The use of GIS technology in modern conditions

D V Andreev
Federal State Autonomous Educational Institution of Higher Education "M. K. Ammosov North-Eastern Federal University", 58 Belinsky str, Yakutsk, Republic of Sakha (Yakutia), 677027, Russia

E-mail: verviL@List.ru

Abstract: This article is devoted to the study of the use of GIS technologies in various fields of activity. GIS technology is a modern type of integrated system that meets the requirements. The article describes various classifications of geographic information systems. The main directions of the application of GIS technologies in today's conditions are formulated. Correct assessment of the situation and rapid response. Describes the history of the development of GIS technology since the late 50s of the last century. Public service, state security service, emergency services, medicine, ecology and nature management, education, business, as well as areas of activity in which it is necessary to carry out data analysis. The work focuses on a particular area, since in the Russian Federation at the moment there are serious problems in this area. The active use of GIS technologies in ecology and nature management allows you to quickly obtain information and predict the development of the situation. GIS technology is a progressive and convenient way to present data to consumers. At the moment, to explore the map of the area, the user does not need to purchase a disk in the store, just download the application on the phone.

1. Introduction
The GIS software product is a tool that allows users to generate interactive queries, explore spatial information, edit information on maps and present the results of all these operations. GIS should be attributed to a number of various technologies, processes and methods, used in science, technology and business: coordinate-time referencing of objects in geodesy, cartography, geology, seafaring, processing and aggregation of photographic images from space for scientific and military purposes, processing of geophysics and geodynamics data, application in the national economy (compiling urban, regional and federal land inventories) and others. For this reason, GIS is one of the most rapidly growing segments of the high computer technology market, which includes a huge number of the largest companies, among which it is necessary to notice the following: Autodesk, BentleySystems, ENVI ERDAS IMAGINE, Esri, Intergraph, MapInfo, Smallworld. The aim of the study is to determine the features of the application of GIS technologies in modern conditions of state development.

Research materials are scientific articles published in journals, publications, textbooks and electronic resources on the topic that is related to the study of GIS technologies. Research methods are: system analysis, synthesis, comparative analysis, analysis of geographic information systems and databases.
2. Research results and discussion

Today, geographic information systems distinguish: a) by territorial coverage: global, subcontinental, national, regional, subregional, local, or local. b) in the subject area of information modeling: urban (municipal), subsurface user, mining and geological, environmental (among them the special name, as especially widespread, received land information systems).

Also, geographic information systems can be classified according to problem orientation - solved scientific and applied problems. Such tasks may be an inventory of resources, analysis, evaluation, monitoring, management and planning, decision support, geo-marketing. They also distinguish between multiscale, or scale-independent geographic information systems, which are based on multiple, or multiscale representations of spatial objects. And spatio-temporal geographic information systems operating with spatio-temporal data [1].

Further, it should be noted in more detail to consider the main directions of the application of GIS technologies in modern conditions. At the moment, the problems associated with environmental protection are more acute than ever. Active population growth, lack of resources and other environmental problems form the prerequisites for the global environmental crisis. For a correct assessment of the environmental situation and quick response to it, an integrated approach is needed. The most correct tools for solving this problem are considered geographical information systems [2].

The history of GIS technology progress begins in the late 50s of the last century. However, in general, the idea of depicting data using different layers on a series of base maps and correlating objects spatially arose long before the advent of computers. The main contribution to the development of GIS for the period of the 50s – 60s contributed by the USA, Canada and Western Europe. Russia joined the procedure for the formation and progress of geographic information technologies only in the mid-1980s [3].

It should be determined that in the history of the development of GIS technologies, 4 periods can be distinguished (table 1).

| Table 1. - History of the development of GIS technology. |
|--------------------------------------------------------|
| **Formation period (late 1950s - early 1970s)** | Analysis of fundamental opportunities, frontier areas of knowledge and technology, accumulation of empirical experience, first major projects and theoretical works |
| **Period of government initiatives (early 1970s - early 1980s)** | Progress of large geoinformation projects supported by the state, creation of state institutes in the field of GIS technologies, reduction of the role and influence of specific researchers and small groups |
| **Period of commercial development (early 1980s - present)** | A wide market for various software tools, the development of desktop GIS, the expansion of their use through integration with non-spatial data bases, the emergence of network applications, the emergence of a significant number of non-professional users, systems that support individual data sets on individual computers, open the way for systems supporting corporate and distributed geodatabases |
| **User period (present - near future)** | Increased competition among commercial manufacturers of GIS technology services provides benefits to users of GIS technology, the availability and openness of software tools allows you to apply and even modify programs |
GIS is characterized by a huge variety of applications. The technology is used in such fields as industry, government, emergency services, medicine, ecology and environmental management, management, education, scientific research, business, that is, in all areas where data research is needed. Among the whole variety of GIS application areas, the environmental area is seriously distinguished [4].

