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A method for automatically identifying vacant area in the current urban environment based on open source data

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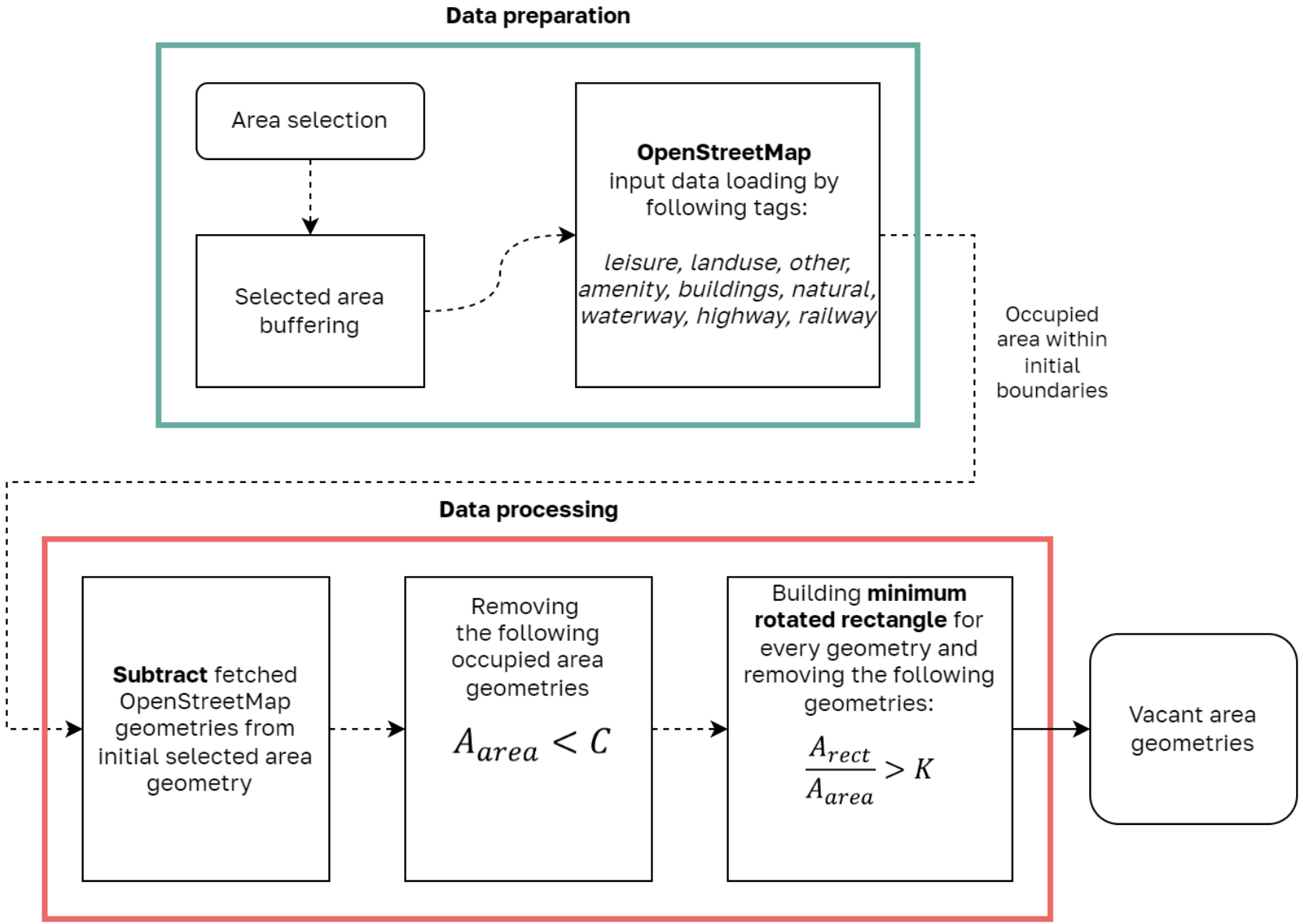
Introduction

