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RAQAMLI KARTOGRAFIYA VA GIS TIZIMLARIDA MA'LUMOTLAR ANIQLIGI MUAMMOLARI

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Abstract: This article analyzes issues related to the accuracy of spatial data in digital cartography and Geographic Information Systems (GIS). The inconsistency of coordinate systems, projection errors, discrepancies in data integration, and the human factor are considered as the main problems. In addition, the importance of transformation algorithms, standardization, and data quality control mechanisms is highlighted. The research findings are aimed at developing scientific and practical recommendations to improve accuracy and ensure data reliability in GIS systems.

Keywords: GIS, digital cartography, coordinate system, projection, spatial data, transformation, accuracy, geodesy.

Digital cartography and Geographic Information Systems (GIS) have become an integral part of modern geodesy. Today, GIS technologies are widely applied in land resource management, urban planning, environmental monitoring, and transportation system design. In practice, platforms such as ArcGIS and QGIS are extensively used. However, integrating spatial data obtained from various sources into a single system often leads to accuracy-related issues, directly affecting the quality of geodetic and cartographic work.

In addition, insufficient metadata documentation complicates the assessment of spatial data accuracy. If information about data sources, survey methods, accuracy level, and update dates is incomplete, errors may arise during further analysis. Moreover, when working with real-time data streams, synchronization and timestamp accuracy become critically important.

Factors Affecting Spatial Data Accuracy:

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1. **Coordinate System Inconsistency**

Different maps and spatial datasets are created using different geodetic datums and coordinate systems. For example, differences between the World Geodetic System 1984 (WGS-84) and local datums may result in significant errors if transformations are performed incorrectly.

2. **Cartographic Projection Errors**

Representing the Earth's curved surface on a flat plane inevitably introduces distortions. Changes in area, distance, or angle may cause noticeable deviations in certain calculations.

3. **Data Integration Issues**

Layers created from remote sensing, GNSS measurements, and archival maps often have different accuracy levels. Harmonizing them within a unified system is a complex process.

4. **Human and Technical Errors**

Operator mistakes during digitization, incorrect georeferencing, and attribute data inaccuracies negatively impact overall precision.

Methods for Improving Data Accuracy:

1. **Improving Transformation Algorithms**

Helmert and Bursa-Wolf transformation models enable accurate datum conversion. Modern software provides automated transformation capabilities.

2. **Standardization and Regulatory Frameworks**

Updating national geodetic networks and adopting a unified coordinate system enhance data compatibility.

3. **Data Quality Assessment**

It is essential to implement criteria for accuracy, reliability, and completeness of spatial data. Statistical analysis and RMS (Root Mean Square) error indicators are widely applied.

4. **Integrated Technologies**

The combined use of GNSS, remote sensing, and terrestrial geodetic measurements significantly improves data accuracy.

Currently, open data platforms, cloud-based GIS technologies, and web mapping systems are rapidly evolving. 3D modeling, Digital Elevation Models (DEM), and LiDAR technologies play an important role in enhancing precision. At the same time, when dealing with Big Data, issues of standardization, validation, and data security remain highly relevant.

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Conclusion

Data accuracy in digital cartography and GIS systems is one of the key factors determining the quality of geodetic work. Inconsistencies in coordinate systems, projection errors, and data integration issues negatively affect positional accuracy. These problems can be mitigated through the improvement of transformation algorithms, standardization, and continuous quality control of spatial data. In the future, the further development of GIS technologies is expected to ensure higher levels of accuracy and automation in working with spatial information.

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