On the completeness of sidewalk information in OpenStreetMap, a case study of Germany

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Abstract

The quality of OpenStreetMap (OSM) data has always been of main concern for use in different projects. In our study, in order to understand the fitness for use of OSM data for a routing and navigation system for people with limited mobility, we have assessed the completeness of OSM data with regards to sidewalk information. Relevant attributes for sidewalk information have been considered, and thorough an intrinsic quality analysis we present the number of sidewalk information (at object and attribute level) for five selected cities in Germany. The results are discussed and an outlook for future research study is presented.

Keywords: Spatial Data Quality, Completeness, OpenStreetMap, Sidewalk

1   Introduction

Since the launch of OpenStreetMap (OSM) project in 2004 [1], due to its nature and objective in collecting data from volunteers which are not necessarily familiar with GIScience and data collection procedures, the quality of gathered information has always been a main concern for both research and industrial communities [2]. Several research studies have been conducted to understand and evaluate the quality of OSM data based on different data quality elements and for different application purposes [3]. Some studies have only focused on assessing the completeness of OSM regarding certain objects of interests such as road street network [4, 5], building footprints [6, 7], bicycle trails [8], as well as land use information [9].

In CAP4Access[1] project we aim to use OSM data for routing and navigation of people with limited mobility. Therefore, in order to evaluate the fitness of use of OSM data for this project, we focus on assessing the completeness of sidewalk information in OSM data. Two major cities in Germany have been selected as regions of interest to perform our assessments. The selected cities in our study include the capital of Germany: Berlin, as well as Heidelberg. The selection of cities is based on having both large cities and smaller ones with different population density.

2   Completeness of sidewalk information for people with limited mobility

Sidewalks are the main object features that need to be used for constructing routes and later passed to a navigation service in order to guide shortest (possible) paths to navigate from an origin to destination for navigation of people with reduced mobility. Therefore, the completeness of sidewalk information in OSM data has been assessed in this study.

In our study, due to lack of access to a reference dataset of sidewalk data in our selected cities, we aim to check the level of completeness of sidewalk data in OSM based on intrinsic quality checking. For assessing the number of sidewalk objects, we have counted the number of road segments (e.g. highways) that have a tag of sidewalk attached to them. This means that the way object also has sidewalk information attached to it. Table 1 gives the statistics relating to the number of ways with sidewalk objects for the selected cities.

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[1] http://www.geog.uni-heidelberg.de/gis/cap4access_en.html

Table 1: The statistics of sidewalk data in OSM for selected cities

City	Total number of highways	Number of highways with sidewalk tag	Percentage of highways with sidewalk info.
Berlin	106232	5927	**5.6%**
Heidelberg	13,025	286	**2.2%**

For the second level of completeness check, we aimed to assess the number of additional attributes relating to sidewalks (e.g. width, incline, etc.) that were present for the roads that have had the sidewalk tag provided. For this purpose, we have used relevant sidewalk attributes for routing and navigation of people with limited mobility. The attributes selected were adopted from another relevant study [10] except the attributes *lit, crossing* and *general access (Table 2)*.

3 Results, Discussion, and Future work

The intrinsic quality analysis showed that in the two study areas in Germany that OSM data was collected for, the completeness of the sidewalk information was relatively low. In the more densely populated city (Berlin) 5.6% of all highway features had an indication of the presence of a sidewalk via the sidewalk OSM tag. While Heidelberg only had 2.2% completeness in terms of the sidewalk tag. This goes to show that at present, information regarding the presence of sidewalks is largely lacking in the OSM dataset (Table 1).

A second level of analysis was also conducted in order to investigate the completeness of individual attributes relating to the sidewalks which would be of importance to applications such as routing and navigation services for people with reduced mobility. Results show that the attribute completeness varies on the attribute in question and on the study area (Table 2). For example, the amount of sidewalks that contained the surface attribute (type of material) varied from 44.5% in Berlin to 23% in the other. This attribute can be seen having far more completeness than incline (0.42%, 2%) and width (7.6 – 2.7%). Other attributes such as the presence of a handrail were not present in any of the study regions.

In Conclusion, although OSM data may not be optimal in terms of a complete coverage, it is certainly possible to make use of sidewalk information that is important for people with reduced mobility in a number of smaller areas.

In terms of future work, it is believed that performing the same study on more cities might be useful and might lead to more promising results that could lead us to better understand the completeness of OSM data with regards to sidewalk information. Therefore, before making final results and decisions on how OSM data could be used in our project we aim to perform the study on more cities having different characteristics that might lead to more results.

Table 2: Statistics for completeness of sidewalk information at attribute level in OpenStreetMap

City	Width	Surface	Smoothness	Incline	Curb	Tactile_paving	step_count	Step_height	Ramp	Handrail
Berlin	452	2632	952	25	0	0	1	0	0	0
Heidelberg	8	66	24	6	0	0	0	0	0	0
% of Coverage[*]:										
Berlin	7.6%	44.5%	16%	0.42%	No data	No data	0.01%	No data	No data	No data
Heidelberg	2.7%	23%	8.4%	2%	No data	No data	No data	No data	No data	No data

* : The percentage of coverage is calculated by considering the total number of ways tagged as sidewalk in the respected city (see table 1)

Acknowledgment

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