Cool Streets – Developing a Healthy Urban Route Planner

by **JIAYING XUE**

Cities have been the hotspots of pollution and diseases [1], due to the rapid urbanization. Further than conventional route planners that mainly focus on the shortest or fastest routing options, healthy urban route planner aims to enhance the satisfaction of life for urban pedestrians and cyclists by optimizing human comfort and health [2].

This thesis develops a health-oriented navigation application prototype to minimize the adverse health impacts of urban residents by providing routes with less pollution and better thermal comfort and evaluates its usability and utility through a user study.

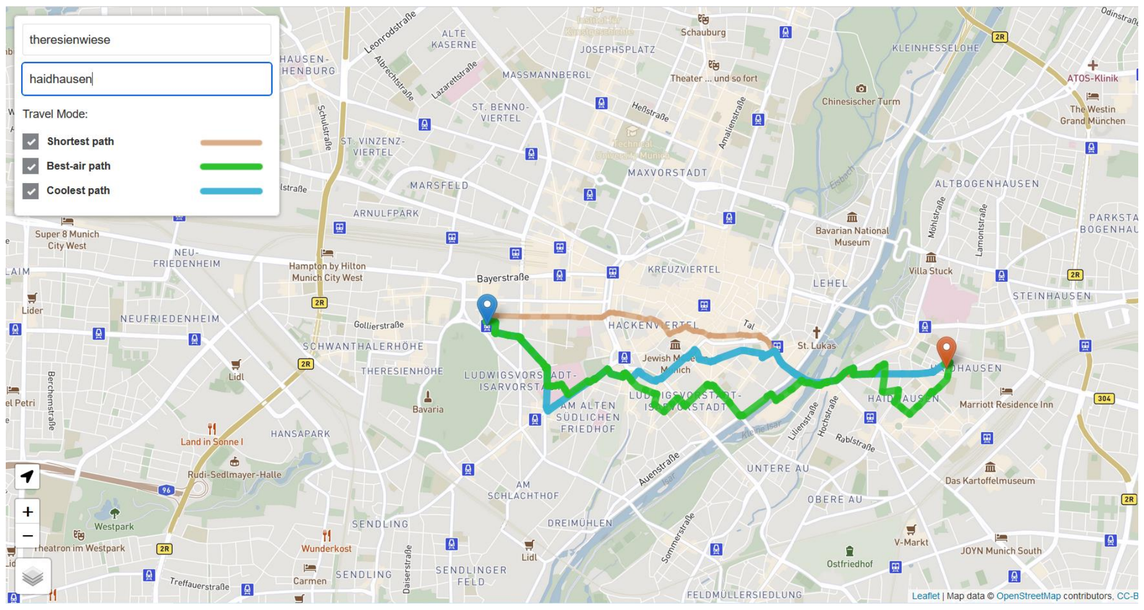

Fig. 2: Screenshot of the prototype with three routing paths.

OBJECTIVES

The three objectives of this study are (1) to develop a web application prototype that helps find health-oriented paths in Munich, (2) to design navigation routes and interactive web interface efficiently, and (3) to evaluate the usability, utility , and user experience through a questionnaire-based user study

HYPOTHESIS

The hypothesis that runs through the study is that (1) this web application is helpful and applicable in practice, and (2) the difference in users' performance in attention distribution can be observed in different cases.

METHODOLOGY

The methodology (Fig. 1) can be roughly divided into three different stages:

Synthesis air quality data was generated within the overall AQI range for the road network based on the observed data collected by Climateflux [3]. Dijkstra's algorithm is applied to determine the optimal path between the origin and destination.

A geo-database was created to build network topology and conduct route computation. The database was then published to GeoServer for route querying by SQL views, and Leaflet was used for interactive map design.

Four basemaps, point, and line symbols were created based on color conventions and attention-guiding techniques in UI design. A questionnaire was designed to collect user feedback regarding Visual Attention, Thematic Analysis, Interface Evaluation, and User Experience.

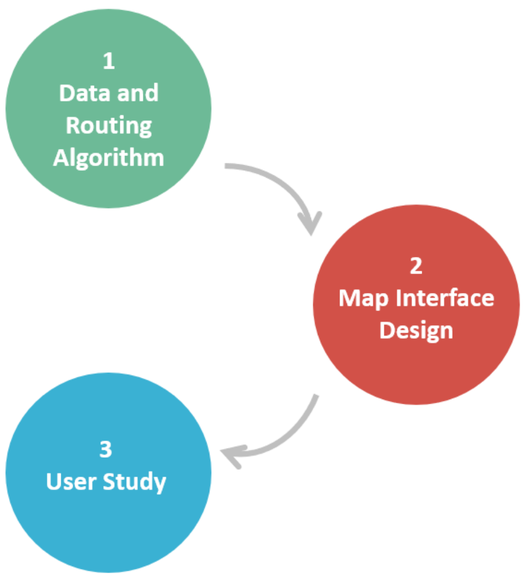

Fig. 1:The workflow of methodology

PROTOTYPE

A web application prototype (Fig.2) was implemented. It contains basemaps, address search boxes, a travel mode switcher, and several buttons. It employs Nominatim as the geocoder to convert addresses to coordinates and fetches the routes through requesting URLs in GeoServer. It allows users to drag markers to get routing paths dynamically within the study area.

USER STUDY

A face-to-face user study was carried out with both quantitative and qualitative questions. Likert-type (5 points) [4] and AttrackDiff [5] methods were used to measure participants' attitudes and impressions, and text-based questions were designed to collect user's subjective opinions.

Participants were asked to choose the most eye-catching route in various cases. Afterward, participants could explore the prototype and rate it in terms of its learnability, efficiency, and satisfaction.

RESULTS

There were 30 volunteers who took part in the user study with the age of 20-30.

The results of the section Visual Attention indicate the underlying maps and other map contents can affect the distribution of the user's visual attention, and the combination of visual variables in symbol design is effective in guiding the user's attention.

Opinions on interface design, usability, and utility were analyzed quantitatively with bar charts and verified by chi-square. It was found that the marker, route, and interface designs were favored by the majority of users. Most participants supposed it was easy to learn and use, and responses of the utility evaluation showed a significantly positive pattern.

The results of AttrakDiff showed the users' positive attitudes toward this prototype. Qualitative thematic analysis showed the themes *Interface Function* and *Desired Feature* were mentioned most. Various features like Expected Time of Arrival and Autocorrection for typing were desired by participants.

CONCLUSION

This study built a web application prototype, which targets pedestrians and cyclists to provide health-oriented routing services. Qualitative and quantitative analysis of the user study verified the usefulness and potential of this prototype. However, there is still room to enhance its performance and user experience in the future.

THESIS CONDUCTED AT

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Department of Aerospace and Geodesy
Technische Universität München

Technische Universität München

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