The Route Planning Services Approach for People with Disability

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Project KA432 of Karelia ENPI programme

"Journey planner service for disabled people (Social Navigator)"

The project aims to improve quality of life of people with disabilities by addressing issues related to social exclusion, accessibility and mobility of disabled people by means of advanced ICTs

The aim and objectives

Information Infrastructure

mobile and web services

data resources filled by authorities and volunteers

- Accessibility passport
- Accessibility Map
- Route Planning Service
- Audio Assistant
- Other services

Social Navigator service

is a route planning service adapted for disabled people which include:

- Collection of data on obstacles and “trouble places”
- Route planning provides optimal route based on the navigation algorithm
- Route sharing between friends using social networks
- Audio-assistance provides the information about obstacles and objects around during the trip

Social Navigator service

Standard navigation and route planning libraries:

- The Google Directions API
- JavaScript API Yandex.Map
- The Open Source Routing Machine (OSRM)

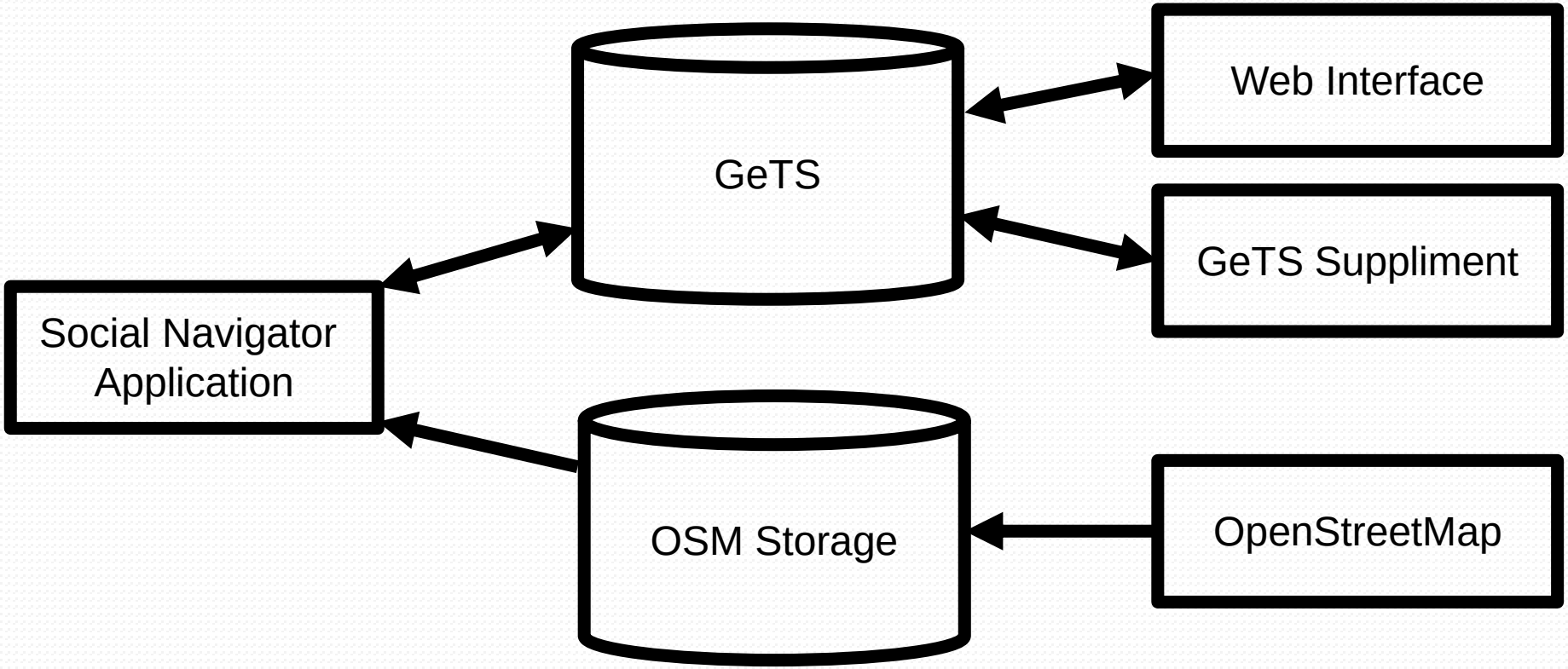
Solutions for disabled people:

