METHODS OF CREATION AND ORGANIZATION OF WORK, TECHNOLOGY FOR CREATING AUTO-NAVIGATION MAPS

Khazratov Fazliddin, Juraev Khusniddin

Lecturer of Department of Information Technology Bukhara State University
hazratovf@gmail.com
Doctor of Pedagogical Sciences, Associate Professor Dean of the Faculty of Physics and Mathematics Bukhara State University
Husni_1982@mail.ru

Abstract – Today, one of the most relevant areas of geographic information systems is the problem of creating auto navigation maps. This article describes in detail the methods for organizing the creation of auto-navigational charts, a detailed technology and the process of introducing them into navigational charts, which may be part of geographic information systems. The articles provide examples of creating and updating an international database using application programs.

Key words: Organization, databases, maps, electronic, auto navigation, geographic information systems, program, technology, cartography, identifier, structure.

I.Introduction

The organization of modern auto-navigation mapping is designed in such a way that a large number of participants are involved in the process of creating an electronic auto-navigation map in the production chain: these are manufacturers of cartographic databases, digital maps, software manufacturers, electronic maps. The creation of an electronic auto-navigation map begins with the compilation or acquisition of a cartographic database, from which later both general geographical and special elements — the road graph — are formed. In parallel with this, a thematic database is created or acquired that contains POI(Points of interest) objects. After the formation of all layers of the database, it is compiled into a derivative cartographic database.

II.Literature review

Geographic information. A significant proportion of the information a person deals with is spatial or geographical. Spatial information is transmitted mainly with the help of small-scale geographic and thematic maps and atlases, topographic maps, aerospace images, plans and diagrams, location addresses of objects, traffic routes and other information. However, the catch phrase "Map - alpha and omega of geography" is filled with new content in modern society. In addition to the traditional paper map, an electronic map breaks into a person's life, carrying a variety of geographical information. The geographical map is becoming dynamic, interactive. The map can be combined with a satellite image - with the image of the entire Earth or a single village, as they are visible from space. A satellite image reflects the real state of affairs at a certain point in time in a given area. In essence, in the modern period, a person studies, analyzes, and views the results of processing spatial data in geographic information systems. Geoinformation systems (GIS) and geoinformation technologies (GIS technologies) have received the widest application in the world today. GIS is actively used to solve scientific and practical problems at the local, regional, federal and global levels. GIS technologies are used to comprehensively study the natural and economic potential, expand them and bring them to a completely different, qualitatively new level. Instrumental capabilities of GIS include the simplest cartometric operations, including the calculation of distances between objects, areas of objects, and absolute heights; morphometric operations; overlay operations with revealing of interconnections between geographical objects and processes; spatial analysis; spatial modeling. GIS technologies provide visualization of source, derived or final data and processing results in the form of thematic geographical maps.

III.Analysis

Compilation is the most time-consuming process of creating a self-navigation map and consists in processing the source databases (cartographic, thematic) and in creating blocks of program code responsible for visualizing content elements and constructing routes. This process is necessary so that the navigation card can be used in car navigators and integrated into software. The complexity and complexity of compilation is due to the fact that for each large-scale level (10-15 levels) of the auto-navigation map, the selection of objects, the installation of styles of symbols and visualization parameters are necessary. It is also important to note that the compilation process is

