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Abstract. The article tells about the formation of geographic information service new direction, which is a symbiosis in the field of the Earth sciences and society. The main definitions of geographic information service based on serviceology, geoinformatics, and spatial positioning are given. An overview of application spheres of geoinformation services in the spatial economy is given. Information technologies of geoservice are considered. The network and software components of geoservices are analyzed. The spheres of geoinformation services application in the tasks of three-dimensional visualization, geomarketing, cadastral works, in railway transport and in the field of tourism are described. In conclusion, it is concluded that geographic information service is firmly included in our life as a technology necessary in the daily practice of searching for spatially distributed information.

INTRODUCTION

The theoretical base of service direction is based on the science of serviceology [1–3]. The science of serviceology arose at the intersection of economics, sociology, marketing, psychology and other disciplines that study a person and his needs [4, 5]. Service is understood as a high-quality performance of a service [6, 7]. That is, the necessary conditions for the existence of a service are the development of this industry and the presence of clients and specialists in this industry [8].

On the other hand, the science of geoinformatics appeared at the intersection of geosciences and informatics [9 - 12]. In the symbiosis of sciences, computer science provides a toolbox for the study of geosciences and society.

The history of geoinformatics development and geoinformation systems is more than 40 years old [13-15]. The term geographic information systems dates back to the 1970s. At first it was a technology allowing to bind a database to an image. This technology came to be called spatial information systems. It was mainly used in computer-aided

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design systems, but then it was transferred to Earth sciences, and spatial information systems received the geo prefix. There are varieties of these systems: geographic information systems [11-14], geodetic systems, cartographic information systems [15, 18], cadastral information systems, space information systems, ecological information systems, etc. Moreover, in the Western world, such systems began to be used in the economy to levy taxes on households, while in Russia they were used for military purposes: targeting guided ballistic missiles, and then cruise missiles, navigation of nuclear submarines, command and control, etc. Further, spatial information systems began to be used in construction, in automated mapping, in oil pipelines design, in mapping minerals, etc.

It is also necessary to distinguish between the terms geoinformation systems, geoinformation technologies and geoinformatics. Geographic information systems describe the object of research as a system or a set of system states, geographic information technologies allow transferring this system from one state to another. Geoinformatics, as a science, contains a set of theories, methods, techniques for describing the states of systems and the transition of a system from one state to another.

Over 40 years of development, geoinformatics in Russia has gone through the same stages of its development as in the Western world: the pioneer period, the period of government initiatives, the period of commercial development, the user period. During the user period of geoinformatics, the needs of clients in obtaining spatial information are being satisfied. The user period began to develop according to the laws service and gave rise to a new direction - geoinformation service [18-19].

The development of the Internet and big data began somewhat later than geoinformatics appeared. The Internet, as such, aims to meet the needs of customers through Internet services [20]. Internet services that are aimed at satisfying customers in obtaining spatial information have come to be called geoinformation services [21-24].

Thus, by the term geographic information service we mean a complex professional activity to create conditions and provide quality services based on spatial information in the field of providing clients with any information and data. Geoinformation service combines such areas of knowledge as serviceology, geoinformatics, geomarketing, space monitoring, digital cartography, information networks, global positioning, etc. Geoinformation service is aimed at meeting the individual needs of the client. The emergence of service as an infrastructure testifies to the sufficient maturity of this activity area.

MATERIALS AND METHODS

Materials or objects of research in the field of geographic information service are spatially distributed data. Research methods are a systematic approach, methods of cartographic analysis and visualization, statistical analysis of geospatial data [23], geospatial modeling [23-24], cluster and geomarketing analyzes [23,24].

RESEARCH RESULTS

The insufficient article volume does not allow describing all the results obtained by the authors in the process of providing services in geoinformation services field, therefore, we will focus on two: three-dimensional modeling of geospatial data and geomarketing and briefly describe other results.

Geospatial Service for Spatial Modeling and Objects Placement in the Internet

One of the significant achievements in geoservices development is the transition from flat representations of the investigated objects to volumetric ones, that is, the transition from two-dimensional (2D) to three-dimensional (3D) models. The concept of 3D is now familiar from completely different areas of human life. 3D modeling technologies are actively used by architects, builders, designers, multimedia workers, etc. [26, 27]. Since they allow automating numerous design processes and creating the final model of the desired object [28, 30].

