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APPLICATION OF GPS AND GIS TECHNOLOGIES IN DETERMINING LAND BOUNDARIES

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Abstract: This article examines the role of GPS (Global Positioning System) and GIS (Geographical Information Systems) technologies in the process of determining land plot boundaries and their state registration. The study highlights the advantages of GPS and GIS integration in ensuring high accuracy, speed, digital database formation, transparency, and regional analysis capabilities. Additionally, existing problems in the application of technologies and proposals for their elimination are presented. The article reflects the importance of implementing modern digital technologies in the system of territorial administration, land cadastre, and real estate registration.

Keywords: GPS, GIS, land plot, cadastre, digital technologies, state registration, territorial management.

Introduction. In today's conditions, ensuring the rational and targeted use of land resources, as well as legally strengthening the rights of real estate owners, relies on reliable and accurate cadastral data. The cadastral system not only records the location and area of the land plot but also reflects its legal status, type of use, and economic value. Therefore, the correct and error-free determination of land plot boundaries is an important stage of the state registration process. The lack of clear boundaries can lead to legal disputes, tax uncertainty, and problems in urban planning.

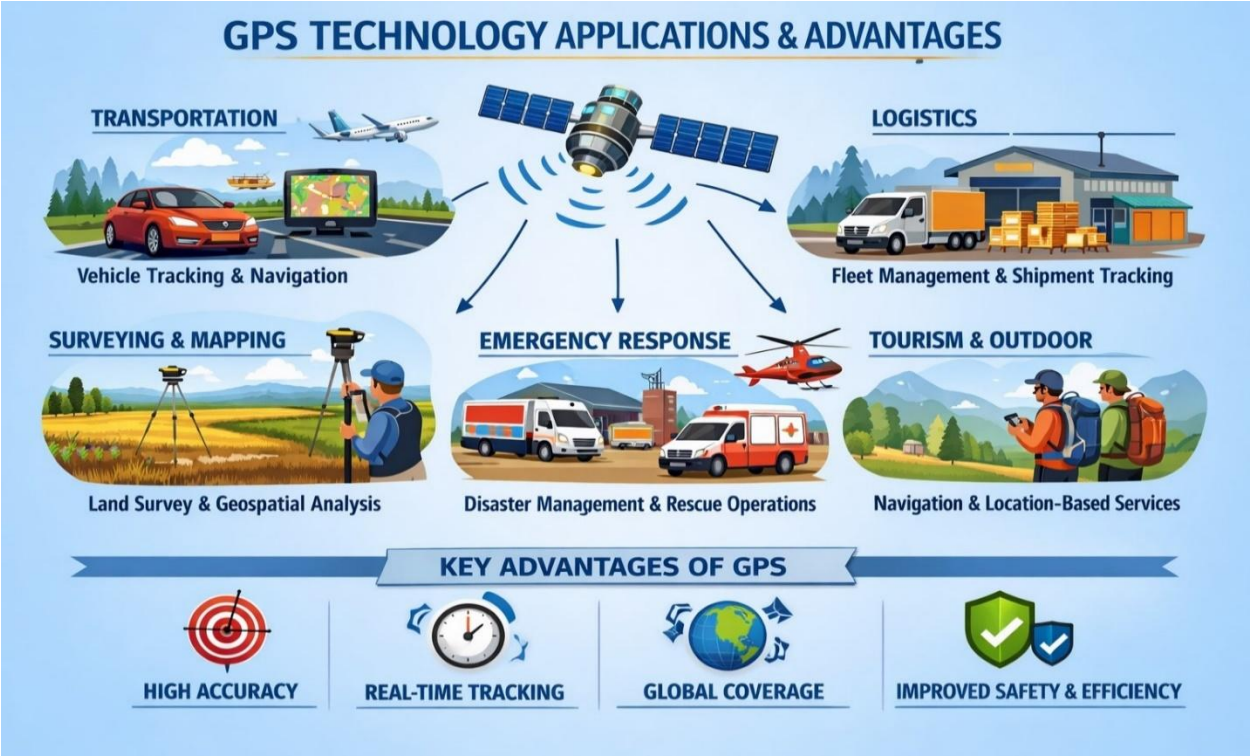
The accuracy of land plot boundaries ensures the principle of justice, especially in the taxation system, as the correct calculation of land area directly affects the amount of property tax and land tax. In addition, the accuracy of spatial data is also important in the development of construction and regional development programs. In the planning of development projects, the actual boundaries of land plots and their mutual alignment with the surrounding infrastructure serve as the primary criteria.