usually performed by programmers who do not have cartographic preparation. At the last stage, the derivative cartographic database is integrated into specialized software and an electronic auto-navigation map is created. The general scheme for creating an electronic auto-navigation map is shown in Figure 1.
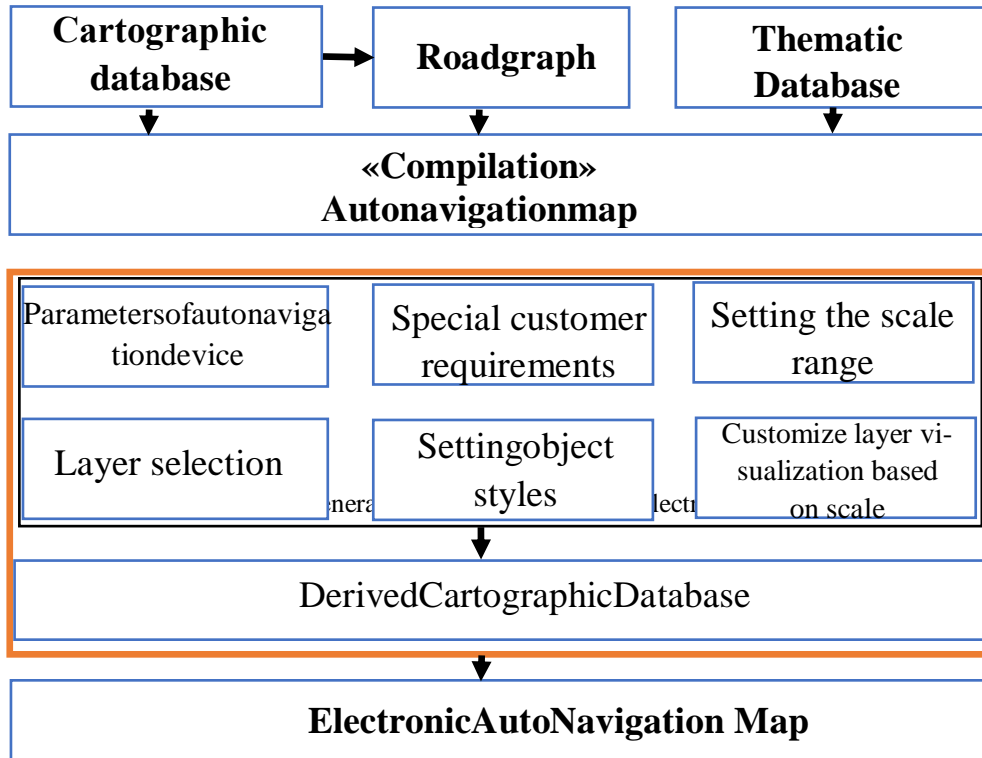
As a rule, in production, the processes of creating cartographic and thematic databases occur in parallel and can be included in one technological scheme for creating a digital auto-navigation map (Figure 2.).

The technology is used to create auto-navigation maps in various geographic information systems, for example, in ArcGIS, GIS MapInfo, GIS Map. To integrate the received card into specialized software, conversion to a custom format is used. The conversion format depends on the requirements of the manufacturer of the navigator softwar
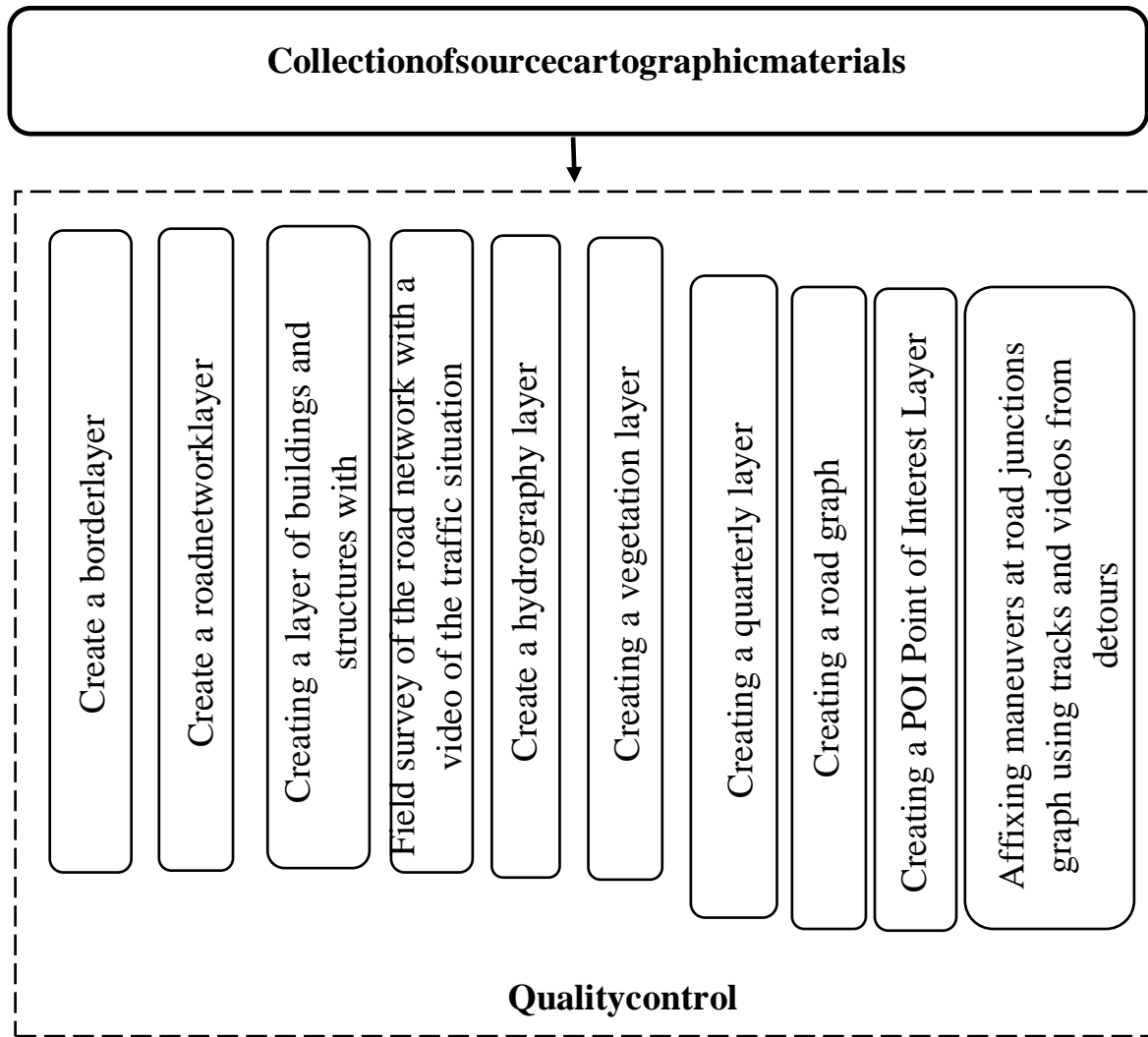
Figure 2. - The technology for creating digital auto-navigation maps.

