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**ОТРАЖЕНИЕ ПРОШЛОГО В ТРЕХМЕРНОМ ПРОСТРАНСТВЕ:
ФОТОГРАММЕТРИЯ КАК КЛЮЧЕВОЙ ИНСТРУМЕНТ
ГЕОГРАФИЧЕСКОГО И ИСТОРИЧЕСКОГО ИССЛЕДОВАНИЯ
ПАМЯТНИКОВ**

Аннотация: В исследовании рассматривается фотограмметрия как ключевой инструмент географических и исторических исследований для документирования и анализа достопримечательностей и культурного наследия. Акцент делается на методах сбора данных, технологиях обработки и создания трехмерных моделей объектов, а также их визуализации и анализа.

Ключевые слова: фотограмметрия, географо-исторические исследования, трехмерные модели, культурное наследие, визуализация данных, геоинформационные системы, точность и детализация, археология.

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REFLECTION OF THE PAST IN THREE-DIMENSIONAL SPACE: PHOTOGRAMMETRY AS A KEY TOOL IN GEOGRAPHICAL AND HISTORICAL RESEARCH OF SITES

Abstract: The study examines photogrammetry as a key tool in geographical and historical research for documenting and analyzing sights and cultural heritage. The emphasis is on methods of data collection, technologies for processing and creating three-dimensional models of objects, as well as their visualization and analysis.

Keywords: photogrammetry, geographic historical research, three-dimensional models, cultural heritage, data visualization, geographic information systems, accuracy and detail, archeology

Introduction

With the development of technology in recent decades, photogrammetry has become an integral tool in the reconstruction and reconstruction of historical and geographical sites. Its applications have a significant impact on the fields of geography, history, archeology and cultural heritage, enriching our understanding of the past and the present.

The relevance of research. Photogrammetry approaches provide a unique opportunity to digitize and preserve cultural heritage sites in three dimensions. They allow the creation of accurate and detailed models of both individual monuments and vast historical landscapes, preserving information for future generations and providing a basis for research.

Purpose of the study. The purpose of this article is to examine the role of photogrammetry as a key tool in creating three-dimensional models for geographical and historical research. We'll look at the methods, techniques, and practical applications of photogrammetry to reconstruct the past in three dimensions.

Literature review

Photogrammetry, as a science and technology, has revolutionized geographical and historical research, providing unique capabilities for

documenting and analyzing cultural and natural heritage sites. In this review, we will consider key works and studies on the use of photogrammetry in the context of geographical and historical sciences.

“Photogrammetry: A Comprehensive Review” This study offers an extensive overview of photogrammetry techniques, covering technical aspects, methodological approaches and recent trends. The author highlights the importance of photogrammetric technologies for object reconstruction and comparison with traditional methods. [1, p. 25-35].

“Applications of Photogrammetry in Cultural Heritage Documentation: A Review” This article examines in detail the applications of photogrammetry in cultural heritage documentation. The authors discuss various methods and technologies used to preserve and reconstruct cultural monuments, including architectural structures and archaeological finds [2, p. 78-92].

“Advancements in Photogrammetric Techniques for Terrain Modeling” This review focuses on the application of photogrammetry to terrain modeling, highlighting technological innovations and methodological approaches. Various methods for creating three-dimensional landscape models and their application in geographical research are considered [3, p. 40-55].

“The Integration of Photogrammetry and GIS in Historical Research” This article examines the integration of photogrammetry and geographic information systems (GIS) in historical research. The author provides an overview of the use of technology in the reconstruction and analysis of historical events and locations. [5, p. 102-115]

Main part: Methodology and Results

Methodology:

To achieve the research objectives of the application of photogrammetry in geographical and historical research, comprehensive methods of data collection and processing were used.

Data Collection: Extensive image collection was conducted using specialized cameras and drones. This included many precise photographs covering all angles of objects and terrain.

Photogrammetry technologies: The use of modern software and hardware to create accurate three-dimensional models from images. Structured light networks and precise shape reconstruction algorithms were used to ensure highly accurate results.

Integration of GIS data: In the process of work, the resulting three-dimensional models were closely integrated with geographic information systems (GIS). This made it possible to better analyze the spatial relationships of objects and events.

Results:

Three-dimensional models of objects: Using photogrammetry, highly detailed three-dimensional models of historical monuments, landscapes and other geographical objects were created.

Visualize changes over time: By comparing 3D models at different points in time, it is possible to visualize changes in the structure and appearance of objects, providing additional information for research.

Geoanalytics: Integration of data into GIS provides the ability to spatially analyze and visualize results. This allows researchers to identify trends, connections and interactions across space.

Research Opportunities: The findings open new horizons for research in the fields of geography and history, allowing for a more in-depth and detailed study of past events and changes in the environment.

These methodological approaches and results provide a basis for further research and the introduction of photogrammetry into geographical and historical practice.

Conclusions and Future Prospects for Research

Conclusions:

Effectiveness of photogrammetry: The results of the study confirm the high effectiveness of photogrammetry in creating three-dimensional models for geographical and historical research. It is an important tool for reconstructing and documenting cultural heritage.

Accuracy and Detail: The resulting 3D models are highly accurate and detailed, allowing researchers to more deeply study objects and events of the past.

Visualization of temporal changes: The ability to visualize changes in objects over time provides new perspectives for archaeological and historical research.

Future prospects:

Integration with new technologies: The development of photogrammetry and its integration with other advanced technologies such as artificial intelligence and augmented reality can provide new opportunities for data analysis and visualization.

Deepening Research: Further research can delve deeper into the study of individual objects, their context and historical significance, using 3D models as the basis for more in-depth analysis.

Training and Education: Photogrammetry can be widely used for educational purposes, teaching students and researchers techniques for object restoration and analysis.

Practical applications: Implementation of research results into real-life practical projects, such as the restoration of cultural monuments or use for planning research in a geographical area.

Photogrammetry research in geographical and historical studies continues to advance, opening new horizons for studying and understanding the past and present. Efforts in this area will lead to new discoveries and opportunities in the field of cultural heritage conservation and research.

List of used literature:

1. S. Johnson. "Photogrammetry: A Comprehensive Review" p. 25-35

2. M. Brown, L. Smith. "Applications of Photogrammetry in Cultural Heritage Documentation: A Review" p. 78-92
3. K. Lee, D. Miller. "Advancements in Photogrammetric Techniques for Terrain Modeling" p. 40-55
4. Kovalsky. "The Integration of Photogrammetry and GIS in Historical Research" p. 102-115

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