- several services provides route taking into account wheelchair accessibility

Mathematical approaches:

- finding a smooth, obstacle-avoiding curve on the plane
- polygonal path taking into account simple obstacles in a form of intersecting polygons

Social navigator general architecture

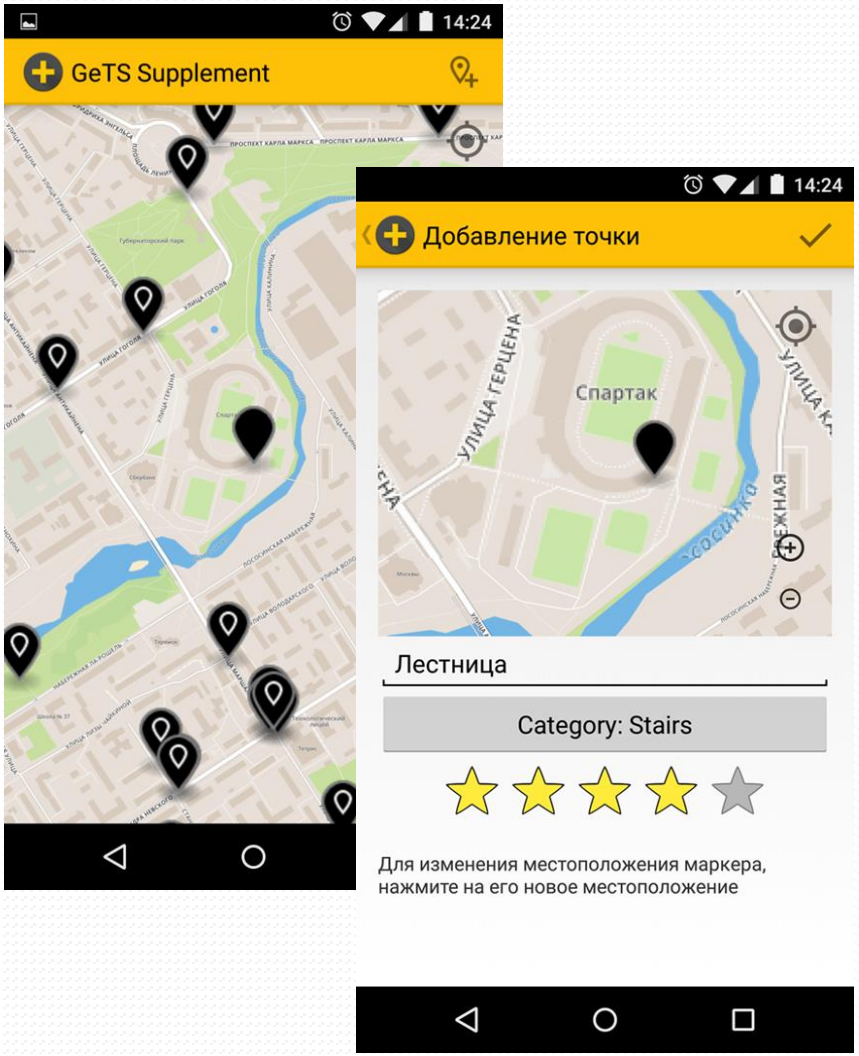


Social Navigator supplement

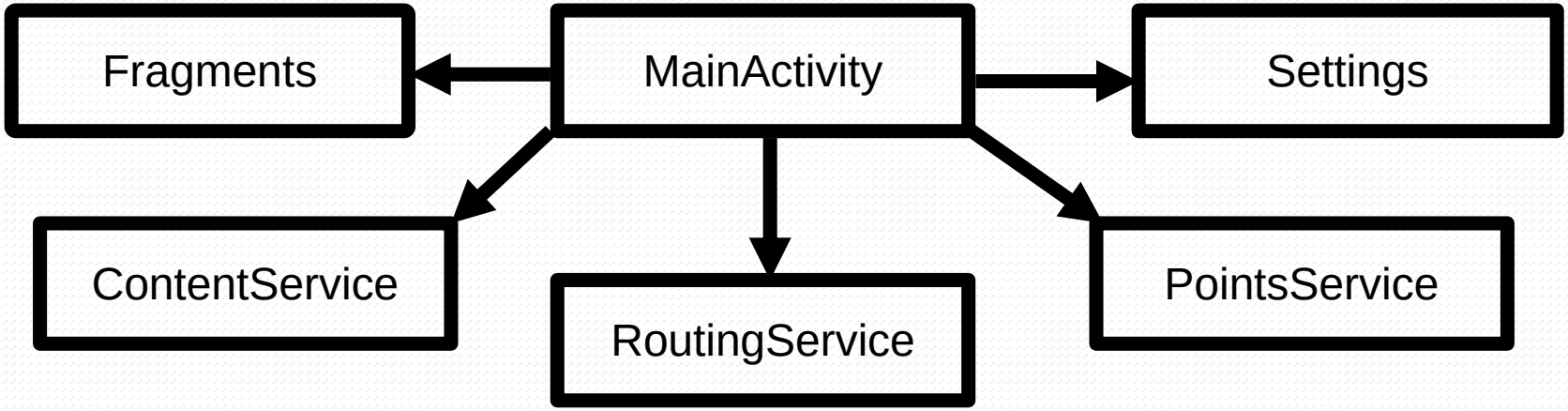
is a module to collect the data in real time on the location

New obstacle is stored into user's private space and can be copied to the public space and/or shared with friends.

We take into account several types of obstacles and access the accessibility of them.