In mathematics, measurement data is usually denoted by the values X, Y and Z. Accordingly, an object built simultaneously in these three dimensions acquires volume. The ultimate goal of 3D construction is a three-dimensional object with certain parameters and characteristics. 3D design technology is designed to create three-dimensional models of detail varying degrees and to solve applied problems.

The main tasks when building a 3D model are:

- studying of the very concept of "3D modeling";
- consideration of 3D modeling types, their disadvantages and advantages;
- methods analysis for constructing models in 3D;

- study and familiarization with software functionality, with the help of which a three-dimensional model will be built;
- studying of the model and stages' structure and methods of its creation;
- search for parametric dependencies and geometric relationships;
- development of a visual 3D image of the desired object;
- measuring and checking the geometry and finally identifying incorrect elements and errors in the final model and correcting them.

Resulting object image as a result of modeling can be seen under different lighting conditions and at different angles. The final volumetric object can be represented as an object from the real world (house, car, tree, etc.). Model building can be based on various materials, being a building plan or product layout, space photos or city plans, raster and vector images, etc.

It is known that for the optimal choice of a program for 3D modeling, it is necessary, first of all, to clearly define the purpose and objectives of building a 3D model. After reaching the goal and determining the main tasks of building a model, one can start choosing specialized software.

Today, 3D technologies are presented on the market, represented by a huge amount of different software, the only difference of which, perhaps, lies only in the price, visualization quality of the modeled object and the completeness of interfaces set.

It is not enough for the modern user to create a model; it must be presented in such a way that it is difficult to distinguish it from the original. This is very important in architectural modeling, design, multimedia, etc.

Today, the most famous types of software for 3D visualization of objects are: Autodesk 3dsMax, AutoCAD, Blender, Google SketchUp, 3DCrafter, Compass-3D, Ashampoo 3D CAD Professional, 3DZ 2Dto 3D, GraphiSoft ArchiCAD, Autodesk Architectural Desktop, Arc Plus Progress, Cadsoft Envisioneer, Wings 3D, Ashampoo Home Designer Pro 2.0, NaroCAD. Such a variety of software allows to design both individual rooms and entire buildings and structures, elements for games and multimedia. In the environment of architectural design and modeling, the most popular are Autodesk 3dsMax, AutoCAD, Solidworks.

These types of software have a very wide and complex interface designed for the design of architectural structures and solving some engineering problems. They are most often used in marketing systems by large companies, architecture and design companies, as their distinguishing feature is the realistic model. The designer has the ability to draw a virtual sample with all the smallest engineering components. Another equally popular program for three-dimensional visualization of objects is Google SketchUp. This software is made for architecture and design. It has a fairly broad interface for creating a model, but its rendering ability is significantly inferior to, say, Autodesk 3dsMax or AutoCAD.

Geomarketing

Recently, geomarketing analysis systems have become widespread. To select the location of the new opening point, thorough analysis of clients' availability to visit it, the presence of competitors, premises availability for this point location is made. The scope of geomarketing analysis can be very wide. This is the search for a place to locate a retail outlet and the choice of the location of a pharmacy, a clinic. A special place in geomarketing is occupied by the choice of housing. Geomarketing systems allow to take into account many factors: remoteness from the center, availability of communications, infrastructure, area ecological state. All these factors can be taken into account when applying neural network methods in conjunction with fuzzy algorithms and linguistic variables.

The entire area is divided into clusters. This is usually squares' network. Inside each square, an estimate is made based on neural network methods. A square map is often referred to as a heat map (Fig. 1).

Other Areas of Geographic Information Services Application

The term geographic information service refers to a wide range of services related to spatial information. There are a large number of companies that have geoservices in their names. People increasingly need and use spatial information and geographic information services as just services.