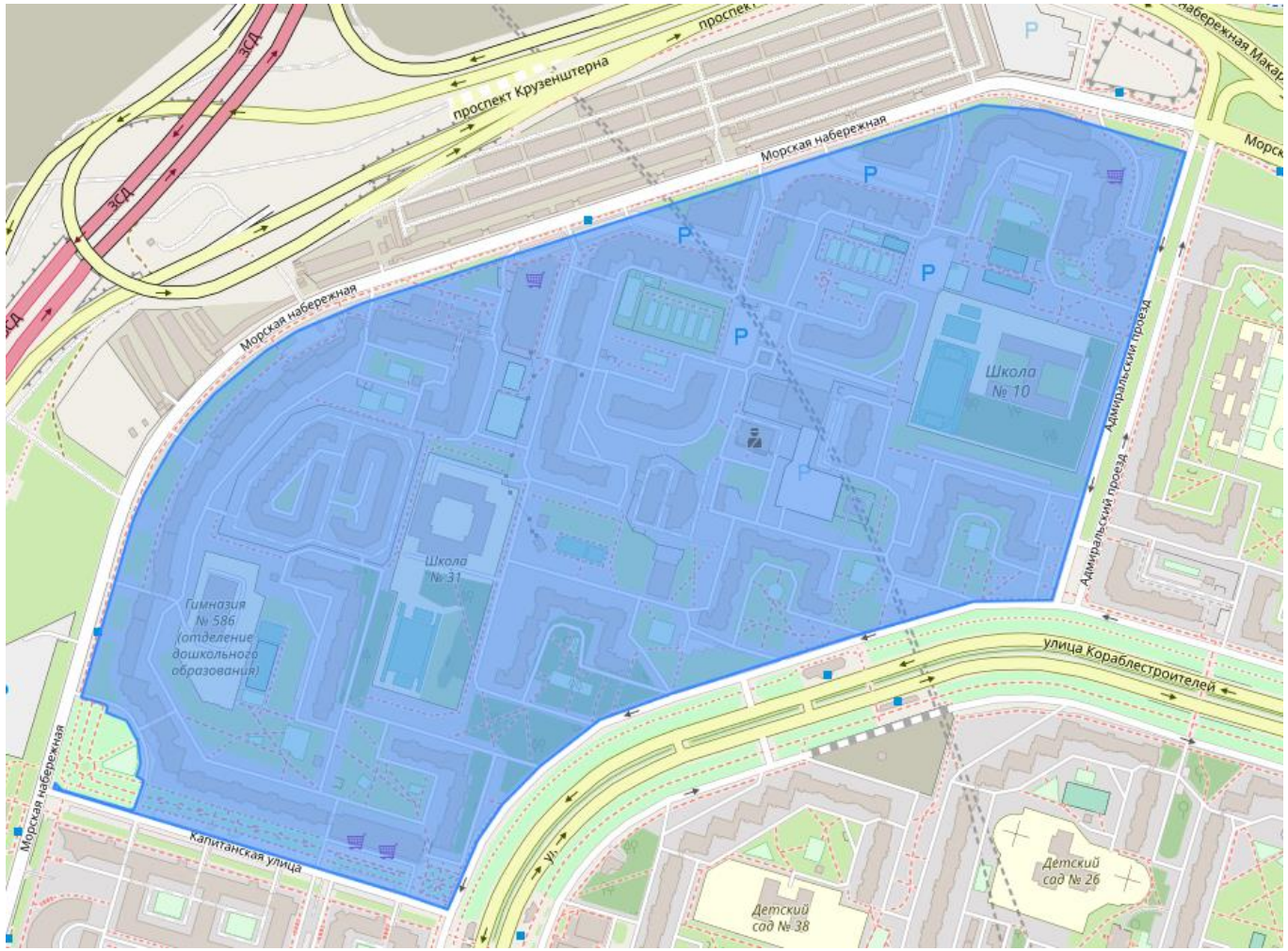
This paper presents a method for identifying vacant areas in the modern urban environment for the placement of various infrastructures. The problem with identifying vacant area is that the process can be complex, costly and time consuming using traditional methods of information gathering. In addition, some data, such as land use regulations, may be closed or have limited access, making it difficult to obtain and use the necessary information.