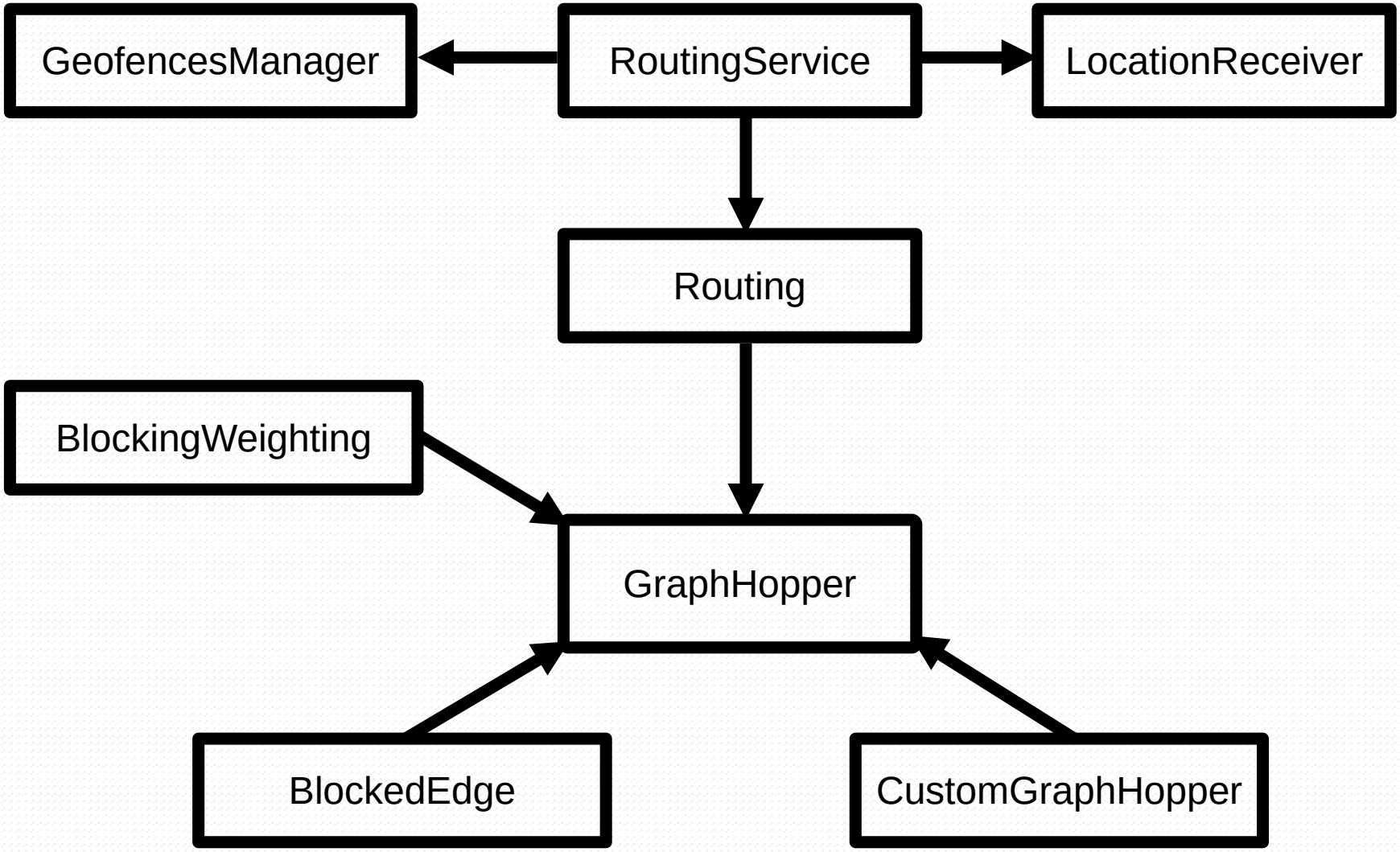


Social Navigator architecture

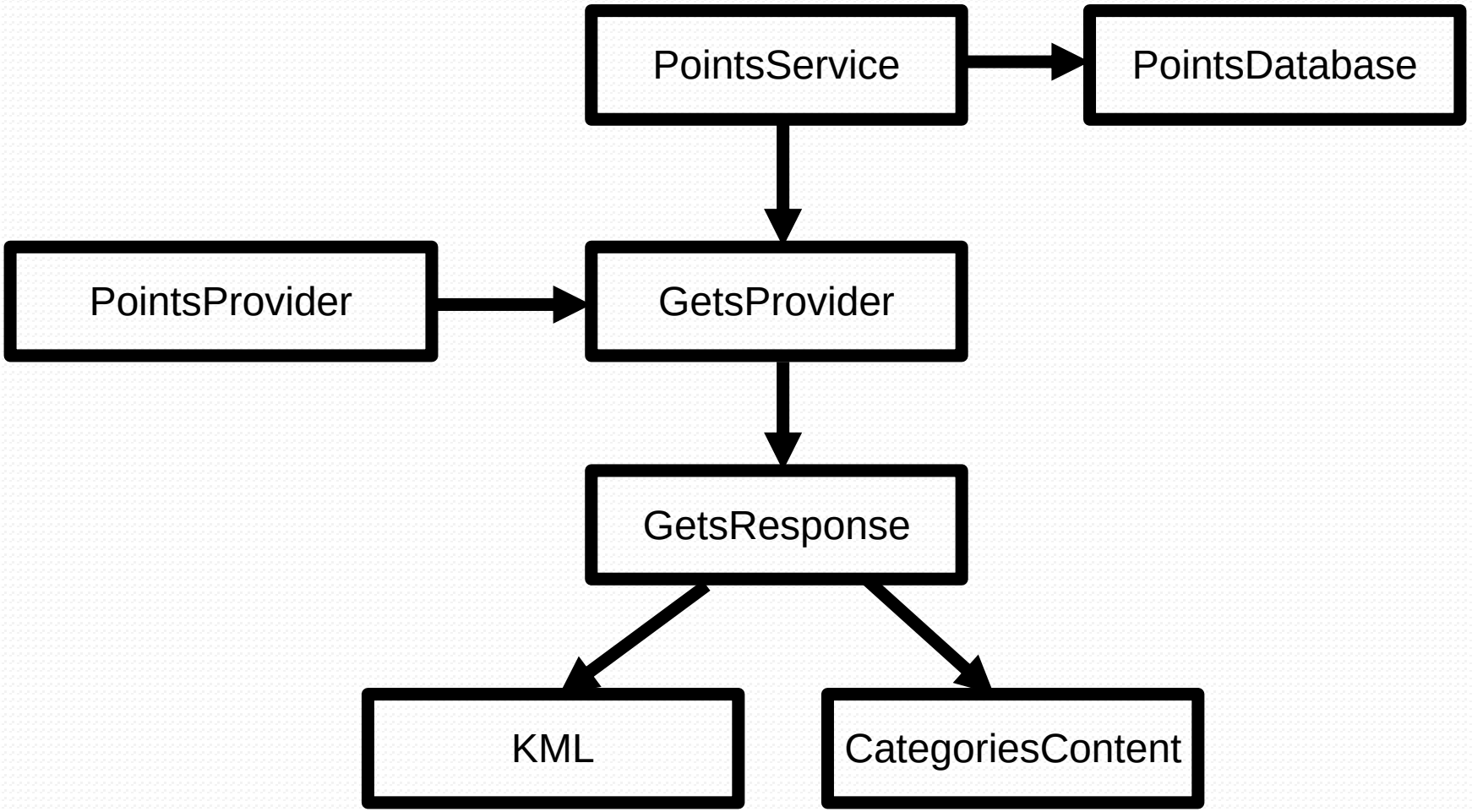


- Common ContentService module
