2nd Online Symposium on Circular Economy and Sustainability, Online Event, Alexandroupolis, Greece, 14-16 July, 2021

Open tools and methodology for the development of a web-based transportation platform

Babis Babalis[1*], Athanasios Ballis[2], Elias Koukoutsis[1]

[1]*Division of Communication, Electronic and Information Engineering of NTUA, Athens, Greece*

[2] *Department of Transportation Planning and Engineering of NTUA, Athens, Greece*

**Corresponding author: chbabalis@ece.ntua.gr*

There is an increasing need for analysis tools to support transportation planning. The current work presents the tools and methodology for the development of a web-based transportation platform consisting entirely of open-source tools (network data and open libraries for modelling and data analysis for presentation). Open-source software is driven by thousands of IT professionals around the globe as such a platform has no dependencies on a proprietary tool.

Figure 1 presents the elements of the proposed platform: Firstly, all required data concerning the transport (road, rail, maritime and air transport) network are extracted from OpenStreetMaps (OSM), a collaborative project that creates a free editable map of the world [4]. The geodata underlying the map is considered the primary output of the project. Geofabrik [5] gives a boost to the OSM Project by supporting it with shape files, maps, map tiles and geodata processing. OSM is closely associated with Overpass API and Overpass-turbo, which is a web-based data mining tool for OpenStreetMap [3]. For the analysis of the transport network, networkX python library is used [6]. With this library the road (or combined) network can be easily modelled as a graph, where the nodes represent the points of interest (POIs), while the edges represent the roads/links of the transport network respectively. For the data process and analysis, pandas and geopandas [] python libraries have also been used, offering advanced capabilities to data manipulation. The web-based platform is served by a number of web applications. Those applications are built on top of plotly-dash python packages [2] which provide an interactive web dashboard. A site built on django collects and serves the web-apps. All software tools/components described above are under free and open source licenses, ensuring the sustainability of the system [1]. The structure of the proposed web-based platform addresses the following challenges: The creation of a custom dataset and the network analysis for computing a four-step-model that provides the user with insights and data visualizations. Platform maps are collected from geofabrik, which provides shapefiles, tiles and maps. Road, rail, maritime and air transport networks are retrieved from the OpenStreetMaps project. Data from the geofabrik and the OSM maps are combined resulting in network modelling as a graph. Transportation platform implementation requires the pre-computation of Origin-Destination (OD) Matrices. A set of OD-Matrices are computed between different areas. The level of detail differentiates the OD-Matrices in terms of size and values. Data regarding points of interest (POIs) as well as geospatial information is retrieved from the overpass-turbo web app. Through further process, POIs data is converted to datatables. All collected data is available to the user who is able to make selections with the help of appropriate filters. Hence a custom dataset is created with the data of interest. Insights regarding the custom dataset can be visualised via bars and pie plots. The user can combine the aforementioned custom dataset with an OD Matrix in order to run a

four-step-model. The results are produced after combining the user's data selection and the modelled (as a graph) network. This is achieved through the modelling and analysis of the transport network as a graph. Finally, the modelled network is combined with the geographical information and projections of the results are presented on a map. Results can either be downloaded or viewed on a map. The system described above has been created and tested to a limited extent in the network of Greece. Further enhancements are under consideration. However, even at this early stage, the proposed design is a proof of concept of an alternative, yet reliable web-based platform that works out of the box offering high-end functionality free of proprietary solutions.

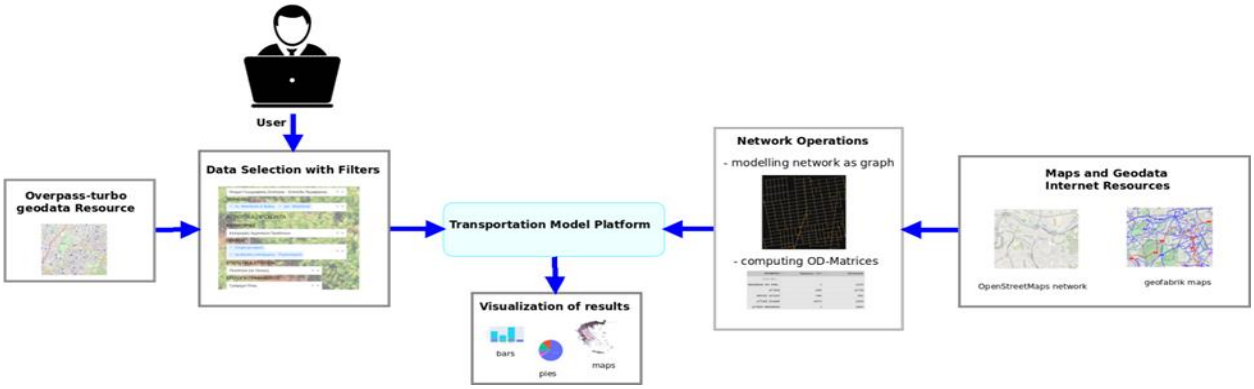

Figure 1: End to end high level presentation of the proposed system in action.

This model is implemented in the framework of the Act "ENIRISST - Intelligent Research Infrastructure for Shipping, Supply Chain, Transport and Logistics" (MIS 5027930) which is part of the Action "Strengthening Research and Innovation Infrastructure" and funded by the Operational Program "Competitiveness, Entrepreneurship and Innovation" in the framework of the NSRF 2014-2020, with the co-financing of Greece and the European Union (European Regional Development Fund).

Key words: open-source software, web-based transportation platform, geospatial data

References

[1] Licenses & Standards | Open Source Initiative. (2021). Retrieved 7 June 2021, from https://opensource.org/licenses

[2] Plotly. (2021). Retrieved 7 June 2021, from https://plotly.com/about-us/

[3] Overpass turbo - OpenStreetMap Wiki. (2021). Retrieved 7 June 2021, from https://wiki.openstreetmap.org/wiki/Overpass_turbo

[4] The licence: where we are, where we're going | OpenStreetMap Blog. (2008). Retrieved 7 June 2021, from https://blog.openstreetmap.org/2008/01/07/the-licence-where-we-are-where-were-going/

[5] GEOFABRIK // Home. (2021). Retrieved 7 June 2021, from https://www.geofabrik.de/

[6] NetworkX — NetworkX documentation. (2021). Retrieved 7 June 2021, from https://networkx.org/

[7] pandas - Python Data Analysis Library. (2021). Retrieved 7 June 2021, from https://pandas.pydata.org/