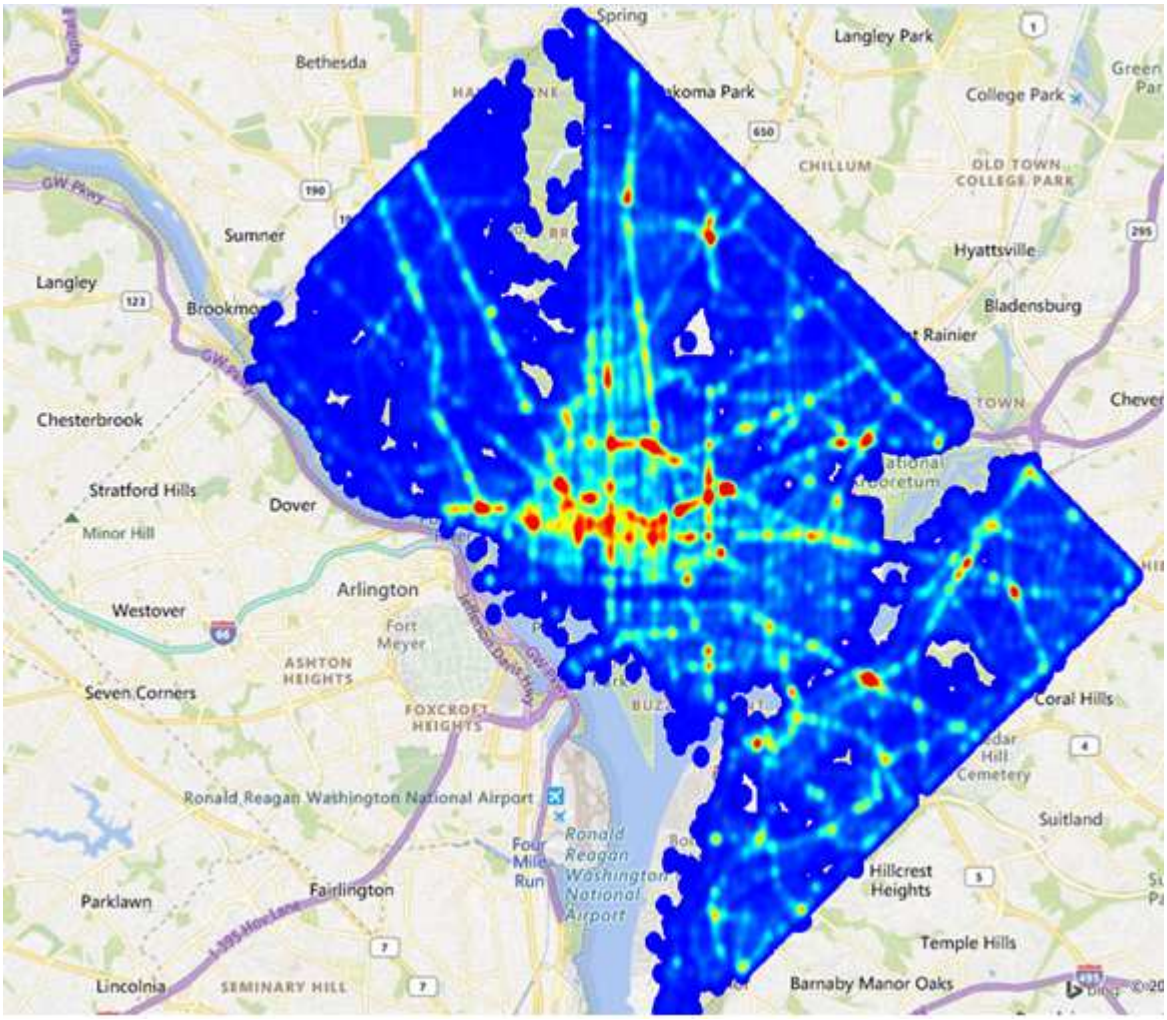

FIGURE 1. Heat map.

Use of Geographic Information Services for Rescue Operations

There are companies that use geoservices to help search and rescue coordinators determine which areas need to be surveyed in order to save people, how to register crew members location if they fell overboard, etc.

In the Russian Federation, some work is underway to create emergency agencies using a single number 112. These agencies are actively using geographic information services that provide mapping of the incident, the location of transport and operational services on area map.

Geographic information services provide the operator with a detailed area map, which displays buildings, roads, infrastructure facilities. Subscriber position is determined automatically. In case of emergency, for example, when hazardous substances are released into the atmosphere, the operator will be able to quickly find socially significant objects and plan measures to rescue people.

These services also allow to find the necessary background information, monitor vehicles and build optimal routes for the prompt arrival of rescuers in the affected area.

Geoservices for Public Utilities

Some of more common geoservice applications include local governments that help residents find nearby public services such as leisure facilities, schools, transportation, and processing. Spatial information increasingly connects consumers and businesses through location-based services, determined via a mobile device with maps and other data, to connect consumers to local services such as dentistry, hairdressers, cafes, etc. Spatial information serves as the basis for management and planning.