- Geo2tag LBS platform support
- GraphHopper library support

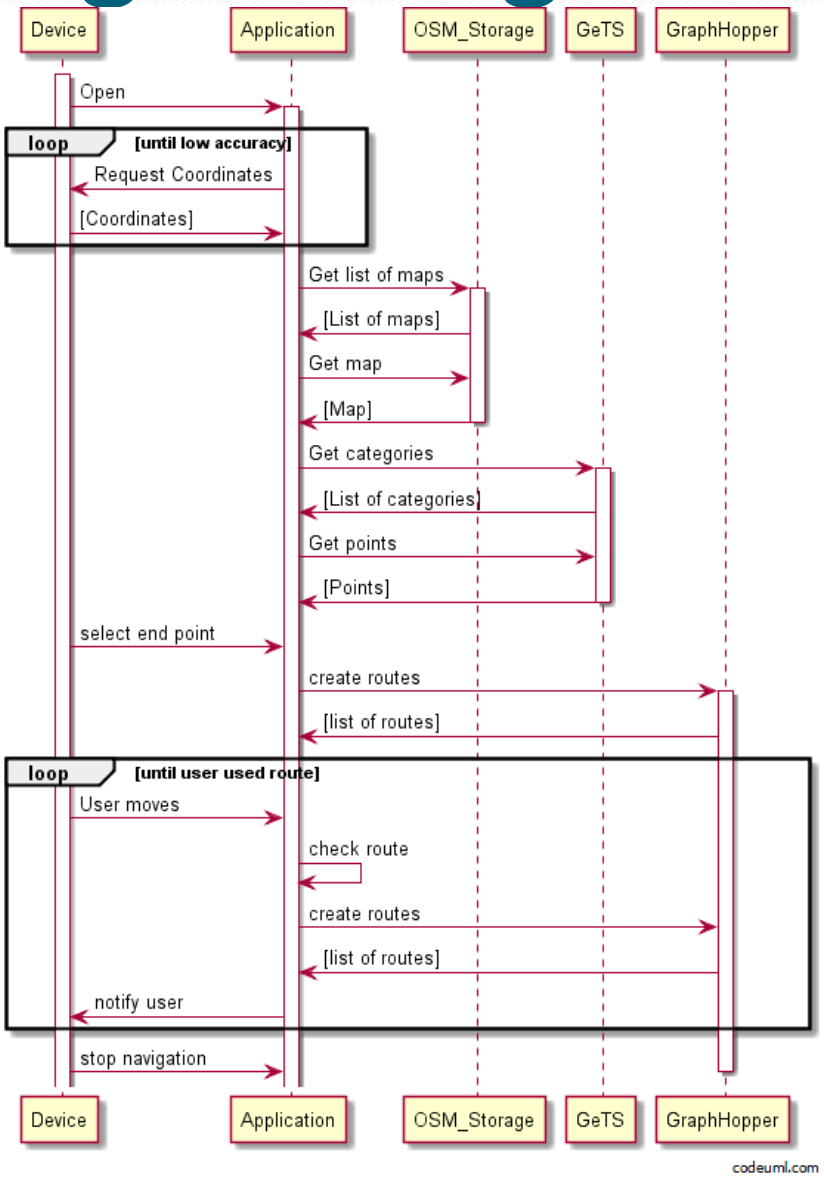
Social Navigator architecture



Social Navigator architecture



Social Navigator Algorithms



The approach to route estimation

The route $\boldsymbol{r} \in \boldsymbol{R}$ contains m edges with distances l_k

