eMaps

Fachpraktikum Algorithms on OpenStreetMap Data 19/20

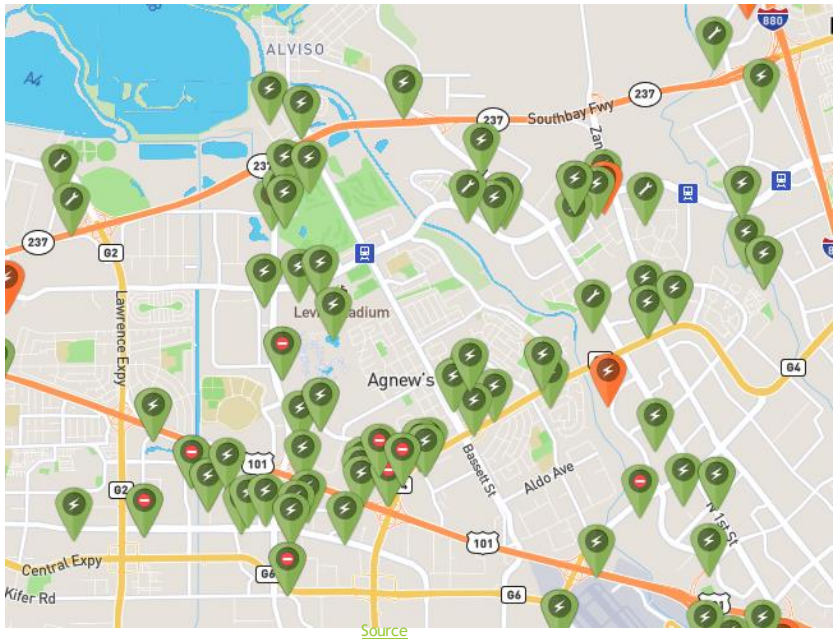
Motivation

Source

- Electrically-powered vehicles important in fight against climate change
- Unique characteristics:
  - Limited cruising range
  - Long recharge times
- May run out of power

→ Adaption of route planners required!

Idea

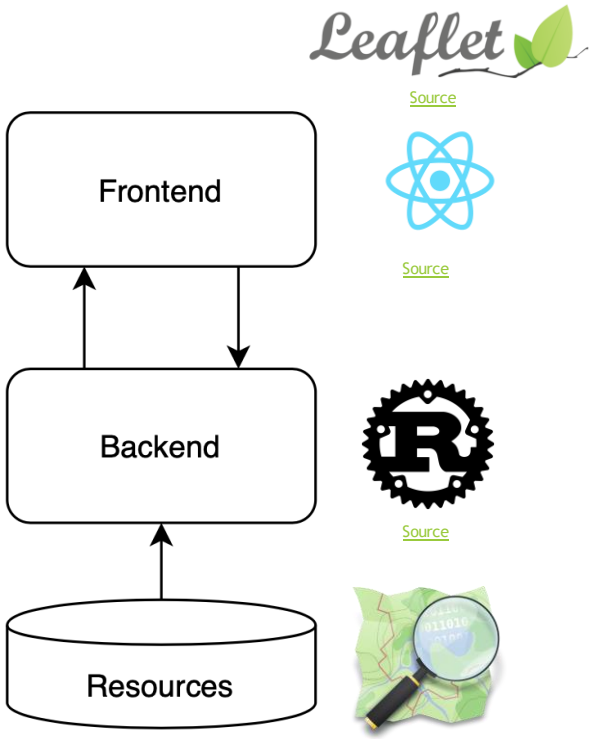


Source

- Route planner for e-Vehicles
- Route planner should consider:
  - Current and maximum range of e-Vehicles
  - Availability of charging stations
  - Never running out of power

Live Demo

Architecture

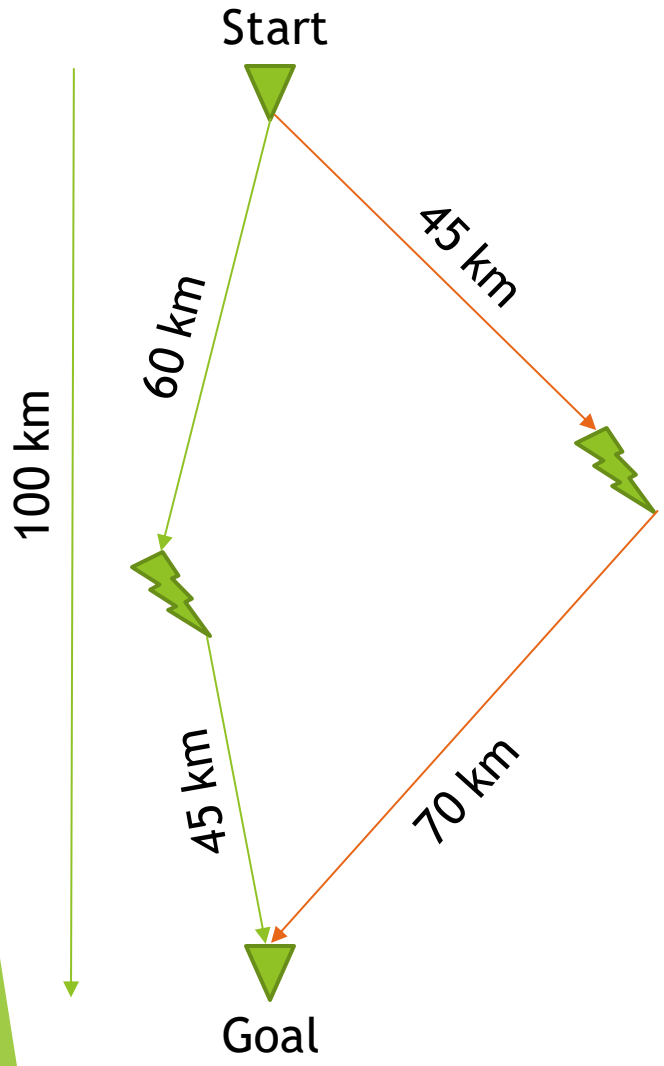


- Model-View-Controller
- Resources: Raw OpenStreetMap data in PBF format
- Backend: core functionality and API written in Rust
- Frontend: display map and routes using React and Leaflet

Key Concepts

- Parse amenities from OpenStreetMap data with {amenity: charging_station}
  - Parse vehicle supported by charging station, i.e. only Cars, only Bikes, or both
- Extend graph with charging station nodes
- Request for shortest path contains current and maximum range of e-Vehicle

Key Concepts



- Backend calculates distance of route
  - If distance within current range → return route
  - Else: calculate route with charging station(s)
- Calculate "optimal" charging station for current route
  - Start coordinates
  - Goal coordinates
  - Current range
- Set current range to maximum range

Key Concepts

- Calculate route with charging station
  - If distance from charging station to goal is within maximum range ⟶ concatenate route + return
  - Else calculate route to next charging station until distance from charging station to goal is within maximum range

Other features

- Search Cities, Places, POIs, … via Nominatim API
- Show map of all charging stations

Limitations & Future Work

- Determining charging station/route not optimal
  - Extend edges by a weight representing the energy consumption
  - Consider elevation profile to determine more energy efficient routes

- Thank you!