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Original Contribution

TYPES OF INFORMATION SYSTEMS

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ABSTRACT: *The report shows ways to divide information systems into different types. Although the separation is artificial, it is important and is the basis for the formation of various GIS applications. Non-land GIS are focused on the population, housing policy, economic and political activity of the population*

KEY WORDS: *Land Information System, Database Management Systems, GIS, Computer-Aided Drafting, Computer-Assisted Mapping*

INTRODUCTION

The term geographic information technology (GLI) for management is a broader and more generalizing concept for all the technologies it incorporates. Recently, however, GIS has become a more commonly used general term for computer technology.

Classification of information systems (IS) can be carried out on various grounds. The most general classification shows the separation between spatial and non-spatial information systems, presented in Fig. 1. GIS belong to the category of spatial IS. The two main classes of spatial information systems are defined as geographic and non-geographical. Non-geographic information systems, although they often represent some part of geographic space, rarely have a spatial relationship with the land. In other words, they are not spatially (coordinated) defined. Systems such as CAD (Computer-Aided Drafting) and CAM (Computer-Assisted Mapping) refer to non-geographic spatial systems. GIS is divided into Land Information System (LIS) and other information systems.

Land Information Systems are further divided into property-based cadastral information systems (Basic Cadastral Property Unit) and non-property-based

cadastral information systems. The latter include Natural Resource Information Systems such as national parks and forests or Water Resources Information Systems.

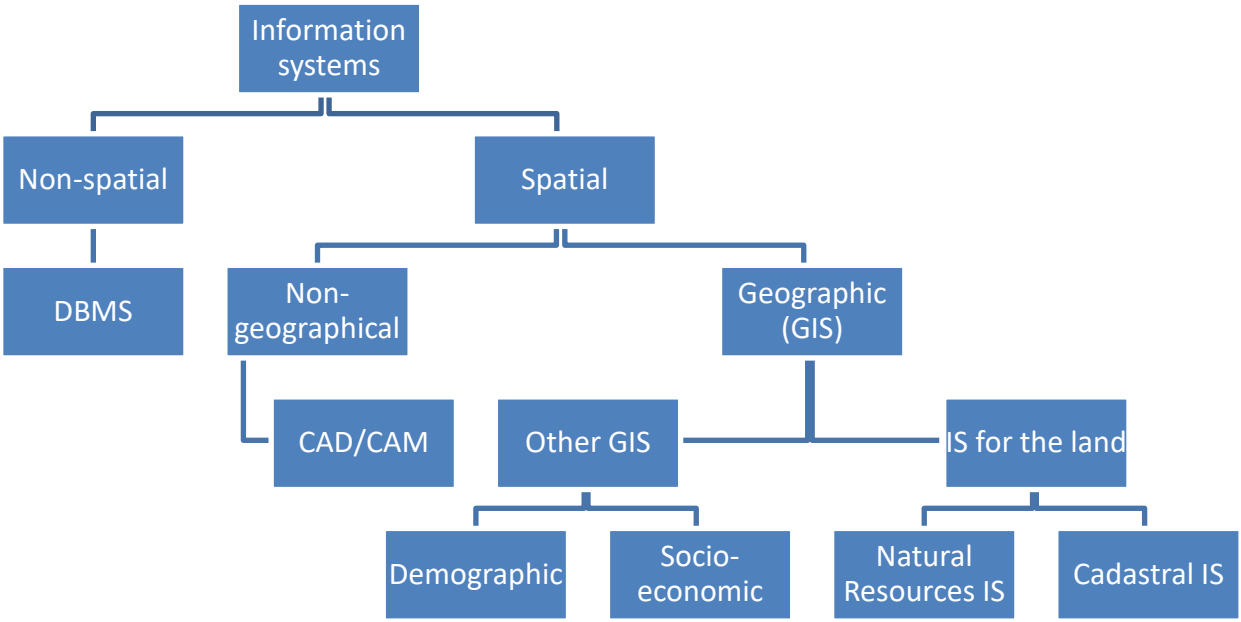

Figure.1. Spatial and non-spatial information systems

THEORETICAL STAGING

1. Classification of information systems.

The activities with such GIS are related to the assessment of biological species, risk assessment, forecast assessment of earthquakes, floods, landslides and other natural disasters.

The operations that are performed in GIS are a series of subsystems. On this basis, a new classification can be carried out. According to this classification, the subsystems are divided into:

- ❖ Data entry systems.

In these systems, data from different sources are collected and pre-processed, as well as transformation of different types of spatial data (from different coordinate systems and map projections, from vector or raster data, or different formats);

- ❖ Information storage and processing systems.

These systems store data in a way that allows for updating and editing;

- ❖ Processing and Analysis Systems.

These systems solve problems on the data, perform parameter estimation, and perform modeling functions;

- ❖ Visualization systems.

Systems that display all parts of the database in tabular, graphic, and map form.

Systems can also be classified according to other characteristics. For example, if the above systems are summarized according to the tasks they solve, they can be represented as:

- ❖ Generalizing, thematic and statistical map systems.

