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Abstract of Engineering Thesis, Submitted 12 May 2016

Algorithm for computation and visualization of searched area with implementation using OpenStreetMap system.

The main purpose of this thesis was to map out algorithm for computation and visualization of area registered by cameras mounted to unmanned aerial vehicles colloquially known as drones based on vehicles' geopositions and angles of camera lenses. Such an area was described in the research as searched area. Additional aim was to create an information system enabling to gather positional data from aircrafts and visualize effects of the algorithm on mobile devices.

At the beginning there were described theoretical aspects connected with touched issues, which contained such topics as global positioning system (GPS), the way it works and its accuracy, reference surfaces for mapping, digital elevation models and the ways to gather them with detailed description of shuttle radar topography mission. Being acquainted with these issues was crucial for further stages of the study. The next section focused on system analysis. There were discussed technologies adequate for designed system, available types of applications, platforms and tools allowing to create software. Furthermore the ways of communication between system elements were chosen and the format of transported data was picked out. Thereafter the study focused on the requirements that the designed system was to meet. The result of this section was a logical model of the system, describing ways of realization of defined preconditions and tasks without implementation details. The next chapter was dedicated to the issue of developing the algorithm for computation and visualization of searched area. At the beginning there was performed an analysis of the requirements and foundations related to the algorithm. Afterwards the complete algorithm was divided into three parts: algorithm for computation of the hull of the area, algorithm for the determination of the areas inside the hull which were eclipsed by something and therefore not registered by the camera and finally algorithm for combining areas calculated in consecutive steps into single area. First two algorithms were designed with use of heuristics and the last one harnessed scientific theory of alpha shapes and algorithm for computation of alpha-concave hull. After system analysis and algorithm description there was time for system design, which consisted of the transformation of the analytical model into model containing informations about internal structure of the system, its configurations and implementation. As the effect of this section there were created static structure diagrams such as component diagram, class diagram, entity relationship diagram and dynamic models such as activity and sequence diagrams. Within the system design stage there was also created user interface design for mobile, visualizing application called DronVision. The last part of the study composed of implementation of the designed information system and invented algorithm and presentation of the conceived solution taking into account apportionment of whole system into subsystems and overview of the visualizing application's views. This part may be circumscribed as user's manual for the application DronVision.

As a result the assumptions stated at the beginning of the thesis were met and the tool for cooperation with unmanned aerial vehicles, in the range of visualization of searched areas, was created. The thesis allowed author to remarkably extend his knowledge in such fields as computer science, mathematics, software engineering, algorithmics, geoinformatics, geophysics and many others which are hard to classify.