Visualization of spatial disparities in mobility service frequency with open public transit feed data in Germany

by **Md Imtiaz Uddin**

Open data are publicly available data that are stored & distributed without any restrictions for use & dissemination [1]. General Transit Feed Specification (GTFS), OpenStreetMap & administrative data of Germany were used to create PubTraDis Visualization. Two reproducible workflows have been developed in this study to process raw GTFS data. This tool visualizes spatial disparities in mobility service frequency. It is suitable to compare between different States & Municipalities. Service frequency were modeled at station & grid levels. Expert-based evaluation was performed to determine the usability & utility of the tool [2]. The usability study shows that PubTraDis Visualization complies with basic cartographic principles.

Objectives

The three objectives of this study are (1) To identify & determine methods of exploring spatial disparities in public transit, (2) To adopt open-source data for interactive web-map-based visualization of spatial disparities in mobility service frequency, and (3) To develop and evaluate a tool for interactive web-map-based visualization of spatial disparities in mobility service frequency.

Methodology

Data Processing

GIS automation workflow was created to process raw GTFS data used in the study. Fig. 1 represents the workflow for station-level frequency, and Fig. 2 shows the grid-level Frequency Indicator and Disparity Index calculation workflow.

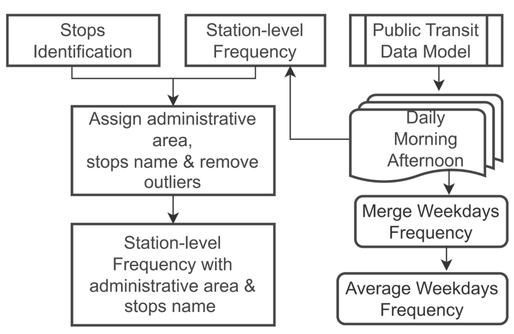

Fig 1. Workflow to calculate station-level frequency

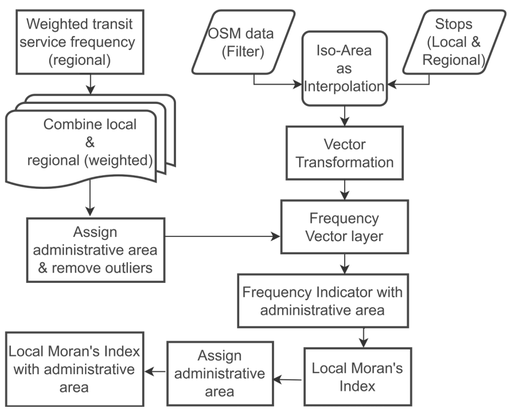

Fig 2. Workflow to calculate Frequency Indicator and Disparity Index

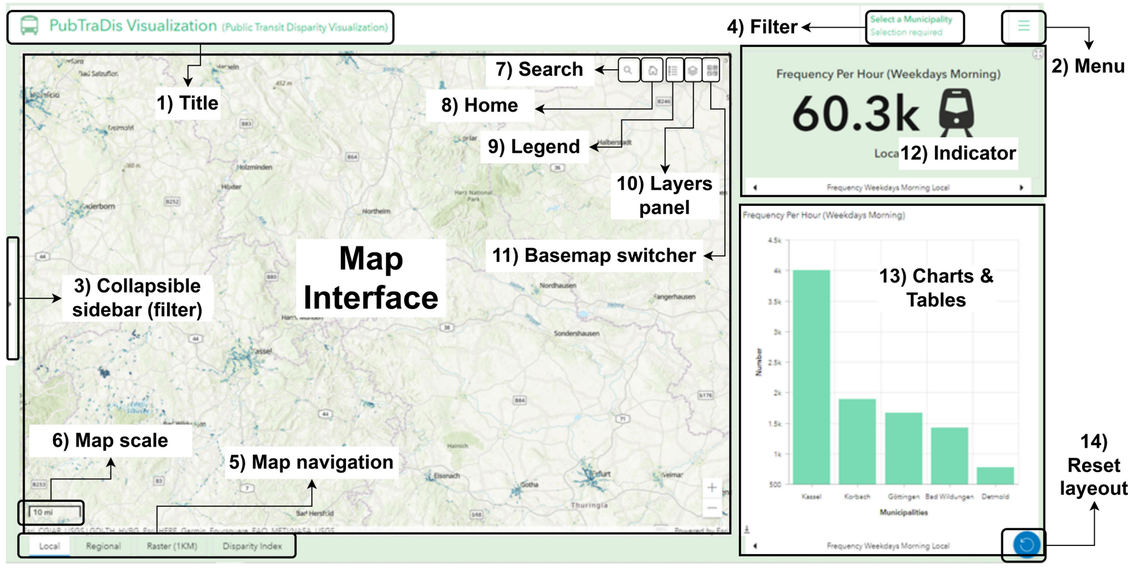

Fig 4. User interface of PubTraDis Visualization

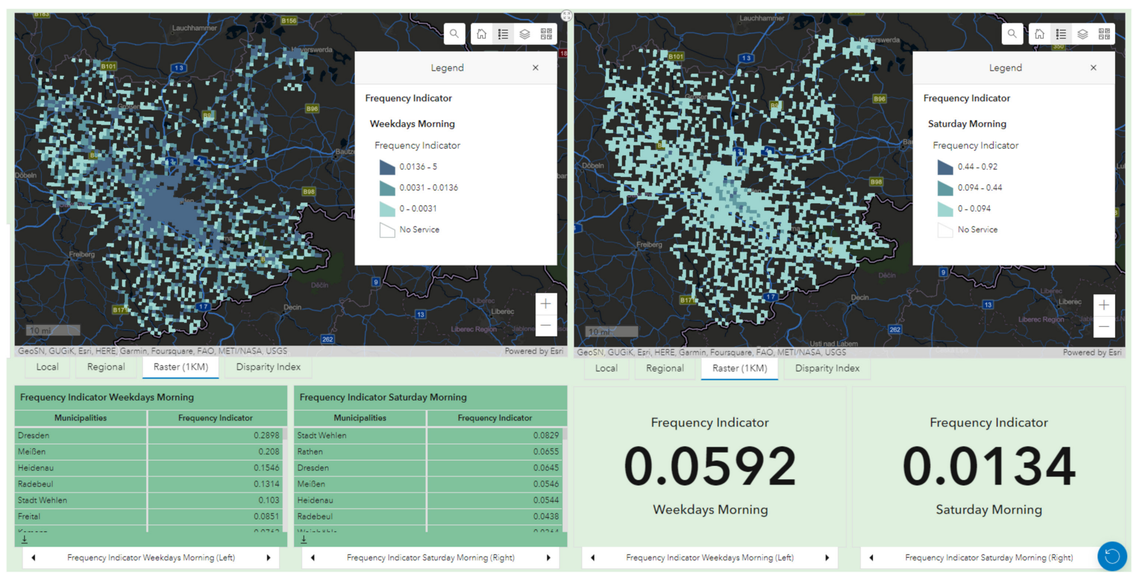

Fig 5. Comparison between weekdays and weekend in PubTraDis Visualization

PubTraDis Visualization

Data design & visualization ideas considered from the literature & existing applications. Fig. 3 shows the UCD process adopted in PubTraDis Visualization.

