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## Working out the plans in a system of object positioning inside the building using mobile devices

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Tekst jest udostępniony do wykorzystania w ramach dozwolonego użytku.

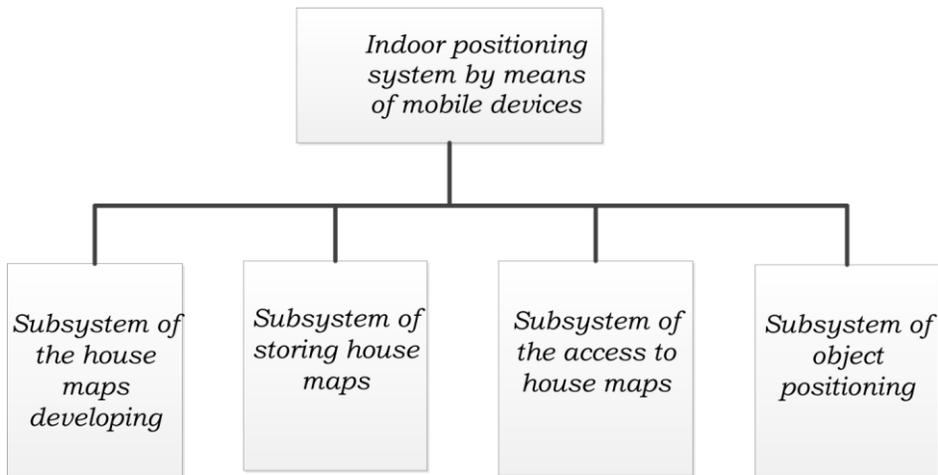
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## **Working out the plans in a system of object positioning inside the building using mobile devices**

Every day when communicating in work process people meet a lot of different indicators and tables, but to find required department or office at large enterprise is not easy task sometimes. The problem of positioning inside large building is very important, especially in emergency case.

Nowadays there is a growth interest to the possibility of getting information about position of this or that object. This information allows improve greatly the service quality of company and expand the list of services given to the users. Quick development of mobile devices constantly leads many new functioning possibilities being created inside them, i.e. equipping smartphones and tablet PCs with inertial sensors which found their application in different application of informational leisure character. Besides, there is a possibility of using given technical means for solving problems of navigation inside the building, which further will be more topical owing to the growth of number of building objects of complicated infrastructure.



**Pic. 1. Conceptual model of the architecture of the indoor positioning system by means of mobile devices**

To use the positioning system of the objects inside the premises the following conditions are necessary:

- Minimum user participation in the system operation;
- Simplicity in ranging (application of the system inside new building);
- The system must not depend on geographical situation of the building.

The proposed the inside object positioning system is based on detection by mobile device the signals surrounding the Wi-Fi networks.

The following architecture can be used for the developing of indoor positioning system by means of mobile devices (pic. 1).

Algorithms using for indoor positioning by means of mobile devices allow detect the coordinates of the object on signal Wi-Fi level, as well as on access points. Thus, the map (plan) of house is input data for the subsystem of object positioning. The plan of the building must be encoded in format which can use mobile application. The format JSON (Java Script Object Notation) is chosen as a mobile application – the text format of data exchange.

For encoding of the objects which are on the map (plan) of the building there are 3 categories:

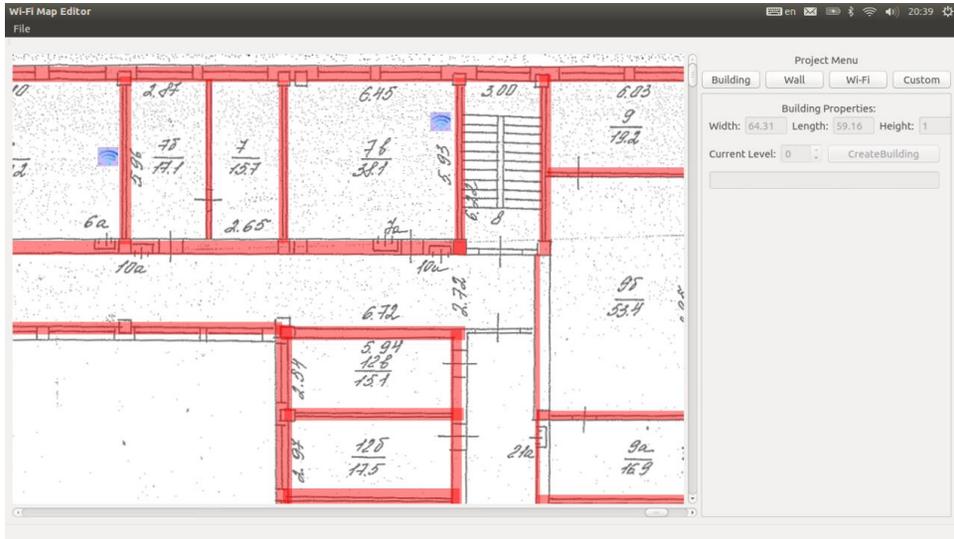
- The Walls,
- The points of Wi-Fi access,
- Other objects,

In encoded form these objects are of the following data set (pic. 2).

Walls					
X-Coordinate, m	Y-Coordinate, m	Z-Coordinate, floors (levels)	Length, m	Width, m	Name (always WALL)
The points of Wi-Fi access					
X-coordinate, m	Y-coordinate, m	Z-coordinate, floors	Name of network		
Other object					
X-Coordinate, m	Y-Coordinate, m	Z-Coordinate, floors (levels)	Length, m	Width, m	Name (always WALL)

**Pic. 2. Format of the map data encoding**

All the requirements to the encoding system mentioned above are realized in subsystem of the building map development. Given subsystem is graphic editor which allows making building map and encoding it into the JSON format. Subsystem is developed with use of cross-platform instrument of the designing of the software in language C++ (pic. 3).



**Pic. 3. Interface of the subsystem of the plan building development**

Given instrument makes it possible to start the map editor in any operation system by means of a simple compiler of the program for each of them without changing initial code. Developed subsystem allows create, edit and delete the object of three types: walls, points of Wi-Fi access and other object (lecture rooms, offices etc.).

Graphic display in the subsystem is realized using OpenGL (Open Graphic Library) – specification determining a platform independent program interface which is free from programming language and is for writing applications using computer 2D and 3D graphics. Thus, entrusting the processing of the graphic information to GPU (Graphic Processing Unit) the maximum productivity is reached.

To the input of the developed subsystem the building plan is delivered in format PNG, as well as a dimension of the building in meters. These data are necessary for defining the image scale of the building, for making it possible to calculate coordinates and dimension of the objects in meters automatically. The system operates with data in pixels, and for data in meters used in positioning subsystem; the function of map export is developed. In the future it is planned to develop a special data format to store not only map data, but also the building plan for displaying it in mobile device.

The idea of using Wi-Fi access points for detecting object location is widely used for different tasks; this technology can provide LBS (Location-based service) inside the building, detecting moving object location, navigation inside large industrial enterprises.

## Literature

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## Abstract

The system of object positioning inside the building using mobile devices and points of Wi-Fi access is considered, in particular, its architecture and sub-system of working out of the building plans.

**Key words:** indoor positioning, WiFi, mobile devices, map (plan).