

Preface to the Special Issue on Computer Assisted Methods in Architecture and Urban Planning

We are pleased to present a special issue of *Computer Assisted Methods in Engineering and Science* (CAMES), covering papers focusing on selected aspects of computer-aided design methods in architecture, urban planning, and landscape architecture. The presented content is interdisciplinary in nature, merging many fields and research areas because of the usage of digital tools.

The editors of this issue intended to highlight the beneficial role of computing methods in data acquisition and spatial analysis, while simultaneously considering the saturation of this space with cultural values. The papers included demonstrate the usefulness of these tools from both engineering and humanistic perspectives. We hope that addressing these matters in the CAMES journal will bridge the technological community with the historical and social aspects of space, thereby justifying the necessity for the development of digital tools to support the preservation of this context.

The issue begins with an article titled ‘Combining Indoor and Outdoor Positioning for Navigation in AR Environments’ by Krzysztof SKABEK, Dominika ROLA, and Wojciech ZAMARSKI [1], which aims to evaluate augmented reality (AR) technologies – Vuforia, Immersal, MultiSet, and the ARCore Geospatial API. The study examined both the efficacy and accuracy of the results and the resilience to disturbances in location and navigation. The initial phase of the research was conducted in the laboratory, enabling a thorough evaluation of the modules. The subsequent phase took place in a hybrid setting on the Cracow University of Technology (CUT) campus, demonstrating the influence of changing environmental factors on augmented reality navigation performance. The research findings facilitated the development of recommendations for selecting AR localisation platforms for mixed navigation, and a practical implementation was created within the Unity environment.

The next research, entitled ‘Digital Tool Supporting the Documentation and Analysis of Cultural Heritage: The Case of the Analytical 3D Model of the Zamość Fortress’, written by Michał WAC and Bartosz SZOSTAK [2], describes the approaches used to elaborate digital documentation and, moreover, possibil-

ities to analyse cultural heritage resources on a city scale. The medieval centre of Zamość, Poland, along with its fortifications, has been designated as a UNESCO World Heritage Site and was chosen as an example. Data acquired through terrestrial laser scanning (TLS), unmanned aerial vehicles (UAVs), and terrestrial photogrammetry produced a 3D dataset comprising over 100 buildings and significant elements of public space. The model obtained was organised based on addresses and plot identifiers. Structured parameters were allocated to specific edifices and integrated into the building information model (BIM)/openBIM system. This organised information is useful in conservation diagnostics and the evaluation of urban structural components. The developed method enables functional classification of objects, the assessment of their technical state, and the analysis of energy aspects.

The article, ‘The Impact of Point Cloud Simplification on the Accuracy of the Viewshed’, authored by Jerzy ORLOF and Adrian WIDŁAK [3], focuses on point cloud data, which are very large datasets that require enormous computational power to process. This makes them difficult to implement in practice. The work addresses visibility analysis, specifically viewsheds. Its objective is to assess the accuracy of determining the field of view depending on the degree of the point cloud simplification. Comparing the viewsheds generated using ray tracing on the original dataset and at subsequent levels of simplification enabled an assessment of the acceptable level of data reduction without a significant impact on results of the analyses. Computational time analyses were also conducted to identify the optimal point cloud simplification level in terms of both performance and the obtained results.

In their recent study, ‘Possibilities for Obtaining Terrain Models, Orthophoto Maps, and Point Clouds with the Use of a Multirotor UAV’, Piotr ŁABĘDŹ and Paweł OZIMEK [4] introduced a method for acquiring spatial data via unmanned aerial vehicles (UAVs). Their investigation involved a hexacopter equipped with a high-end camera capable of recording 4K video and collecting high-resolution images. The subsequent phases of the project involve flights over the analysed object to capture video or a series of photographs. Image processing follows image selection, organisation based on capture location, and subsequent integration to generate a dense point cloud. The resulting structure is subsequently utilised to create a mesh with a variable number of vertices. The photographs serve as the foundation for acquiring textures for polygons. This method provides high-quality terrain and architectural data, with the point cloud being useful for analysis, inventory, accurate model creation, or supplementing less detailed resources.

By presenting you with this special thematic issue, we cordially encourage you to submit your papers, which will enable us to continue this initiative in the form of a series of journal issues devoted to the above-mentioned topics. Sub-

missions may cover any aspects of computer-aided design methods in building architecture, interior, construction, and urban design, landscape architecture, urban planning, and land use, including but not limited to:

- building information model,
- computer-aided design,
- geographic information systems.

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