REVIEW

Of the PhD thesis presented by Martin Borisov Iliev, PhD student in faculty of Geography and Geology at the Sofia University

Morphological differentiation and zoning of urbanized territories for the purposes of urban planning using geospatial technologies

Member of the scientific jury: Prof. PhD Stoyan Nedkov, National Institute of Geophysics, Geodesy and Geography – BAS

1. General information

Marin Borisov Iliev is a PhD student in the Department of Cartography and GIS at the Faculty of Geology and Geography of Sofia University. The thesis presented by him is in the volume of 162 pages, of which 142 pages are the main text (including 73 figures and 17 tables), a bibliography of 213 literary sources (191 publications in English and 22 Internet sources) and 20 appendices. It is structured in four chapters, conclusion and appendices. An abstract containing 47 pages is also presented, which correctly reflects the content of the main text of the dissertation. The PhD student has also submitted two publications on the topic of the dissertation, one in a scientific journal and one in a collection of scientific conference proceedings, both in English.

2. Characteristic of the PhD thesis

The topic of the PhD thesis, "Morphological differentiation and zoning of urbanized territories for the purposes of urban planning" well defined and has significant practical-applied potential.

In the first chapter, which essentially represents an introduction, the significance of the topic, object, subject, goals and tasks are presented. The main goal of the research is formulated clearly and concretely as "creating a concept for designing and developing a spatial (geographical) model, which will allow the implementation of scientifically based morphological differentiation and zoning of urban territories, through the integrated application of modern geoinformation solutions", the object of research is defined as urban morphology, and as a subject its modeling for certain aspects of urban planning. In this regard, the work has a rather methodological focus, and the object was chosen to demonstrate the application of the developed approach.

The second chapter represents the theoretical-methodological basis of the study. An overview of the theoretical statements regarding urban morphology, geospatial data related to the urban form and geospatial technologies in the study of urban planning has been made. The review is thorough and with a clear focus on the theory of the approaches used in the work. It shows deep knowledge in the field of remote sensing of urban areas and in particular those with unmanned aerial vehicles.

The third chapter is devoted to the concept of an integrated digital spatial model, which is essentially the research methodology. At the beginning of the chapter, three schemes are successively presented, for the process of geospatial modeling, for modeling in an urban environment and for processing the collected data. This is actually the conceptual framework that is then developed for three specific approaches. The first represents an approach for modeling the urbanized space through aerial photogrammetry and UAV. In the second, spatial modeling is done by ground laser scanning. The third represents an integration of the results of the previous two to obtain a digital model of the urbanized territory.

In the fourth chapter, the main results of the research are presented with a focus on two current problems of urbanized territories, the urban heat island on the surface and the solar potential of the roof spaces of residential buildings. Both applied aspects have been demonstrated in a test area of the city of Sofia and on a larger scale for the municipal district Lyulin. The text in this chapter is well illustrated with maps, graphs and charts.

3. Scientific and application contributions

Four contributions are presented in the abstract to the PhD thesis. They correctly present the main achievements of the thesis. As the most significant scientific contribution, I would point to the third one, which is related to the development of a methodology for modeling and analyzing the effect and intensity of the urban heat island on the surface. The results of testing the methodology for the district of Lyulin clearly demonstrate its applicability. The second contribution, to create a geospatial model of the urban environment, has a clear applied nature, which is demonstrated through the presented results in chapter 4. The fourth contribution is also of an applied nature, demonstrating improvement and adaptation for the country's territory of an existing approach for assessing solar potential. I have some doubts about the first one specifically the formulation of the contribution, since it is not clear what the innovation of the geodata collection approach for the morphological differentiation of urban areas consists of.

4. Critical remarks and questions

The overall impression of the presented PhD thesis is positive, but some weaknesses can also be pointed out:

1. The conceptual scheme is presented too generally and in some places the connection with the research methodology is not completely clear. A flowchart presenting the overall methodological approach developed on the basis of the conceptual scheme would facilitate the understanding of the overall design of the study;

2. The overall structure of the dissertation is logical and well-formed, but in the methodological and results part there are some texts that are better to be given in the theoretical part. For example, the description of the urban heat island in item 4.1 p.49-51 is more suitable to be in the theoretical chapter. The methodology for determining the local climatic zones in the same part would be better given in the methodology.

3. The map of the local climate zones in Sofia (Fig. 31) was obtained by serious generalization. In each of the outlined areas there are also other LCZ. For example, in built-up areas there is usually some type of vegetation in the inter-block spaces. Isn't it more appropriate to present LCZ as a combination of building type and land cover?

5. Conclusion

My overall impression is that a considerable amount of work has gone into the development of this PhD thesis, through which the student demonstrates skills in working independently with disparate information and the ability to conduct in-depth research. Despite the critical remarks, I believe that the presented work is up-to-date and in a finished form, the work demonstrates scientific and practical results that represent an original author's contribution. On the basis of the above, I express my positive assessment of the presented PhD thesis and recommend the Scientific Jury to vote for awarding the scientific and educational degree "Doctor" to Martin Borisov Iliev.

Reviewer:
(Prof. Stoyan Nedkov)