Due to the ability of an integrated approach, modeling and forecasting, application in monitoring, planning of land management, cartography, GIS are indispensable for solving environmental and its management problems which are mostly in demand in this area. The use of GIS in ecology and nature management makes it possible to quickly obtain information upon request and display it on a cartographic basis, assess the state of ecosystems and predict their development [5].

Ecology and nature management are characterized by an integrated approach, the ability to model and predict the situation. To do this, it is important to apply the generalizing properties of the environment, but at the same time, the volumes of initial information are enormous. The problems that are associated with nature management and the environment require precise and prompt action, and the responsiveness directly depends on the processing and structuring of the necessary information [6].

This is the essence of an integrated approach, due to which it is possible to instantly assess the situation that has formed. For this, operational access to a huge amount of required information, its systematization based on needs, is important. This information can be obtained as a result of environmental monitoring. Environmental monitoring is a comprehensive system, assessing and forecasting changes in the state of the environment under the influence of natural and man-made factors [7]. During the monitoring period, data are collected and processed, it gives modeling and analysis of environmental processes and trends, also they are used for environmental protection [8].

GIS gives the ability to connect heterogeneous information with each other, to compare, research, select the most convenient and visual data visualization, for example, by forming on the basis of them the necessary maps, drawings, tables, charts, diagrams. It is possible to group the data depending on the needs of the nature user, to carry out their comparison and research [9].

In Russia, the most popular GIS applications are such GIS as ArcGIS, MapInfoProfessional, Quantum GIS, GlobalMapper, Intergraph.

With the development of geographic information technologies, ways of presenting these cards to consumers have also developed. Now, in order to see a map of the area, the user does not need to purchase a disk in the store, just download the application on the phone [10].

At the moment, a lot of convenient add-ons have appeared in GIS maps for gadgets that help the user quickly navigate the terrain. These add-ons may include voice search of streets and houses, search for directions, search for restaurants and shops nearby and much more that is considered necessary for each person.

Geographic information system (GIS) is designed to collect, store, process, display and disseminate spatially coordinated data, including spatial analysis, mapping and modeling, classification, assessment, regionalization, etc. [11]. GIS are widely used in various fields and areas of territorial activity: in cadasters (land, water, forest, real estate, etc.); in municipal administration; in the design, construction, operation of facilities; in geological exploration; in the development and operation of various fields; in agriculture, forestry and water management; in nature management and environmental monitoring, etc. [12].

At the current level of development, the role of GIS is not limited to the collection, storage and transmission of information. Modern GISs are becoming a tool for modeling natural, economic, social processes and situations, tracking their relationships, interactions, predicting development in space and time, obtaining new qualitative and quantitative information, and, most importantly - a means of providing (support) decision-making of a managerial nature and presenting conclusions.

GIS makes it possible to build thematic maps based on the created spatial databases that reflect the current state, study the dynamics of changes in space and time, stimulate the development of the situation, obtain complex estimates, construct various graphs, tables and diagrams. The use of GIS
makes it possible to reliably calculate the damage, because geographically attached information of various thematic layers is the basis for the calculation [13].

Having presented the history of the development of geographic information technologies and their classification, it is necessary to highlight several main advantages and disadvantages using the 2GIS application for phones as an example.

The advantages of this technology should be determined [14]:

a) the ability to change the scale at its discretion;
b) setting routes from point "A" to point "B";
c) receive through a map in real time numerous databases and information about organizations;
d) change the way objects are displayed (show all shops, cinemas);
e) make certain amendments (for example, add an object to your favorites);

However, it is worth determining that with a wide range of advantages, there is one serious drawback - the irrelevance of this information.

Studying this technology from an economic and practical point of view, it should be noted that this technology is used in almost all areas of human life. There are many examples of the successful implementation of GIS in the practice of state and municipal bodies, as well as in commercial organizations [15].

For example, GIS technologies are used in the military defense industry, since information on the spatial location of objects is used to make decisions at any level.

In addition, it is worth demonstrating that GIS technologies are also actively used in the field of forestry management.

Of course, geographic information technologies are necessary for humans, but they are very expensive. The installation of equipment and instruments for various equipment requires large financial costs, including the payment of qualified specialists for the installation, configuration and management of these systems. GIS technologies provide work with remote sensing data, which nowadays is one of the main sources of updating new spatial data in geographic information systems and in a wholegeography.

The above emphasizes the high educational potential of GIS technology. Creating methodological conditions for its implementation in the educational process allows us to talk about geoinformation education [16-17].

