The American Journal of Engineering and Technology
(ISSN – 2689-0984)
Published: August 25, 2020 | **Pages:** 59-63
Doi: https://doi.org/10.37547/tajet/Volume02Issue08-08

IMPACT FACTOR
2020: 5. 32

Journal Website: http://usajournalshub.com/index,php/tajet

Graphical Basics Of Geoinformation Systems (GIS)

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ABSTRACT

Effective use of GIS to solve various spatially localized problems requires the user to have sufficient knowledge about geodetic coordinate systems, cartographic projections and other elements of the mathematical basis of GIS maps, knowledge about methods of obtaining various information from the map, mathematical and other methods of using this information to solve spatially localized GIS problems.

KEYWORDS

Arable land, fall, field agricultural land, geographic information systems, graphic visualization, haymaking, land balance, land fund, management and planning, objects of assessment, pasture, resource inventory.

INTRODUCTION

Geoinformation systems (GIS) are automated systems whose functions are the collection, storage, integration, analysis and graphical interpretation of space-time data, as well as associated attribute information about objects represented in the GIS.[1]

GIS appeared in 1960 with the advent of information processing technologies in the DBMS and visualization of graphic data in CAD, automated card production, and network management.

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MATERIALS AND METHODS

The purpose of the GIS is determined by its tasks (scientific and applied), such as resource inventory, management and planning, decision support. [2]

Stages of GIS creation:

- pre-design studies, in particular, user requirements and functionality of the software used,
- feasibility study (FS)
- profitability assessment,
- GIS system design, including pilot phase, GIS development;
- testing of GIS in a small territorial fragment or test area or creation of a prototype,
- implementation of GIS;
- GIS operation and maintenance.

Data sources for GIS creation:

- The base layer - cartographic materials (topographic and general geographic maps, maps of administrative-territorial division, cadastral plans, etc.), used in the form of a geodetic coordinate system and flat rectangular coordinates of cartographic projections of initial materials, geodetic coordinates and projections of the created basic maps, based on which digital models are built-in GIS and practically all their tasks are realized.

- Remote Sensing Data (RSD): in pm, materials obtained from spacecraft and satellites, Images are obtained and transmitted to Earth from survey vehicles located in different orbits. The obtained images differ in the level of visibility and detail of the display of objects of the natural environment in several ranges of the spectrum (visible and near-infrared, thermal infrared and radio range), which allows solving a wide range of environmental problems. Remote sensing techniques also include air and ground surveys and other non-contact techniques, such as hydroacoustic surveys of seabed terrain. The materials of such surveys provide both quantitative and qualitative information about various objects of the natural environment;

- Results of geodetic measurements on the ground performed by levellers, theodolites, electronic tachometers, GPS receivers, etc.;

- Data of state statistical services for various branches of the national economy, as well as data of stationary measurement observation posts (hydrological and meteorological data, information on environmental pollution, etc.).

- literary data (reference publications, books, monographs and articles containing various information on individual types of geographical objects). GIS rarely uses only one type of data, most often a combination of various data to a territory.

The scientific, technical, technological and applied aspects of the design, creation and use of GIS are studied by geoinformatics. Data collected in geoinformatics are separated into a special class of data called geodata. [3] Geodata - data on objects, forms of territory and infrastructures on the surface of the Earth, and as an essential element, spatial relations should be present in them. Geodata describes objects through their position in space directly (for example, by coordinates) or indirectly (for example, by links).

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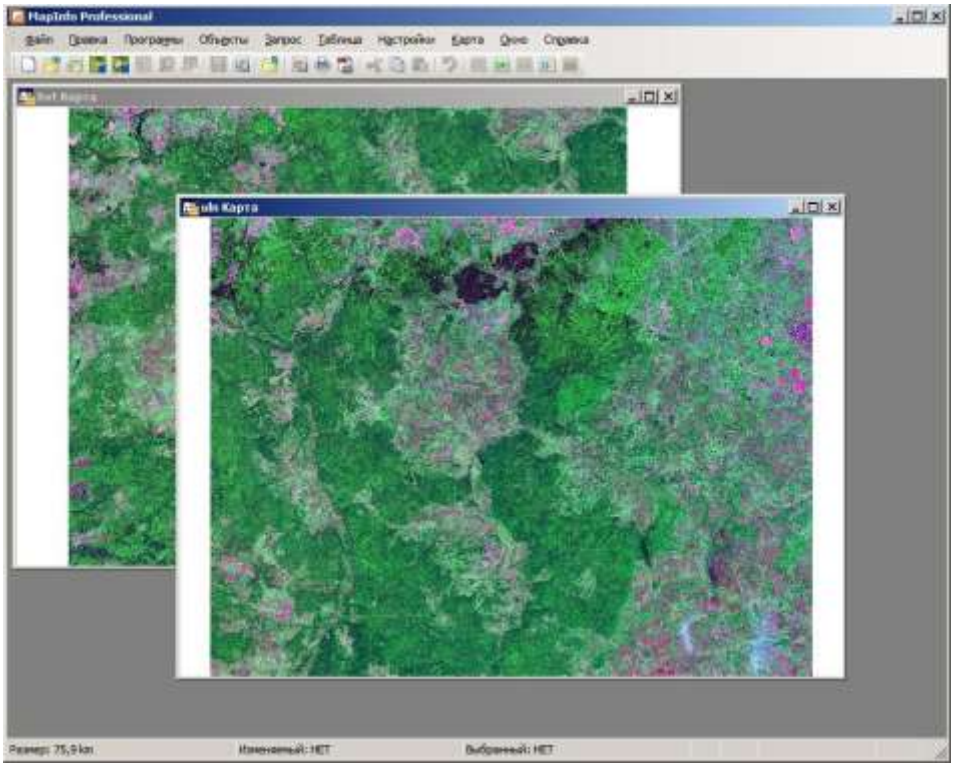

