

Abstract

The urban heat island effect (UHI) describes the balance of solar radiation, which is positive for urban areas. The increase in the intensity of the UHI phenomenon forces a redefinition of the term "urban planning" in order to mitigate the effects of climate change.

The aim of the work is to create a software project optimizing the thermal environment of the city. The goal was achieved by confirming the hypotheses: 1) modification of the thermal environment of the city is possible by changing the values of various parameters of the objects of the built environment (BE) and blue-green infrastructure (BGI); 2) the multitude of data related to the impact of BE and BGI facilities on city thermals makes it possible to build a digital model of the city's thermal environment and to create optimization guidelines; 3) it is possible to design an IT system creating multi-layered systems of BGI objects. The aim of the software is to achieve the highest level of UHI effect mitigation and optimization of human thermal comfort. The paper uses a query of available literature on the topic, supplemented with graphic content and comments developed to present the results. The research also used a mixed research methodology (MMR) in the field of information sciences, conducting quantitative and qualitative research.

Conducting research on urban ecosystem (EU) objects allowed to prove the first hypothesis – changes in the values of various parameters of objects located in the city allow modification of its thermal environment. By analyzing the parameters of the objects filling the EU and the provisions of Polish law, the second hypothesis was proven – it is possible to build a digital model of the thermal environment of the city. The logical architecture of the model was created, a simplified mathematical formula was presented, guidelines for thermal optimization of the city were set and restrictions on the optimization process in Poland were determined. The third hypothesis was proven by presenting a flowchart of an algorithm and the design of an IT system based on it – achieving the goals of the work.

The algorithm and design documentation confirm the readiness to create an IT system that will enable the transfer of optimization guidelines to the field of spatial planning. The high implementation potential of the designed solution means that it may become the world's first automated system for controlling the city's microclimate, based on a genetic algorithm.

Keywords: urban heat island mitigation, urban parameterization, blue-green infrastructure, human thermal comfort, thermal optimization

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