Method for identifying vacant areas

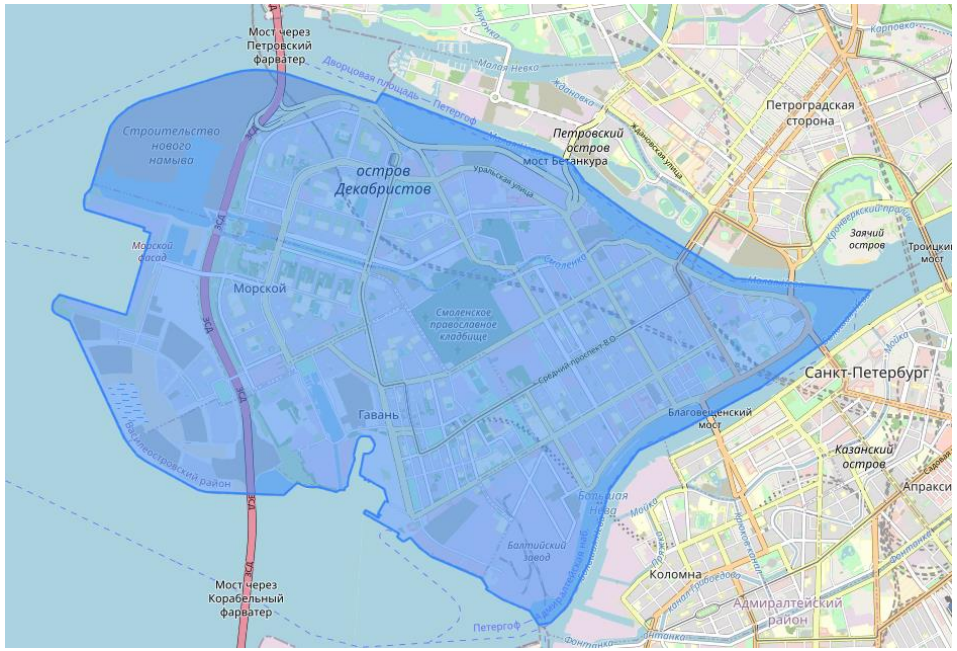


Method for identifying vacant areas

1. Choice of territorial unit

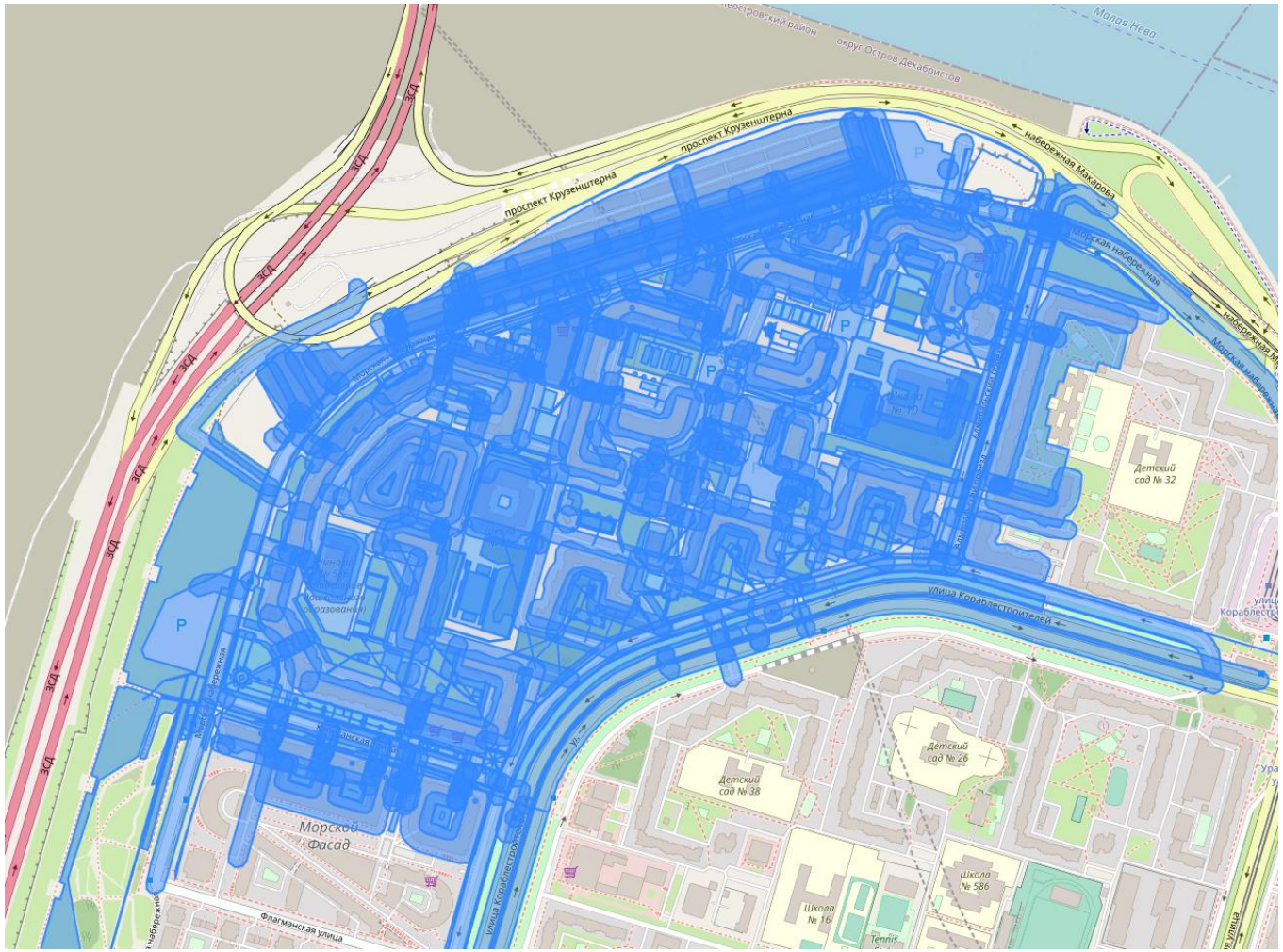


In the context of this method, the selection of an area unit is the first and most important step in identifying the vacant area with potential