Fig 3. UCD process in PubTraDis Visualization

User Interface

Fig 4. is showing the user interface of PubTraDis Visualization. Users can interactively perform filter, search, comparison & overlay in different parameters. Additional information is offered with chart & table which interactively changes with the map interface. Multiple or one state can be filtered, one Municipality can be filtered at once. Comparison is possible between morning & afternoon as well as weekdays & weekend of any area.

Comparison window

Comparison between weekdays morning and Saturday morning Frequency Indicator in Verkehrsverbund Oberelbe (VVO) service area is showing by Fig. 5.

Conclusion

PubTraDis visualization is the first tool that is able to show spatial disparities in public transit mobility service frequency using GTFS data. Evaluation outcomes suggest that PubTraDis Visualization will contribute to spatial disparity analysis in public transit research.

Thesis Conducted at

Institute of Cartography
Department of Geosciences
Technische Universität Dresden

Thesis Assessment Board

Chair Professor: Prof. Dipl.-Phys. Dr.-Ing. habil. Dirk Burghardt (TUD)

Supervisor: Prof. Dipl.-Phys. Dr.-Ing. habil. Dirk Burghardt (TUD)

Dr. Ing. Sujit Kumar Sikder, Research Associate (IOER)

Reviewer: Dr. Barend Köbben (UT)

Year

2022

Keywords

Open Data, GTFS, Public Transit Service, Interactive web-map, Spatial Disparities

References

[1] C. P. Geiger and J. Von Lucke, 'Open Government and (Linked) (Open) (Government) (Data)', JeDEM, vol. 4, no. 2, pp. 265–278, Dec. 2012, doi: 10.29379/jedem.v4i2.143.

[2] R. E. Roth et al., 'User studies in cartography: opportunities for empirical research on interactive maps and visualizations', International Journal of Cartography, vol. 3, no. sup1, pp. 61–89, Oct. 2017, doi: 10.1080/23729333.2017.1288534.

This master thesis was created within the Cartography M.Sc. programme – proudly co-funded by the Erasmus+ Programme of the European Union.

Technische Universität München · Technische Universität Wien · Technische Universität Dresden · University of Twente. · Erasmus+ · cartographymaster.eu