- **summary:** shortest path problem
  - A* search algorithm
  - extended with verification of constraints
- **software:** Python based simulation framework that provides
  - generated trip data
  - time-dependent parameters

Smart scheduling approach for EVs

- **simulation model**
  - electric vehicles (EVs)
  - charging stations (CSs)
  - highway
- **scheduling design**
  - local to the EV
  - communication with charging stations
  - highway-related information system
- **scheduling process**
  - calculate set of charging stops and times
  - submit bookings to the charging stations
  - proceed trip as planned unless an update event is received

Interactive Front-Ends

Our task was to design and implement two front-ends for the simulation framework.

- **Simulation Manager Interface**
  - show current states of EVs and CSs
- **EV Driver Interface**
  - show relevant vehicle information
  - display travel-related information

Research question

What is the most suitable form of presentation for the data that is most relevant during the simulation and while driving respectively?

- **Simulation Manager Interface**
  - data-heavy application
  - structured data access
  - relation between EVs and CSs
  - schedule changes
  - aggregated metrics

- **EV Driver Interface**
  - limited user attention
  - separation of information
  - time-relevant data

Which tools, libraries, frameworks or APIs can be used to implement the two front-ends? Which are most suitable for our purpose?

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Simulation Manager Interface

Google Maps JavaScript API

config.js

```
var config = {
    mapID: "map",
    mapCenter: "Germany",
    mapZoom: 7,
    markers: {
        car: {
            url: "img/markers/car.png",
            anchor: new google.maps.Point(24, 18)
        },
        battery: {
            url: "img/markers/battery.png",
            anchor: new google.maps.Point(20, 36)
        }
    }
};
```

main.js

```
$(document).ready(function () {

    // Init map
    var map = new Map();

    // Electric vehicles traveling from A to B
    var ev = [];

    ev.push(new EV(map.map, 1, 0, "Munich", "Berlin"));
    ev.push(new EV(map.map, 2, 10, "Munich", "Berlin"));

    // Charging stations at location C
    var cs = [];

    cs.push(new CS(map.map, 1, "Ingolstadt"));
    cs.push(new CS(map.map, 2, "Nuremberg"));
    cs.push(new CS(map.map, 3, "Bayreuth"));
    cs.push(new CS(map.map, 4, "Osterfeld"));
    cs.push(new CS(map.map, 5, "Rabenstein"));
});
```