Figure 1. Map Info, map plan overview.

Using the example in Figure 1, Map Info examines the map plans of an area. In general, the following technologies for data collection in geoinformatics should be highlighted:

- Aerial survey, which includes an aerial survey, a survey from mini-carriers;
- Global Positioning System (GPS);
- Space survey, which is one of the most important sources of data for GIS in environmental research, environmental monitoring, assessment of agricultural and forest lands, etc.;
- Maps or map information, which is the basis for building digital GIS models;
- Data from the Internet;
- The ground photogrammetric survey serves as a source of information for GIS when analyzing urban situations, environmental monitoring of deformation and precipitation;
- The digital photogrammetric survey is based on the use of digital photogrammetric cameras, which allow to output information in digital form directly to the computer;
- Video shooting, as a data source for GIS, is used mainly for monitoring purposes;
- Documents, including archived tables and catalogues of coordinates, serve as the main source of data for entering into the GIS so-called substantive or thematic information, which includes economic, statistical, sociological and other types of data;
- Geodetic methods (automated and non-automated) are used to refine coordinate data,
- The source of data for GIS is also the results of processing in other GIS;
- Photos, drawings, drawings, schemes, video images and sounds;
- Statistical tables and text descriptions, technical data;
- Postal addresses, telephone books and directories;

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- Geodetic, environmental and any other information.

GIS are classified according to the following characteristics:

1. By functionality:
- Full-service general-purpose GIS;
- Specialized GIS aimed at solving a specific problem in a subject area;
- Information and reference systems for home and reference use. GIS functionality is also determined by the architectural principle of their construction:
- Closed systems do not have expansion capabilities, they can perform only the set of functions that are uniquely defined at the time of purchase; - open systems are characterized by ease of adaptation, expansion capabilities since they can be completed by the user himself using a special apparatus (built-in programming languages).

2. By spatial (territorial) coverage, GIS is divided into global (planetary), national, regional, local (including municipal).

3. According to the problem-thematic orientation - general geographic, environmental and environmental users, sectoral (water resources, forest management, geological, tourism, etc.).

4. According to the method of organizing geographical data - vector, raster, vector-raster GIS. The GIS structure includes a set of technical facilities (STF) and software (software), information software (IS). STF is a complex of hardware, in h, a workstation (personal computer), information I/O devices, data processing and storage devices, and telecommunications. The workstation is used to control the operation of the GIS and perform data processing processes based on computational and logical operations. Data processing and storage devices are integrated into a computer system unit, which includes a central processor, random access memory, storage devices (hard disks, portable magnetic and optical storage media, memory cards, flash drives, etc.).[4]

Data output devices - a monitor, a graph builder, a plotter, a printer, which provides a visual representation of the results of spatiotemporal data processing. [5]

Software - provides an implementation of GIS functionality. It is divided into basic and application software. The basic software includes operating systems (OS), software environments, network software, database management systems, and data input and output control modules, a data visualization system, and modules for performing spatial analysis. Application software - software tools designed to solve specialized problems in a specific subject area. They are implemented as separate modules (applications) and utilities (tools). [6]

IS - a collection of information arrays, information coding and classification systems. The peculiarity of storing spatial data in GIS is their separation into layers. The multilayer organization of the electronic map, with a flexible layer management mechanism, allows you to combine and display much more information than on a regular map. [7]

The information presented in the form of separate layers and their joint analysis in different combinations allows obtaining additional information in the form of derived layers with their mapping (in the form of isolinear maps, combined maps of various indicators, etc.).

GIS technology combines disparate data into a single form, which simplifies the adoption of management decisions of information support at various levels of planning and receive, analyze and make decisions in science and management.

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The market of GIS, differing in functional capabilities, requirements for STF, software and information technology, is quite developed. Software is one of the few industries where the Russian Federation competes on equal terms with the West.

CONCLUSION

Finally, data entry is implemented using various technical means and methods: directly from the keyboard, using a digitizer or scanner, through external computer systems. Spatial data can be obtained from electronic geodetic devices, using a digitizer or scanner, or using photogrammetric devices.

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