The weight of edge k for category i of disabled person:

$$r_k^i = \sum_{j=1}^{N_k} \omega_{ij} p_{kj}^i \ , i = \overline{1,n}, k = \overline{1,m};\ j = \overline{1,N_k}$$

p_{kj}^i – an assessment of obstacle j of the edge k ;

ω_{ij} – the weight of obstacle j of category i

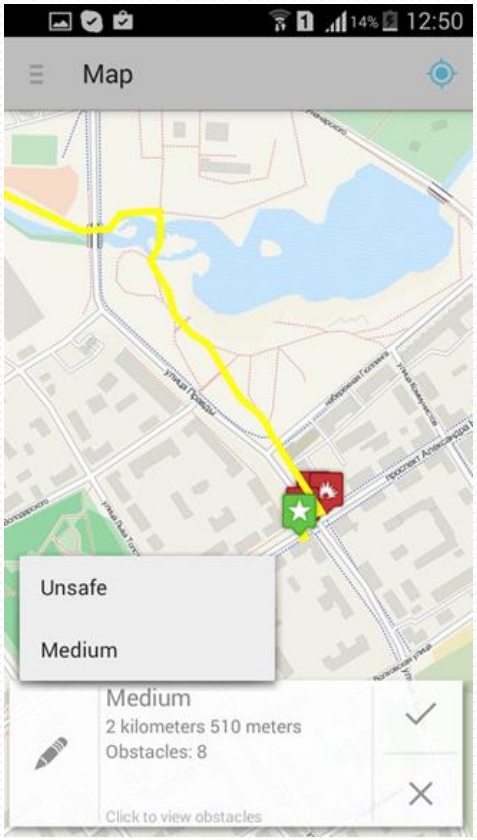
N_k – the number of obstacles on the edge k.

The accessibility level of route r for category i:

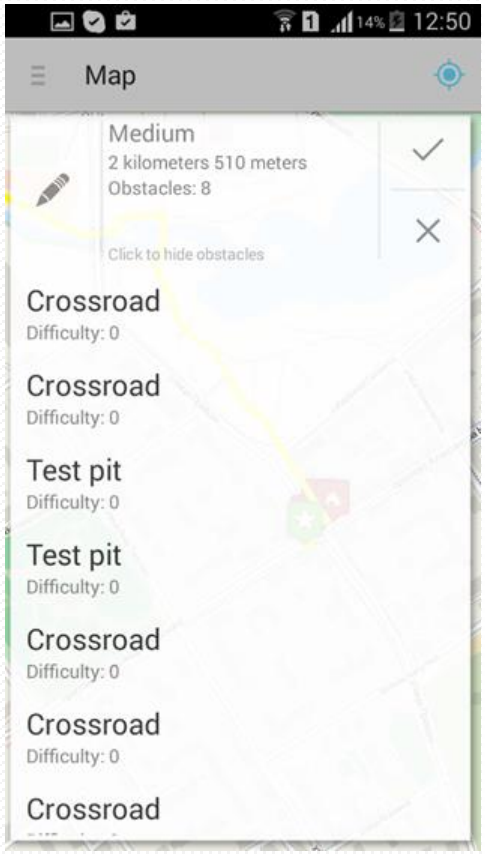
$$l_i(r) = \sum_{k=1}^{m} r_k^i$$

The obtained level is used to inform user on the route which can be more appropriate to him