These include the systems for management of natural resources (forestry, vegetation, geology, soils) and socio-economic phenomena (population census, planning and development of settlements, etc.);

- ❖ Network and spatial analysis systems.

For example, for the analysis of road and air control networks, underground pipelines, water supply, sewerage, etc.

Geographic management information technologies include the following well-known computer systems:

1. Automated Mapping (AM) and Computer-Assisted Mapping (CAM) are Automated Mapping Systems (AMS);
2. Computer-Aided Drafting (CAD) and Computer-Aided Drafting and Design (CADD) are automated drawing (design) systems;
3. Geographic Information System (GIS);
4. Automated Mapping / Facilities Management (AM/FM) are systems for mapping and data management;
5. Geoprocessing and Network Analysis – are systems for network analysis;
6. Land Information System (LIS);
7. Multipurpose Cadastre is a multipurpose cadastre system;
8. Database management systems (DBMS) are systems for processing attribute information (e.g. property, services, taxes, statistics, etc.).

The automated mapping systems AM and CAM are designed for creating, processing and visualizing maps and other graphic products. They have limited ability to perform analyses.

Automated drawing systems CAD and CADD are used in various engineering fields such as: cadastre, road and bridge construction, communication networks, building design, photogrammetry, topography, mechanical engineering and others. These systems operate in interactive mode, can perform various engineering calculations and analyses.

The two information systems GIS and AM/FM process graphical and non-graphical data. In them, the non-graphic data (attribute properties) are related to the map image or other engineering drawing by means of a unique number. Although the two systems have similar capabilities, GIS is used more for spatial modeling and analysis, while AM/FM emphasizes more on geographic data management.

GIS unites a significant part of CAD and DBMS systems, but it is not always necessary to have a direct connection with geodetic or cadastral information or a system.

Network Analysis Systems Geoprocessing and Network Analysis are computer systems mainly for performing geographic analysis. They are geocode (identifier) dependent on the database records.

LIS (land information systems) contain data based on graphics and text. They are used in various local and state offices for determining fees, taxes, facilitating the work of various real estate companies in the land market, etc.

The cadastral information systems for Multipurpose Cadastre are designed to create cadastral maps that contain the boundaries of properties and their ownership.

Over a hundred software systems claim cartographic and GIS capabilities. The most appropriate classification of the main GIS software packages is based on their functionality and type and divides them into six groups: professional, desktop, hand-held, component, viewer, Internet.

All these systems are widely used in all spheres of human activity, covering the distribution (local and regional) and management of objects, processes and phenomena in space and time. For example, for planning, development and management of settlements, migration of people and animals, movement of air masses, linear networks, analysis and assessment of transport load, real estate, market value of land, etc.

2. Classification of GIS software packages.

- ❖ Professional GIS.

The term "professional" fully covers the essence of this class of software. The distinctive feature of professional GIS is to include a collection of tools for editing, administration, processing, analysis and other special tools. Examples of professional GIS are: ESRI ArcInfo and Smallword GIS. People who use these systems are usually technically educated;

- ❖ Desktop GIS.

In the last years of the 20th century, desktop GIS, also called desktop mapping systems, became the most widely used category of GIS software packages. Apart from using the data, they are more focused on generating it by using excellent tools to create maps, charts, and tables. Well-known examples of desktop GIS are: Autodesk World, ESRI ArcView, Integraph GeoMedia, Clark Lab's idrisi, and MapInfo Professional.

Desktop users work in the fields of planning, engineering and military affairs, aviation, marketing and other professional fields;

- ❖ Handheld GIS.

Over the past few years, both hardware design has improved significantly, but it has also become possible to develop GIS software for mobile and personal users for manually managed systems. Like desktop GIS, these handheld devices can support many features – visualization, database query, and simple analytical applications. One interesting feature of these systems is that all programs and data are stored in memory, due to the lack of a hard drive, which provides quick

access to them. Handheld GIS systems are designed for mobile users who use them in field conditions.

Handheld GIS is available from many vendors. Famous systems are Autodesk OnSite, ESRI ArcPad, and Smallworld Scout. Many of these systems are designed to work with the Internet;

Table 1: Types of GIS Software Products and Major Commercial Companies

	Autodesk	ESRI	Integraph	MapInfo	GE Smallworld
Internet	MapGuide	ArcIMS	GeoMediaWebMap GeoMediaWeb Enterprise	MapXtreme MapXSite	Smallworld Internet Application Server
Viewer	AutoCAD LT	ArcExplorer	GeoMedia Viewer	ProViewer	Custom
Compound	In several products	MapObjects	Part of GeoMedia	MapX, MapJ	Part of Smallworld GIS
Handheld	OnSite	ArcPad	Under development	MapXtend	Scout
Desktop	World	ArcView	GeoMedia	MapInfoProfessional	Spatial Intelligence
Professional	AutoCAD/ World	ArcInfo	GeoMedia Pro	MapInfoProfessional	Smallworld GIS
Database server	Vision	ArcSDE	Uses Oracle Spatial	SpatialWare	Part of Smallworld GIS
CAD	AutoCAD MAP	ArcCAD	In several products	In several products	Part of Smallworld GIS

❖ Compound GIS.