In the past, traditional geodetic measurement methods were performed in the field using numerous mechanical instruments. This process demanded considerable time, significant labor, and high-precision calculations. Due to their reliance on the human factor, these methods occasionally resulted in errors.

The introduction of modern GPS (Global Positioning System) and GIS (Geographical Information Systems) technologies has fundamentally changed the process of determining land boundaries. Using GPS devices, the precise coordinates of land plot turning points are determined in a short time and with high precision. The data obtained are processed using GIS software, displayed in the form of digital maps, analyzed, and integrated into a unified electronic cadastral database.

The role of GPS technology in determining land boundaries. GPS (Global Positioning System) technology is considered one of the primary tools for determining land boundaries, providing modern and high-precision precision. This system allows for the determination of

precise geographical coordinates (latitude, longitude, and altitude) of points on the Earth's surface via satellites. As a result, the turning points of the land plot are accurately measured and their location is formalized in connection with the state geodetic system.



GPS technology is of particular importance in cadastral and geodetic work. Compared to traditional measurement methods, GPS allows for faster and more accurate results in field conditions. Modern geodetic GPS receivers provide accuracy down to centimeters using the RTK (Real Time Kinematic) method. This minimizes errors in establishing boundaries between land plots and prevents potential land disputes in the future.

Another important aspect of GPS technology is that measurement results are stored directly in digital format. The obtained coordinates are processed using specialized software and used to create electronic cadastral maps. This simplifies and accelerates the process of entering land plots into the state register. Furthermore, using GPS devices, it is possible to measure complex terrain or large areas within a short period of time. Accuracy is maintained through satellite signals even in mountainous, desert, or remote areas. This feature is of great importance for the comprehensive inventory and monitoring of land resources.

The practical significance of GIS technologies. GIS (Geographical Information Systems) technologies are an important practical tool in land resource management, cadastral data management, and territorial planning processes. This system allows for the collection, storage, processing, analysis, and visualization of spatial (geographical) data. As a result, information about land plots is displayed not only in the form of text, but also in the form of a clear map.

The main practical significance of GIS technologies lies in combining data from various sources on a single platform. For example, coordinates determined by GPS, aerospace imagery, topographic maps, and legal information will be integrated into a single system. This makes it possible to see the exact boundaries of the land plot, automatically calculate its area, and determine its mutual location with other objects.In the cadastral system, GIS performs the following practical tasks:

- Creating and updating digital cadastral maps

- Graphical representation of land plot boundaries
- Automatic land area calculation
- Identify border overlaps or errors

Advantages of GPS and GIS integration. The combined use of GPS (Global Positioning System) and GIS (Geographical Information Systems) technologies significantly increases efficiency in the land cadastre and territorial management system. These two technologies complement each other perfectly: GPS provides reliable information when determining the location of land plots, buildings, structures, and other objects by determining precise spatial coordinates, while GIS analyzes this information on maps and databases, simplifying territorial planning, control, and monitoring processes. As a result of integration, the processes of defining land boundaries, registering property rights, taxation, and managing regional infrastructure facilities will be carried out within a single system. For example, precise coordinates obtained using GPS are uploaded to the GIS system and visually analyzed on the map, which reduces boundary errors and ensures legal accuracy.

Additionally, this integration allows for time savings and the efficient use of resources. By entering the data obtained from field work directly into the GIS system, the processing process is automated, and the need for manual calculation and verification is reduced. As a result, the speed of cadastral work increases, errors caused by the human factor decrease, and the accuracy of data increases. By creating a digital database, information on all land plots will be stored in a single electronic system. This not only creates convenience for the state register but also facilitates the efficient use of land resources, territorial planning, and investment monitoring. Furthermore, using GIS analysis, it will be possible to identify regional development, various types of land areas, and assess connections with infrastructure facilities.

Conclusion. The integration of GPS and GIS technologies significantly expands regional analysis capabilities while ensuring high accuracy, speed, and transparency in the land cadastre system. Thanks to the harmonious operation of these two technologies, the coordinates of land plots are precisely determined, their location is visually displayed on maps, and cadastral data is updated in real time. As a result, the processes of protecting rights to real estate objects, their state registration and taxation will be carried out more reliably and effectively.

Also, GPS and GIS systems serve as an important tool in planning regional development. The availability and constant updating of a digital database increases the efficiency of regional management, optimizes the decision-making process, and supports investment activities. For example, opportunities for attracting investment, planning infrastructure projects, rational use of land resources, and integrating regional analysis results into economic and social development strategies will expand.

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