Large companies, as a rule, have their own auto-navigation map formats. A variety of formats are being developed, both with a closed and an open process for creating and editing maps. Examples of internal formats are IMG (map format for Garmin navigators) and NM3 (map format for Navitel navigators). Often used is the GDF (Geographic Data Files) format, an exchange format for geographic data. Maps in GDF format are issued by many digital map providers, such as Navteq, TeleAtlas, Mapscape BV, GeoSmart.

Survey of the investigated auto-navigation maps

For the study and analysis of auto-navigation maps, the products of Avtosputnik, Navitel, and CityGid were selected from the entire variety of auto-navigation materials. The main requirements for maps were: completeness of content, relevance of information and the prevalence of the auto-navigation system among users. The following is a brief summary of each navigation map. The Avtosputnik company card first appeared in 2005 and in 2007 the entire territory of Uzbekistan was covered with cards. In 2008-2009, maps were added that cover in detail the entire territory of Uzbekistan, with a detailed display of large cities and settlements. Addresses are presented up to the number of the house, building, building, taking into account the regional specifics of the administrative division. The map contains information about the objects: road network, settlements, hydrography, green spaces, houses and buildings, industrial zones, point objects of transport infrastructure, attractions, etc. For each content element, a database structure is developed that is necessary for the correct use of the data. An example of the structure of the cartographic database "Autosatellite" data for the element "Settlements" is presented in table 1, for the element "Road network" - in table 2.

Field name	Data type	Description
1	2	3

ID	Decimal	Object Identifier
PARENT_ID	Decimal	Community Identifier item to parent
TYP_COD	Integer	Settlement Type Identifier
COUNTRY_ID	Integer	Country Identifier
REGION_ID	Integer	Region Identifier
DISTRICT_ID	Integer	District Identifier
CENTRE_ID	Integer	Identifier of the center of the region or center of the district
NAME_ru_RU	Symbolic	Name of settlement
AREA	Decimal	Area of the settlement
POP	Decimal	Population. In the absence of data is not filled

Table 1 - the structure of the database "Autosputnik" (Human Settlements)

Field name	**Data type**	**Description**
1	2	3
ID	Decimal	Unique identifier for a road edge
TYP_COD	Integer	Road type identifier
NAME	Symbolic	The name of the road that includes this rib
ROUTENUM	Symbolic	Nationalroadnumber
ROUTENUM_INT	Symbolic	Internationalroadnumber
COUNTRY_ID	Integer	Country Road Identifier
FEDERAL_ID	Integer	UzbekistanRoadIdentifier
REGION_ID	Integer	ID of the road to the region
CITY_ID	Decimal	Settlement ID
DISTANCE	Decimal	Rib length
SPEED	Decimal	EstimatedEdgeSpeed
SPEED_LIM	Decimal	Officialribspeedlimit
DIRECTION	Symbolic	Permitted direction of travel
CLASS	Integer	Category (class, level) of the road. Determines the importance of the road in terms of its role in shaping the road network.
FREEWA	Integer	Speedway sign without single level intersections
TUNNEL	Integer	A sign of the passage of a road over a bridge, in a tunnel or similar structure.
FERRY	Integer	The presence of a ferry

