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Pedestrian routing of periodically changing areas using Volunteered Geographical Information (OpenStreetMap)

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Abstract:

Pedestrians, contrasting with vehicles, do not take routes only over defined linear features. Routing networks have historically ignored that pedestrians have a higher degree of freedom, and can naturally move through open spaces (Graser, 2016). On top of that, our real world is not static, it changes dynamically. Routing apps also fail in most cases to portray the varying character of the reality on the ground.

Combining both time dependent, and open areas we can define a complex scenario called Time Dependent Open Areas (TDOAs). There are no routing services we are aware of that can handle TDOAs.

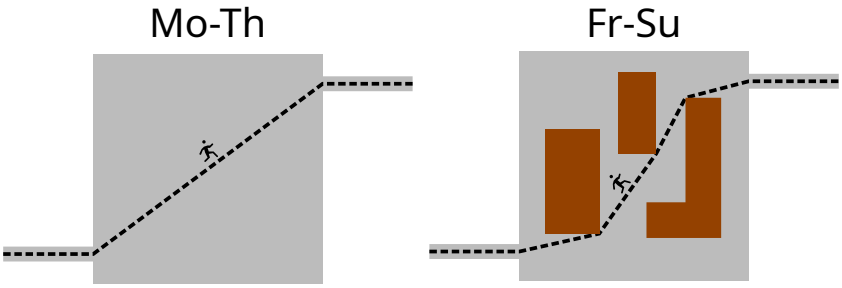

Figure 1. Example of a TDOA. A pedestrian square is fully traversable from Monday to Thursday. From Friday to Sunday, there is a weekly market that changes the areas that can be walked over, so a pedestrian would have to walk around the market stalls to reach the opposite end of the square.

When commercial solutions do not exist, Volunteered Geographical Information (VGI), that is edited by individual users, can fill the gap in the availability of digital geographical information (Goodchild, 2007). OpenStreetMap (OSM) is the most renown actor of VGI, being a free editable spatial database of the world, which data can also be downloaded and reused with an open license (OpenStreetMap Wiki contributors, 2022a).

This openness, in both data and specification, helped with the development of a whole range of applications around it, creating a sort of "ecosystem". The ecosystem of OSM applications provides a starting point for our solution, and paves the way for the development of derived work on an already established base.

This work in progress aims to develop a standard way (schema) of mapping TDOAs, deriving from the current OSM time dependent (OpenStreetMap Wiki contributors, 2022c) and pedestrian open areas (OpenStreetMap Wiki contributors, 2022b,d) schemas. After that, combine time dependent (Bundesministerium für Verkehr und digitale Infrastruktur, 2019, Rylov et al., 2022) and open area (Hahmann et al., 2018, GIScienceHD, 2017) routing algorithms to create a single unified routing service for TDOAs. The unified routing service uses OSM data and the new schema to generate the routing graph.

A web client is also being developed from previous work (Butzer et al., 2021). It acts as a graphical interface to interact with the unified routing service. This web client has the options to set a start and end points, and a time. It also incorporates a map to visualize the route.

The tagging schema and the unified routing service is set to be proven in a real world example. The surveyed data is then incorporated and merged into the existing OSM database, and therefore openly shared for other uses. After that, the

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adequateness and effectiveness of the results obtained are analyzed, comparing the unified routing service with a routing service that cannot handle TDOAs. The analysis focuses on measurable variables like computing time for generating the routing graph and routes, needed memory for the graph and distance variability with the most efficient route.

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