Geoservices in Construction and Archeology

In software field, the name geoservice is associated with two types: support for geographic information systems and the development of interfaces for working with spatial information. The latter category relates to the geoservice API, which provides developers with consistent and complete access to structured data. Using the geoservice interface, developers can query data using SQL-like statements for geospatial and temporal filters, performing aggregations, sorting, text search, and spatial projection. Geo services include the ability to ensure the security of private houses, apartments and garages, as well as surveys for site selection and construction of private and engineering structures.

Geo services also means archaeological research and excavation services. Archaeological Geoservice Companies bring together experts in the fields of geophysics, geometry and geoarchaeology to provide specialized materials and a wide range of services for clients' projects.

Geographic Information Service in Railway Transport

One of the main goals of creating geoservices for railway transport is to provide comprehensive spatially consistent information on all areas of its activity [12, 13].

Geographic information services should ensure the maintenance of a single, quickly updated database of geoinformation road data on all hierarchical electronic maps, plans and large-scale diagrams, as well as means of information exchange with other automated systems.

Geographic Information Service in Tourism

Tourism industry is currently a huge computerized business with the participation of the world's largest carriers, hotel chains and travel agencies. Thanks to information technology, modern travel services are becoming more unique and individual, the most attractive and affordable for most consumers. Tourism business, more than other industries, unites with information technology, which contains information about offered tours, tour operators, offers, living conditions, travel, recovery, etc. personal conditions and abilities of clients. The tourism industry is so diverse and vast that it requires the use of a wide variety of information technologies, from all known technologies for working with text, tables and databases to the use of special software products that automate the activities of each travel company or hotel.

The main essence of geographic information services is the ability to combine description data (primarily numeric and textual) with a specific location. Given this circumstance, we can conclude that for the tourism sector such technologies are not of secondary importance, but of primary importance.

Geographic information services are integrated into all car navigators, which help to find and navigate the shortest path to the trip destination, both in the city and throughout the country. Connecting traffic reporting services to a navigator service is becoming one of the main factors in the rapid growth of the car navigator market: it is the most productive way to speed up travel in today's city traffic jams.

The installation of navigation chips and multifunctional geoinformation services in mobile phones and gadgets, in addition to human convenience, also caused the formation of a huge sphere of promoting goods and services, adding points of interest to GIS. By using points of interest, you can very quickly find the nearest ATM, restaurant, gas station or supermarket in an unknown location.

DISCUSSION

As part of geographic information service study as a phenomenon, its impact was divided into three broad categories:

- direct effects from geographic information services - economic effect and added value, measured in accordance with the revenues received by the companies that develop and provide geographic information services;
- consumer effects - the benefits that consumers, businesses and government receive from geographic information services use, in cost excess that can be paid for any services;
- broader economic consequences - benefits that are enhanced by improving geographic information services in other economy sectors, through the creation of new products and services, creating savings that cannot be obtained by other sectors.

Geographic information services include providers of satellite imagery, digital maps, satellite positioning signals and navigation devices. The direct impact of geographic information services is related to the companies' economic presence directly involved in the creation of geo-information (for example, companies involved in the value chain, such as Google, Carifact and Garmin) and the value they create. These effects can be measured in various ways: by income received; by market capitalization; by gross value added (GVA).

Geographic information services have a wide range, which is reflected in the spheres of their use. All uses of geographic information services bring different benefits to consumers, and these benefits, in turn, are reflected in part in the revenues illustrated in the direct impact. Practice shows that consumers are ready to pay for geoservice services use. In addition, consumers benefit from services that are not recorded through income. This follows from the fact that many services are free at use time (for example, Google maps).

In the field of geoservices, a special type of service is distinguished, which is called geoinformation services. These services are provided via a computer or smartphone. Geographic information services are usually midline, meaning they usually have no value by itself, but help consumers engage in other activities and have an indirect impact, such as saving time in purchasing tickets or choosing a travel destination.

Geographic information services include savings in time and fuel through the use of more efficient navigation devices. Navigation devices reduce travel time and fuel consumption. They optimize routes, reduce the risk of being late and help avoid traffic jams.

CONCLUSION

The modern concept of geoservice includes many technologies that were previously disintegrated. The basis for integrating technologies into a single service and their overall integration became possible thanks to geoinformatics and spatial data structures development. Geodata is a specific structured framework and information resource. Geodata unite almost all types of data, which makes it possible to use geographic information services in any industry and direction. At the same time, this direction is developing in the applied aspect, and, so far, there is little scientific research in it. There is a complete analogy here with geoinformatics. Geoinformatics emerged as a purely technological science, but over time it began to rely on some theories and systems. Geoservice is also waiting for its theorizing and systematization.

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