Reinflow Feature Proposal

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Context

Reinflow is an existing web application that manages traffic signals and path routing. The purpose of the system is to make use of algorithms to create a smarter traffic management system than what currently exists, with easy access. However, the system is very simple and requires expansion. The purpose of this proposal is to present forth an idea and framework for an additional feature that will improve the system allowing smarter route choices to be made for emergency vehicle routing based on live traffic data.

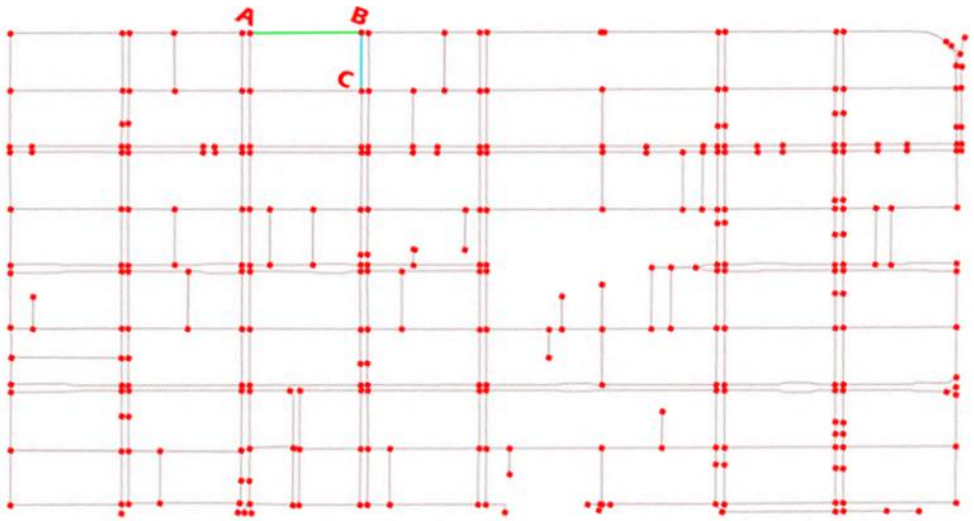
Concept

The current system takes the shortest distance route and changes all signals to green for that route for emergency vehicle implementation. The current system makes use of openrouteservice and generates a single route based on a start and endpoint.

The proposition is to generate multiple routes between two points with a minimum of five should the route allow. Another requirement is access to live traffic data. As this isn't available there are two options. Real-world sensors could be introduced to track vehicles. However, if this is not possible using traffic flow data and incident reports will be used to simulate and derive timings for the best route choice under all circumstances.

Implementation Strategy

Create endpoints to receive sensor data and store it to a database. This database will store the average traffic flow over a 5-minute interval in order to determine potential delays. The data would be stored as node-to-node data. Take the following node-graph which is a representation of the Melbourne CBD.



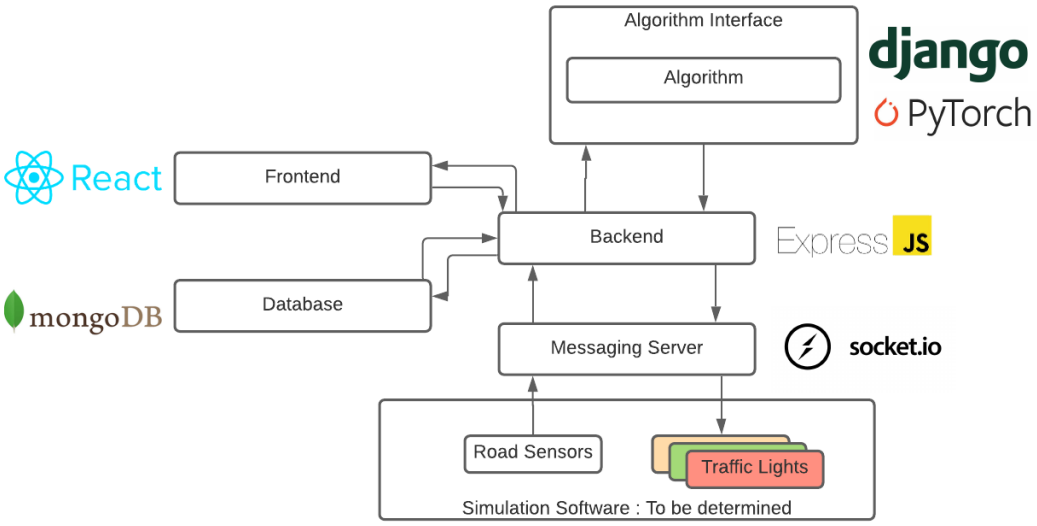
Point A (top left) knows the average volume from A → B and point B also knows the time from B → A but it also knows B → C and it would know B → X (The next node to connect to B). this information allows strategic decision making and timings to be calculated based on real-time data.

Openrouteservice makes use of a time-distance matrix which will be used to establish base-line readings. There is also an "optimization api" part of this package which can be used specifically for vehicle routing problems and can take in some more input data which can be used for travel planning for emergency services when a whole fleet of vehicles needs to be dispatched.

Openrouteservice will also be used to generate several paths to one location with its estimated time-distance matrix. All of this information will be passed to the Django api. Using Python will allow complex mathematical computation to happen very quickly and efficiently. Python will analyze each route, add on timing based upon traffic volume and return the routes based on the fastest travel time.

All features will be displayed via the React front-end and handled by back-end endpoints. Anything that requires more complex calculations such as multi-route selection will be routed to the Django api and handled by Python libraries, notably OSMNX which will allow advanced algorithmic calculations and data generation integrating cleanly with openrouteservice.

The changes will be built open the existing framework and software stack which is as shown below:



Bibliography

https://openrouteservice.org/
https://www.djangoproject.com/
Feld S, Roch C, Gabor T, Seidel C, Neukart F, Galter I, Mauerer W and Linnhoff-Popien C (2019) A Hybrid Solution Method for the Capacitated Vehicle Routing Problem Using a Quantum Annealer. *Front. ICT* 6:13. doi: 10.3389/fict.2019.00013