3. Conclusions

Summing up, it is necessary to say that with the development of information systems, GIS technology began to develop, due to which a person's convenient applications appeared to help people search for information and comfortable navigation [18]. GIS technologies allow efficient work with dynamic data on spatially distributed objects, complementing them with the ability to visualize, the ability to build models and solve problems of spatio-temporal analysis. As any IP that has the means of collecting and processing data, GIS makes it possible to accumulate and explore such information, quickly find and process the necessary geographic data and visualize them in a user-friendly form. The use of GIS technology greatly increases the efficiency and quality of work with spatially distributed data comparing to traditional “paper” cartographic methods [19].

From the regulatory point of view, it is necessary to notice that the state is as interested as possible in the development of geographic information systems, which is confirmed on September 1, 2015, by Russian Prime Minister Dmitry Medvedev. It was determined the action plan for 2015-2030 to implement “The State Policy Fundamentals in Using of the Results of Space Activities in the Interests of Modernizing the Economy of the Russian Federation and Development of Its Regions for the Period till 2030. ”

Comparing to the previous years, there are shifts in the formation of a national spatial data infrastructure, which is a geographically distributed structure for collecting, processing, storing and providing customers with spatial data from various departments, starting from the federal and regional levels and ending with the district and municipal levels. The use of GIS makes it possible to provide
 absolutes all services with an information base on an essentially new level and, on this basis, implement the solution of technical, technological, economic and a number of other tasks [20-21].

GIS technologies perfectly solve the needs of a large number of market sectors. They have often been used for a long time, but initially in data collection systems on the state of network objects, where they studied not only the networks themselves, but their interaction with the environment.

References
[1] Vakhrousheva M Yu 2005 Systems of modern information technologies in enterprises Proceedings of Bratsk State University 1 114-6
[2] Glebov M P et al 2013 Knowledge of the land as an integral element of the general culture Bulletin of the Irkutsk State Agricultural Academy 2(57-2) 83-8
[3] Vakhrousheva M Yu and Evdokimov I V 2014 Software development of analytical information systems Proceedings of Bratsk State University 1(1) 196-9
[4] Biryukov L E 2010 Fundamentals of planning and improvement of populated and industrial territories (M.: Higher School)
[5] Kapralov E G et al 2010 Geoinformatics (M.: Publishing Center "Academy")
[6] Pyankov S V and Kalinin V G 2010 The use of geographic information technologies in hydrological research (Perm)
[7] Buryak Zh A 2014 Improving approaches to assessing the erosion hazard of agricultural landscapes using GIS technologies Scientific reports of BelSU 23(194) 140-6
[8] Karpik A P 2014 Analysis of the state and problems of geoinformation support of territories Geodesyand aerialphotography 4 3-7
[9] Hiller B and Yambaev Kh K. 2016 Development and full-scale tests of an automated deformation monitoring system Bulletin of SSUGiT 133) 48–61
[10] Mazurov B T 2016 Geodynamic systems (kinematic and deformation models of block movements) Bulletin of SSUGiT 3(35) 5–15
[11] Vovk I G 2012 Mathematical modeling in applied geoinformatics Bulletin of SSGA 1(17) 94–103
[12] Vovk I G and Bugakova T Yu 2010 The theory of determining the technogenic geodynamic risk of the spatio-temporal state of technical systems GEO-Siberia-2010. VI International scientific Congr. (Novosibirsk, April 19–29, 2010) vol 1pp 21–4
[13] Vovk I G 2011 Modeling in applied geoinformatics Bulletin of SSGA 1(14) 69–75
[14] Vovk I G 2013 Modeling of the form and estimation of the size of systems in applied geoinformatics Bulletin of SSGA 2(22) 17–25
[15] Vovk I G 2012 Determination of geometric invariants of the surface in applied geoinformatics Bulletin of SSGA 4(20) 59–69
[16] Vovk I G 2012 System-target approach in applied geoinformatics Bulletin of SSGA 2(18) 115–24
[17] Bugakova T Yu 2011 On the risk assessment of geotechnical systems according to geodetic data GEO-Siberia-2011. VII International scientific Congr. (Novosibirsk, April 19–29, 2011) vol 1 pp 151–7
[18] Karpik A P 2012 Problems of geodetic support for monitoring territories Interregional interdisciplinary scientific conference "Analysis and Innovation at the Beginning of the XXI Century" (Novosibirsk: SSGA) pp 13–20
[19] Varfolomeev I V and Savelyev A S 2011 Representation and processing of spatial data in GIS: guidelines (Krasnoyarsk: KSTU)
[20] Serbulov Yu S et al 2017 Geographic information technology (Voronezh: Voronezh State University)
[21] Yakubaylik O E 2011 Methods and techniques of spatial analysis in geographic information systems (Krasnoyarsk: Publishing house of the Krasnoyarsk State University)