

## **Integration and optimisation of geospatial data in the process of generating three-dimensional cartographic materials**

### **Abstract:**

Geospatial data are a source of data on places and objects. There are many methods and tools which can be used to generate this type of data. Terrestrial Laser Scanning (TLS) and Unmanned Aerial Vehicles (UAV) are among the most modern and increasingly frequently used techniques. The process of acquiring spatial data is well understood and widely used in civil engineering, particularly in surveying and cartography. By integrating measurement results obtained by using various types of sensors, it is possible to generate a geospatial database which constitutes a comprehensive set of information on an object of study, regardless of its size, shape, or location. The same coordinate system was used for all measurement techniques which was possible thanks to the use of the same target points that were treated as a measurement control network. The use of shared points allowed for the presentation of all the obtained results in a single coordinate system. The next step was to conduct optimisation of the obtained geospatial databases, allowing for the reduction of information redundancy and the size of the point cloud while preserving a high level of precision and quality in the data, as well as relevance of the information presented.

In this thesis, procedures for the acquisition, generation, and processing of geospatial data obtained from different sources are presented. The process of integration and optimisation of the obtained geospatial databases is discussed and implemented. Possibilities for the use of this information in the process of generating 3D cartographic materials are presented, with attention paid to the intended use of these data as well as to the assumptions and precision requirements and level of detail of the 3D model.

Three research objects were studied, differing in their spatial and urban planning characteristics. The results obtained from analysis and the results of field studies conducted allowed a methodology for the conduct of such study to be defined which aims to be both simple to use and to provide precise integration of geospatial data. This thesis also includes a description of procedures and data optimisation algorithms, methods for generating 3D cartographic materials using 3D models, Building Information Modelling (BIM) technology and visualisations and spatial imaging based on integrated point clouds developed from TLS as well as ones generated based on photographs taken from UAVs.

### **Key words:**

TLS, UAV, point cloud, integration, optimization, georeferencing, 3D maps

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