for development. This step involves determining the specific area or site in which the analysis and assessment of vacant space will be conducted.



Method for identifying vacant areas

2. Loading of facilities and zones with functional purpose

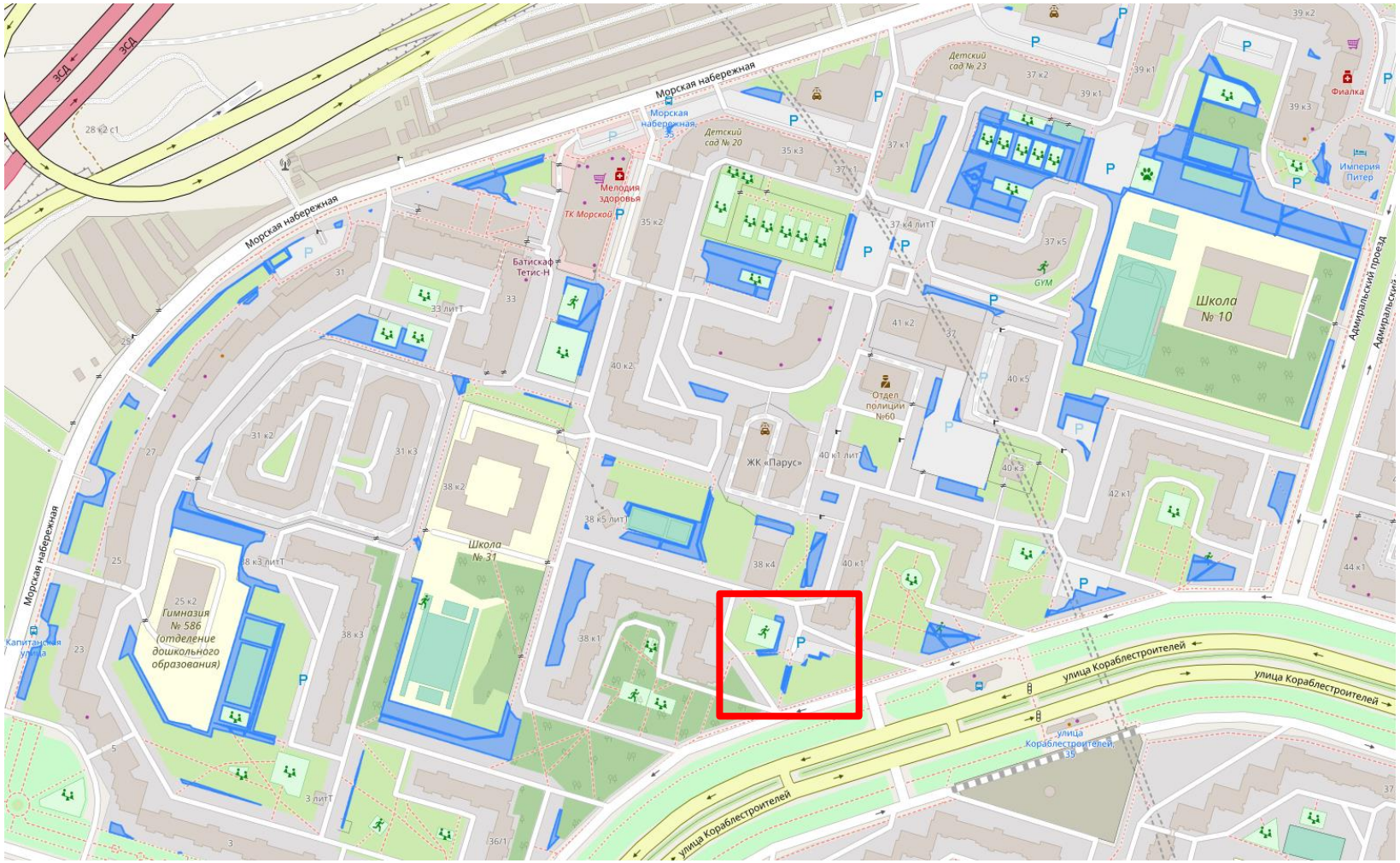


Example of keys with OpenStreetMap:

- **Leisure** - key is primarily for places people go in their spare time.
- **Landuse** - used to describe the primary use of land by humans.
- **Amenity** - is the top-level tag describing useful and important facilities for visitors and residents.
- **Buildings** - tag is used to mark a given object as a building.
- **Natural** - is used to describe a wide variety of physical geography, geological and landcover features, including ones that have been modified or created by humans.
- **Waterway** - include linear water features such as rivers, canals and streams, as well as water areas such as lakes, reservoirs and docks.
- **Highway** - is the main key used for identifying any kind of road, street or path.
- **Railway** - the tracks of all modes of transportation using metal rails.

Method for identifying vacant areas

3. Cleansing from small-area data



$$A_{area} < C$$

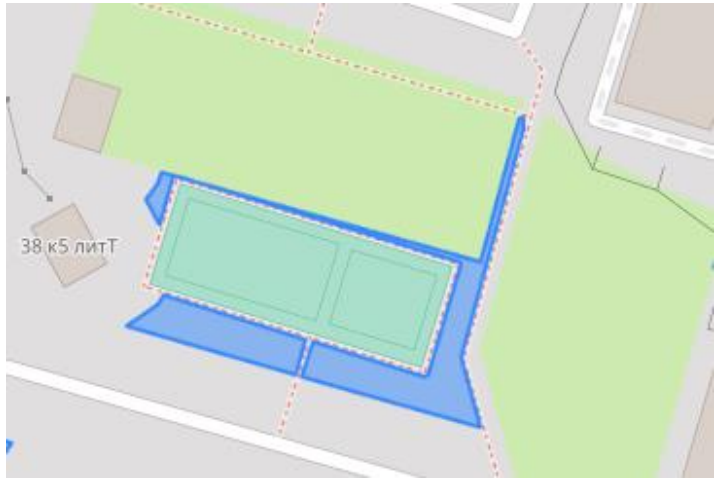
Where:

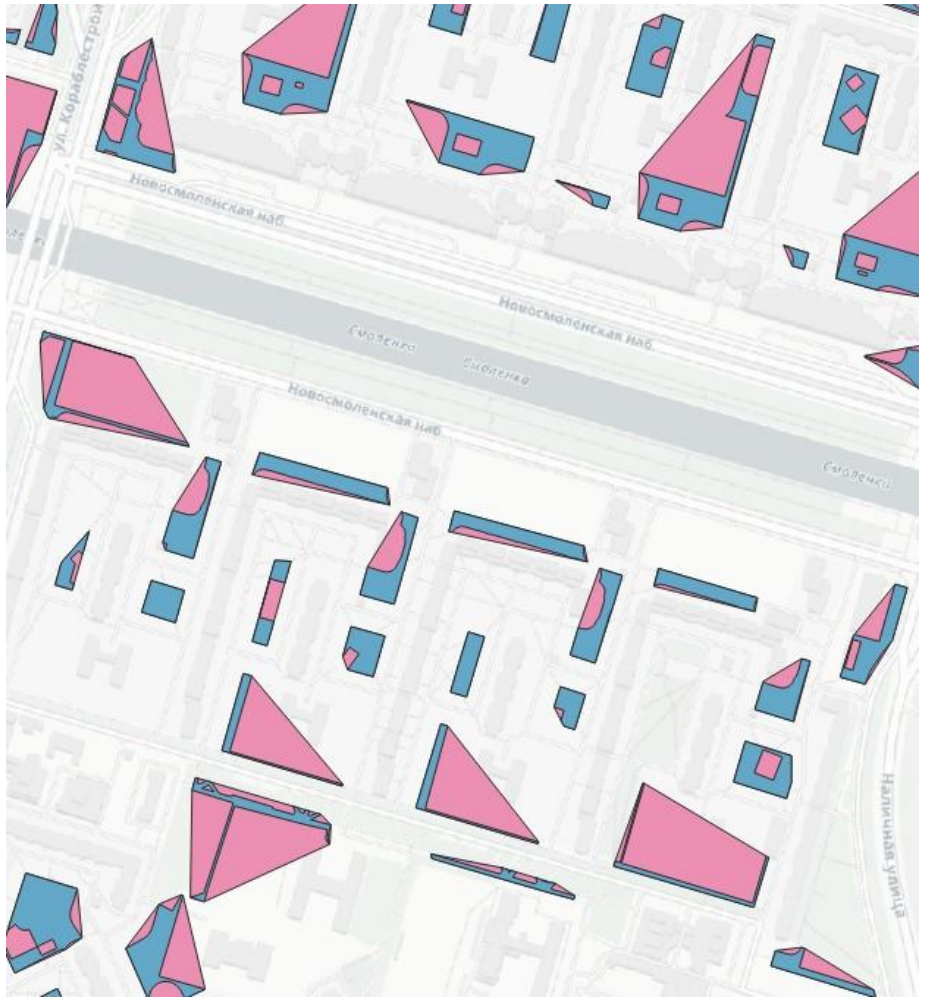
Aarea - area of geometry

C - Minimum area

Method for identifying vacant areas

4. Deleting data with unsuitable geometry



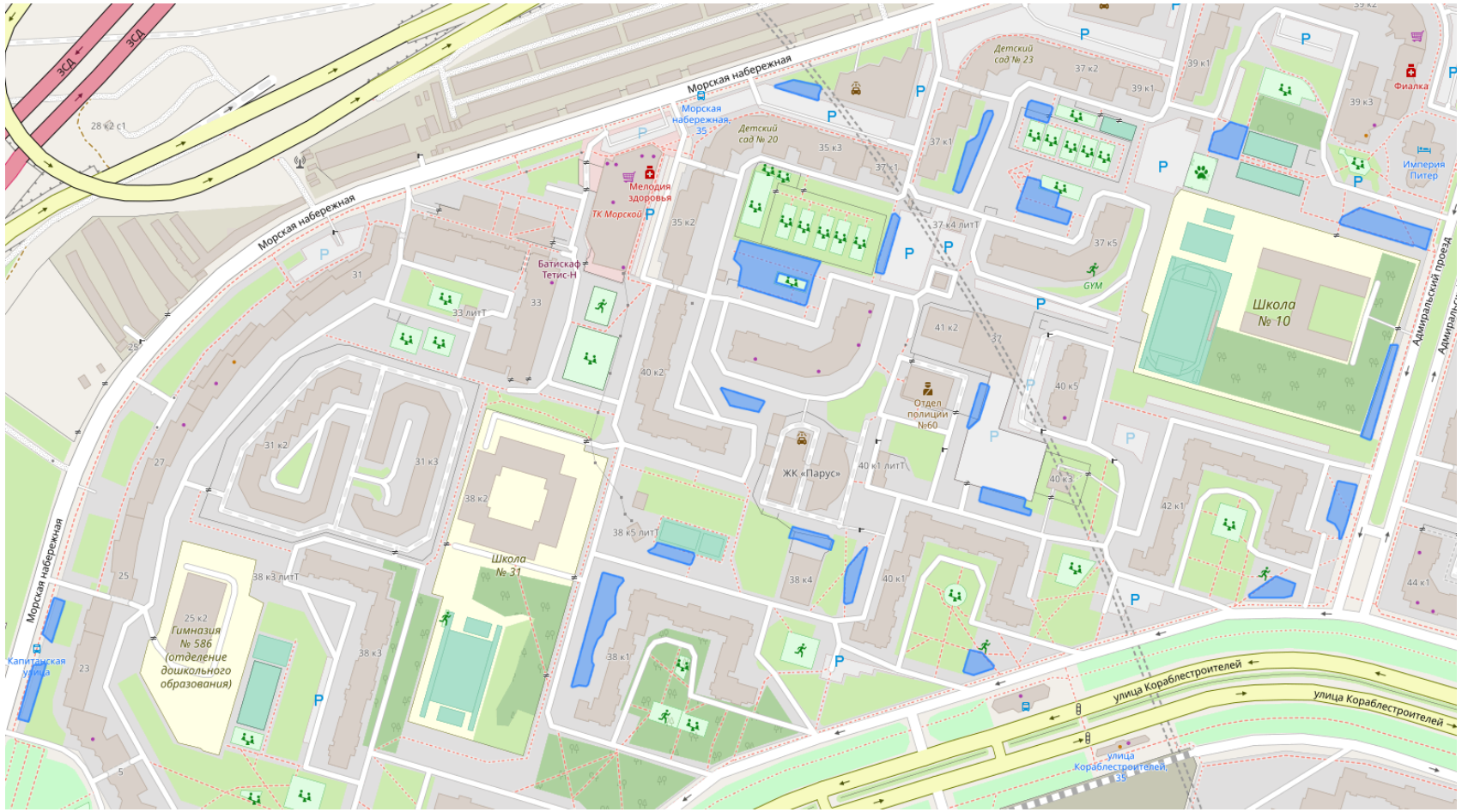


Methods returns the general minimum bounding rectangle that contains the object. Unlike envelope this rectangle is not constrained to be parallel to the coordinate axes.

