Why do route planning strategies of machines differ from each other and from humans?

by SYED MIFTAH ZEYA

In recent years, Pedestrian Navigation has come up as an important research topic in disciplines such as Cartography, GIS, Spatial behavior, Indoor and Global positioning as well as Neuroscience [1]. With the increasing use of GNSS-enabled mobile devices and various routing apps, we heavily rely on them for routing and navigation. Almost constant walking speed throughout makes pedestrian navigation different from car navigation [2]. When travelling from one point to another, different people can have different preferences. All the routing apps insist that they provide the most optimum route in a given scenario. But do they? Should we always follow machine-generated routes?

RESEARCH OBJECTIVE

The main objective of this thesis is to develop a set of metric indicators that can evaluate routes calculated by different routing engines as well as humans between the same source-destination pair. This thesis also aims to investigate if or how the human route choice preference changes with changes in scenarios and travel needs. The scope of this work is limited to pedestrian and bicycle paths due to time constraints. The results of this research can be used for understanding pedestrian routing behavior.

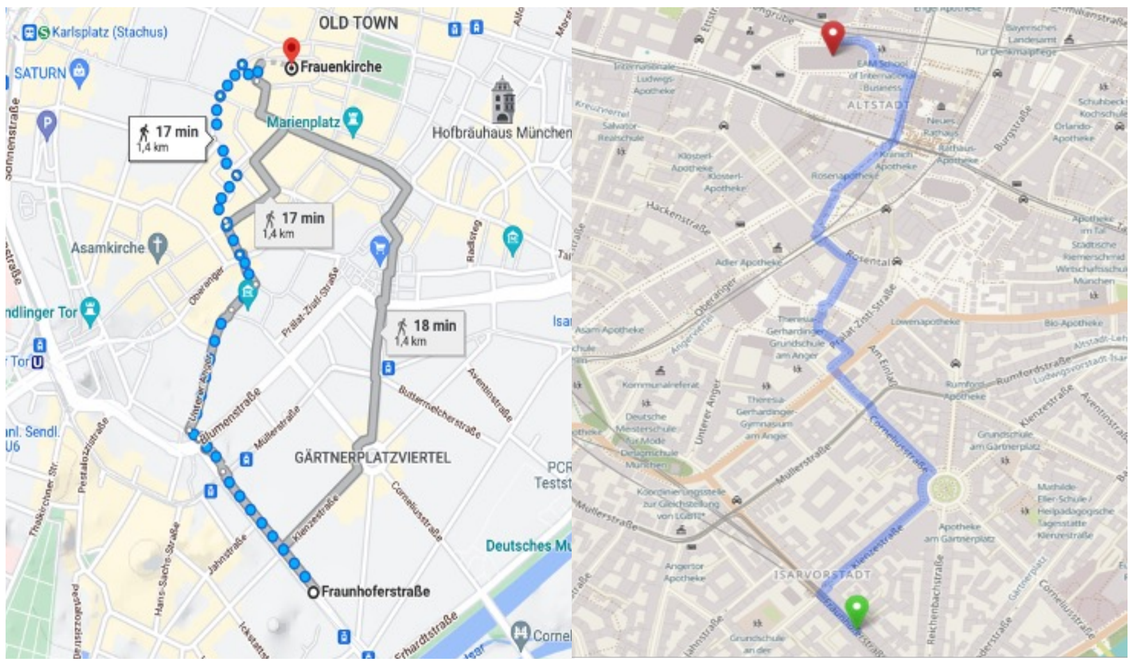

Fig. 1. A screenshot from Google Maps showing the optimum walking route (Left) and a screenshot of OpenStreetMap showing the optimum walking route (Right) for the same source-destination pair.

METHODS ADOPTED

The city of Munich was chosen as the study area. Three scenarios have been considered for this research namely *Travelling to work place*, *Leisure walk* and *Bike trip on a weekend*. The development of this work consists of three important phases: understanding the basics of human route choices and preferences through an initial user survey (a), formulation of metric indicators (b), and validation of these indicators by subsequent user study (c). In the end, it also identifies the limitations of this work and recommendations for future work.