With the development of software production, suppliers have realized a collection of GIS software components. They are indeed a set of tools containing GIS functions with which custom and optimized applications can be created. Typically, GIS packages offer contrast visualization and good capabilities for "querying" the database, but limited mapping and analysis tools. Examples of compound GIS are: Blue Marble Geographics GeoObjects, ESRI MapObjects and MapInfo MaxX;

❖ GIS for visualization (Viewer).

At the end of the 90s of the 20th century, free GIS appeared for visualization and query of the database in the most popular file formats. Such products are ESRI's ArcExplorer, Integraph's GeoMedia Viewer and MapInfo's ProViewer. Today, these systems represent a significantly large category. They help to promote specific GIS terminology and establish the market share of providers. Visualization systems have limited possibilities for querying the

database and simple mapping. They do not support editing, complex analysis and modeling;

- ❖ Other types of GIS systems.

Raster-based GIS, as their name suggests, is designed to work with raster data and raster analysis. In recent years, raster systems have additional capabilities for working with vector data. Also, many vector-based systems have additional extensions for analysis with rasters. For example, ESRI ArcInfo and ArcView have a Spatial Analyst extension, and MapInfo Professional has a Vertical Mapper.

CAD-based GIS are systems that were originally designed as drawing and design systems and later GIS capabilities were added. Typically, a CAD system is supplemented with a database, spatial analysis capabilities, and cartographic capabilities. Not surprisingly, these systems are mainly liked by users who have worked with typical CAD systems such as architects, engineers, constructors, who also want to use geographic information and geographic analytics in their projects. The most well-known CAD-based GIS are: AutodeskMap and ESRI ArcCAD, which extend Autodesk AutoCAD and Bentley GeoGraphics, and Integraph Modular GIS Environment (MGE), which extend Bentley Microstation.

CONCLUSION

One of the main benefits of GIS is improving the organization and management of data sources. GIS can connect networks of data along with common localized data, such as the most commonly used addresses, which help departments and agencies separate their own data. By creating separate databases, one department (organization) can benefit from the work of another – data that can be collected once and used many times.

For example, GIS can be used to help achieve a solution for the location of a new residential neighborhood that has minimal impact on the environment, is located on a low-hazard terrain and is close to the center of the settlement. The information can be presented briefly and clearly, in the form of a map and accompanied by a report. Therefore, GIS products can be productive, fast with multiple scenarios, and can be evaluated effectively.

More often we connect maps with the earth's surface, but the map in GIS is not only mapping of the terrain. GIS can display on a map any data we want. Making a map with GIS is much more flexible than in the traditional way or with automated cartographic approaches. A GIS creates maps from data downloaded from the database. Existing paper maps can also be digitized and transferred to GIS.

A GIS-based mapping database can be continuous and arbitrarily scaled. Then the cartographic products can be created for any territory, at any scale, displaying the selected information effectively with extremely specific

characteristics. A map can be created at any time, at any scale, for each user and for a period of time for which we have data.

In the model, the representation and recognition of geographical objects is sometimes different from the human idea. There is a big difference between presenting the data in a table of rows and columns and presenting it in map form.

The difference is not just aesthetic, it is conceptual. It turns out that the way we see our own data has a profound impact on the connections we make and the conclusions that come from them. GIS gives the blueprint and drawing tools that help present the facts in clear and concise documents.

References:

[1] Andreev A., Markov M. Geographic Information Systems. MW Shumen 2009.

[2] Andreev A. (2012) Modern Geoinformation Concept and Security Modeling Technologies. Dissertation autoabstract for awarding the scientific degree "Doctor of Economic Sciences".

[3] Kambourov A. (2010) LiDAR technology and its application to terrestrial 3D laser scanning. Wc. "Geomedia" (http://www.geomedia.bg/geodesy/item/3293).

[4] Kastreva P. Geographic Information Systems and Computer Cartography. University Press "Neofit Rilski", Blagoevgrad 2011.

[5] Koeva M. (2015). 3D modelling in architectural photogrammetry. Abstract of the Dissertation Thesis for awarding educational and scientific degree "Doctor".

[6] Maldzhanski Pl. (2012) Development of Methods of Capturing and Data Processing in Architectural Photogrammetry. Monograph, 122 pp.' EFT Design", Sofia 2012.

[7] Ognyanov D. Kamenarov A., Todorov P., Spiridonova Yu. (2011) Technology for geodetic and cartographic documentation of objects of cultural and historical heritage in the preparation of a project for their management. Geomedia Magazine.

[8] Petrov D. I., 2013, "Tool on digital photogrammetry / creation of orthorectified images using a program system for digital photogrammetry ERDAS - LPS", Bishop Konstantin Preslavski, Shumen.

[9] Ruoss E., Alfare L. et all, (2014) Sustainable tourism as driving force for cultural heritage sites development. Planning, Managing and Monitoring Cultural Heritage Sites in South East Europe.**(** (www.cherplan.eu).

[10] Shashi Shekar, Hui Xiong (Eds.). Encyclopedia of GIS. Springer © 2008 SpringerScience+Buisiness Media, LLC.