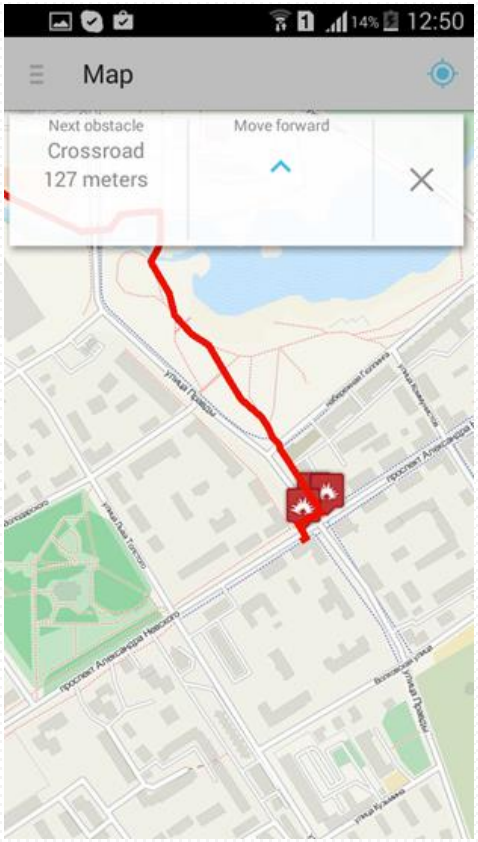
Service implementation



The start and end points selection



Route information – obstacles list

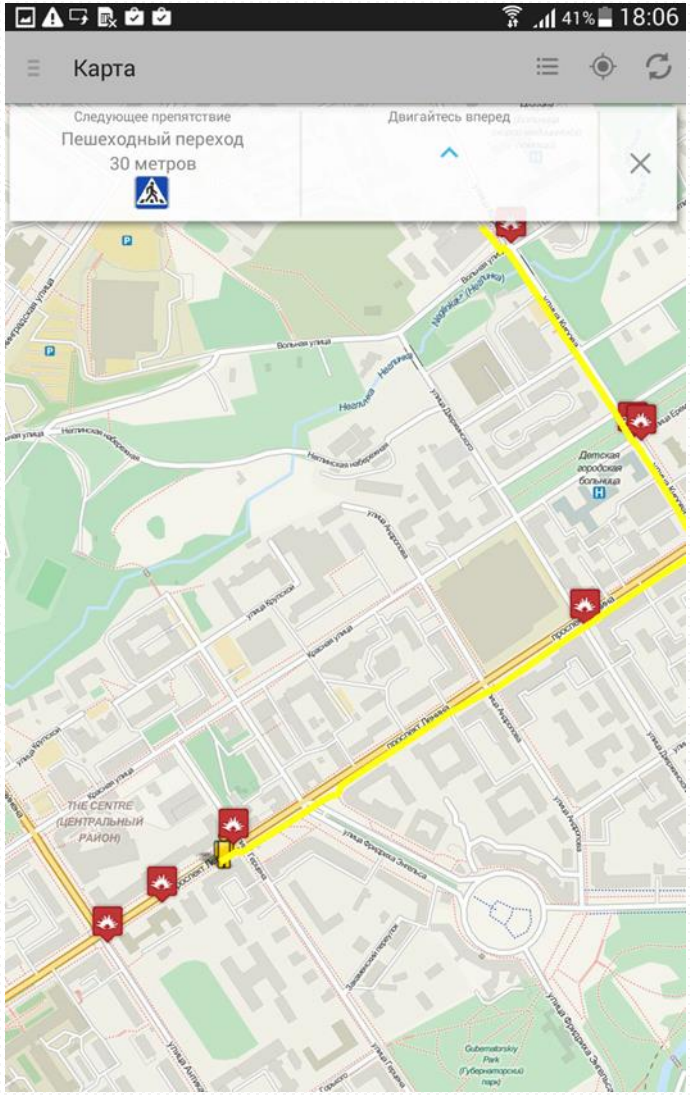


Navigation interface

Evaluation of service

The several assessments of the service:

- Regions: Oulu and Karelia
- 2000+ obstacles in DB
- 14 volunteers in Petrozavodsk
- 77 downloads of application from store



Conclusion

- The service aggregates the approaches, technologies, modules and data investigated and elaborated during the Project
- The routes are described as a graph with weighted edges, the weights are the accessibility of the path
- For route building issue the Dijkstra method implemented in GraphHopper library was used.
- The Geo2Tag platform are used for storing and manipulating the data