CONCLUSION

Human route choice preference is very much connected with scenarios and travel needs. The most important factor of one scenario might be the least important in another. The finding of this work clearly states that routing apps do not consider scenarios and travel needs, they suggest you same route irrespective of your travel needs. During this research, Google maps always suggested the fastest route and not the shortest route. In scenarios such as *Leisure walk* and *Bike trip on a weekend*, just using routing apps could lead to purposeless travel.

N	Metric indicators	Traveling to work place	Leisure walk	Bike trip on a weekend
1	Type of the surface / wheelchair accessibility	✓	✓	✓
2	Total length of the route	✓	✓	✓
3	Number of turns / crossings	✓	✓	✓
4	Slope	✓	✓	✓
5	Air quality index / green area	✓	✓	✓
6	Noise level	✓	✓	✓
7	Amenities (benches, waste bins, public toilets, drinking water, shade, etc.)	✓	✓	✓
8	Estimated time of arrival	✓	✓	✓
9	Number of underpasses (underground crossings)	✓		
10	Sidewalk availability	✓	✓	
11	Illumination		✓	✓
12	Dedicated bike lane			✓

Fig. 2. Metric indicators for the three different scenarios created for the purpose of this study.

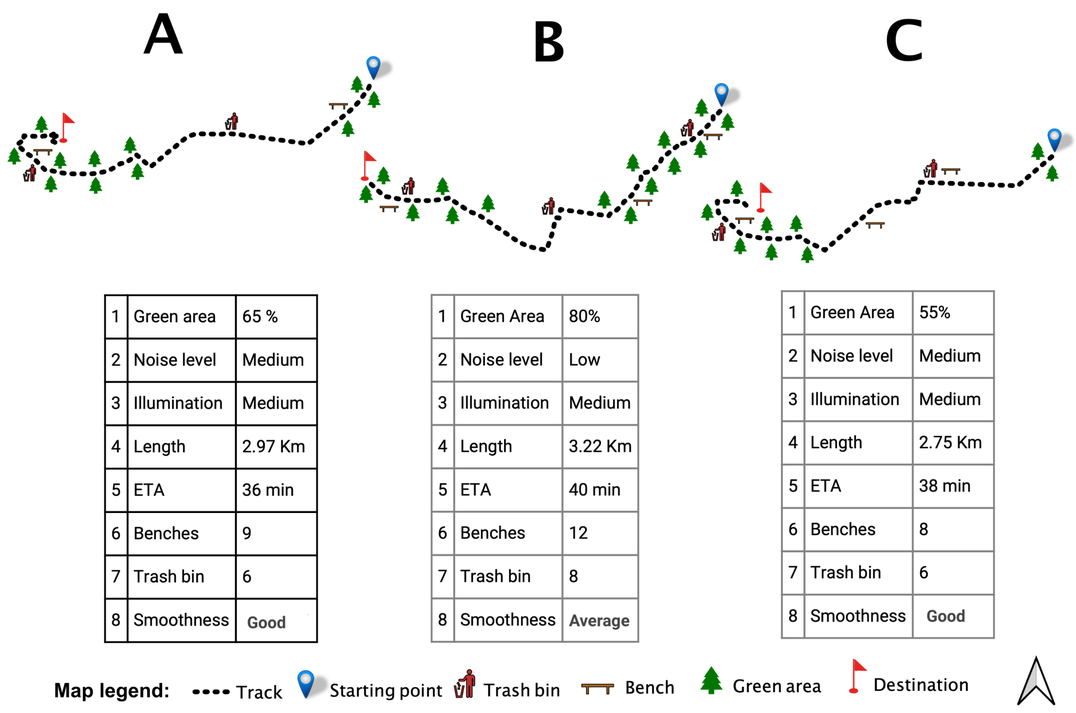

Fig. 3. A map created for the second user study showing two machine generated routes (A & C) and one human generated route (B) based on the first user study.

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