$$\frac{A_{rect}}{A_{area}} > C$$

Where:
Arect - area of geometry
Aarea - area of geometry
C - Minimum area

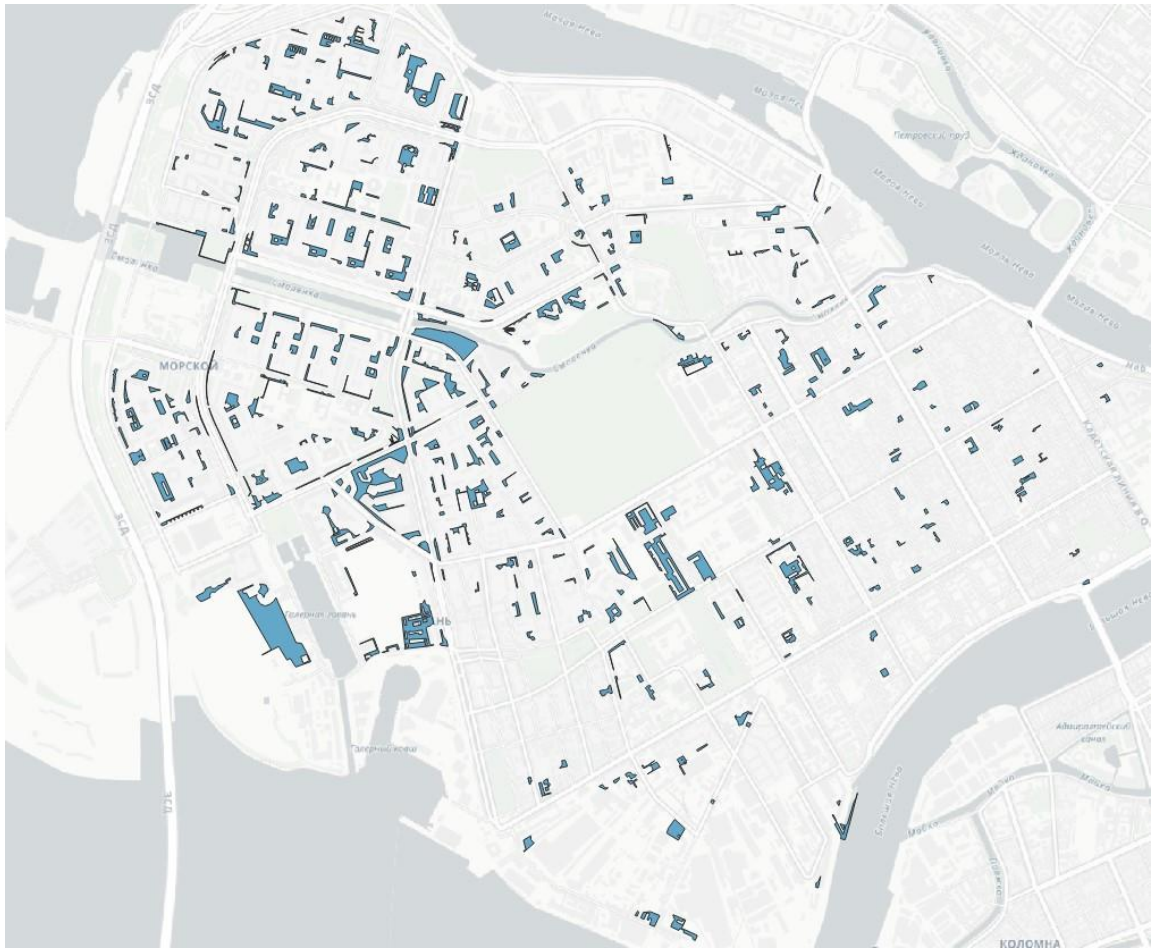
Obtaining vacant area polygons

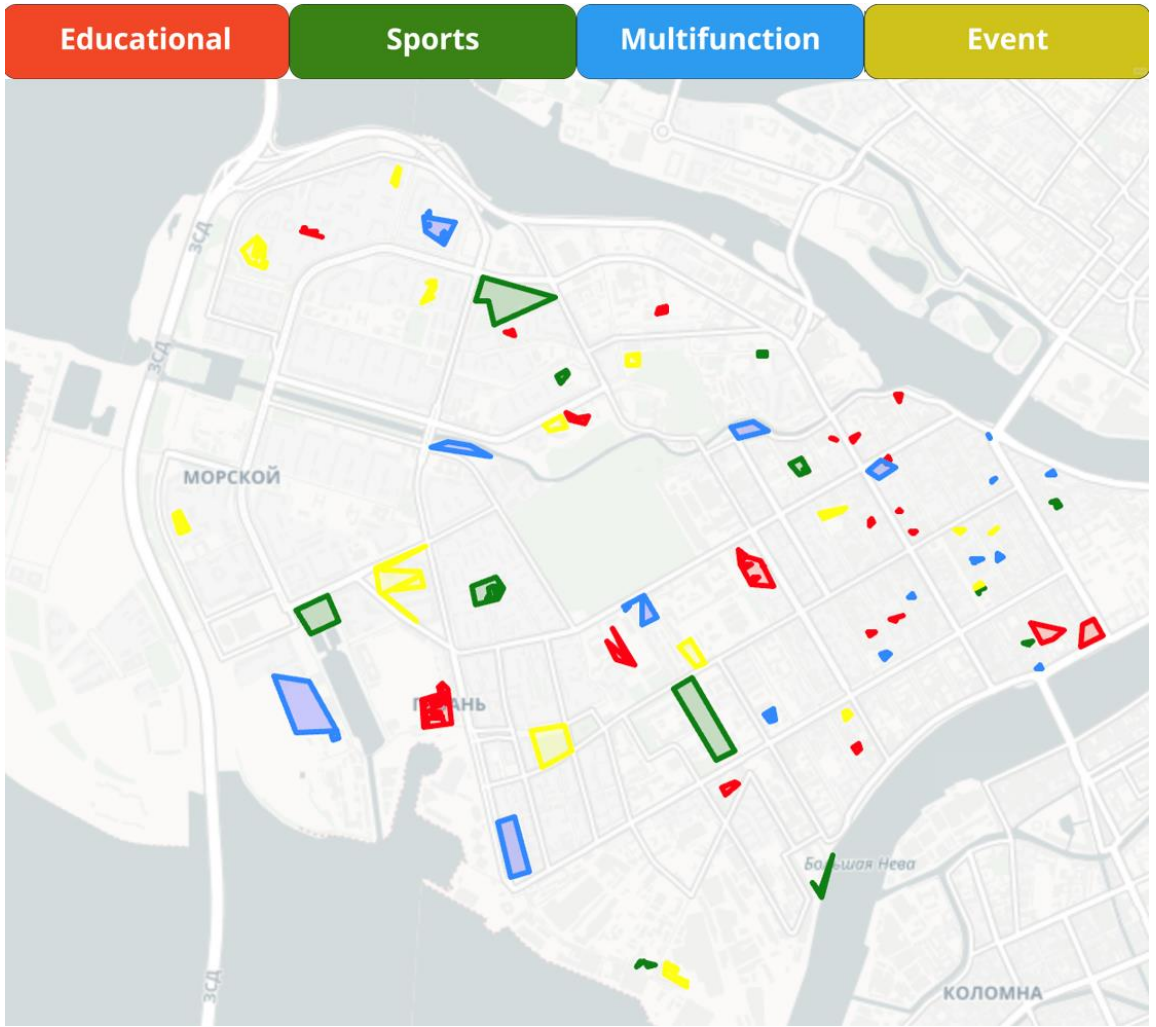


Open library with tools for generation the city model and optimal requirements for future development with specified target parameters

Blocksnet: Open library with tools for generation the city model and optimal requirements for future development with specified target parameters (github.com)

Examples and analysis of results





Results

The main advantages and novelty of the developed method in comparison with previously reviewed works are as follows:

- The initial data of the method can be taken from the OpenStreetMap. It determines the availability of the method for different levels of users and for different cities of research.
- The method is easy to use for non-developer researchers, which allows its implementation to be used literally "out of the box".
- Unlike ML-based methods, it does not require model training, verification, and high computing power.

Although this method has shown promising results, there remains room for further research and improvement. The cleaning step can be improved by applying better algorithms and techniques to identify and remove geometries with unsuitable characteristics.

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Thanks for your attention