FERRY_TIME	Integer	Ferry Hours
COVER	Symbolic	Road surface
START_ID	Symbolic	The list of road network segments IDs (of the same table), which cannot be turned from the end of this segment. The end of the segment corresponds to the end of the polyline in the direction of digitization. ID values are listed throughcomma.
END_ID	Symbolic	The list of road network segments IDs (of the same table), which cannot be turned from the beginning of this segment. The beginning of the segment corresponds to the beginning of the polyline in the directiondigitization. ID values are separated by commas.

Table 2 - the structure of the database "Autosputnik" (Road network)

Analysis of the content of electronic auto-navigation maps

For the analysis, the following content elements were selected: road network, settlements, hydrography, borders. This choice is due to the fact that these elements make up the content of the digital cartographic basis. In addition, special content objects — POI objects — were analyzed.

The analysis was carried out in two stages: first, the composition of objects displayed at different scale levels was determined, and the features of the distribution of objects across layers were noted; Further, the density and graphic load of the elements of the general geographic basis were calculated and their dependence was studied with a change in scale. Then, a comparative analysis of the calculated indicators of the studied products was made.

IV.Discussion

Evaluation of the content of auto-navigation maps begins with the study of classifiers. Some programs have a special classifier file that contains a list of map layers, the order of their location and the scale on which they are displayed. The rest, as a rule, have instructions for distributing elements among layers with a detailed description of the names included in the layer of objects and their main characteristics. Using the classifier, you can study the hierarchy and structure of map symbols for subsequent visual analysis.

The next step in studying the composition of the auto-navigation map is to work with the program emulator. Emulator is a special program that allows you to simulate in a simplified form the navigation system on personal computers. As a rule, such programs exist in the form of a special application. They help to pre-evaluate the navigation map and are suitable for studying its cartometric properties. The emulator displays all the cartographic information in the form in which it is contained in the working navigation system.

In visual analysis, it is important to identify all levels of the scale series at which map elements are displayed. The result of the analysis is a table in which information is entered about all levels of the scale series, each name of the group of content elements, as well as information about at what level which elements are displayed.

Processing of Bukhara city map using SAS. Planeta. Release software

SAS. Planet is one of the programs that works with multi-function cards. We can easily download ready-made cards through this program. For example, we can load several maps, such as GoogleMap, Yandex map, Cosmosnimki, Geoportal, Yahoo and so on. You can save cards in different formats.

To create a map of Bukhara, we first run the program, and we need to connect to the Internet. First of all, we will download the map of Uzbekistan from the Google Map portal, this process is shown in Figure 3.
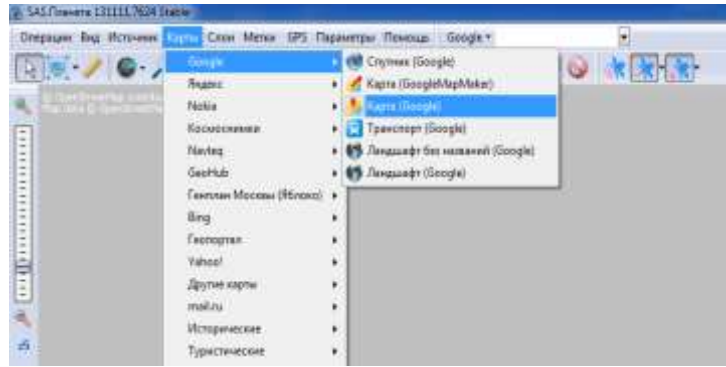
Figure – 3. Select a map using SAS.Planet.

To do this, first go to the program source menu and select the Internet part (Figure - 2).

Figure 2. Connecting SAS.Planet to the Internet.

After loading the map, we will search for a map of Uzbekistan. Then we select the map of Bukhara and save it as follows. Select and save the desired part of the map (Figure 4).
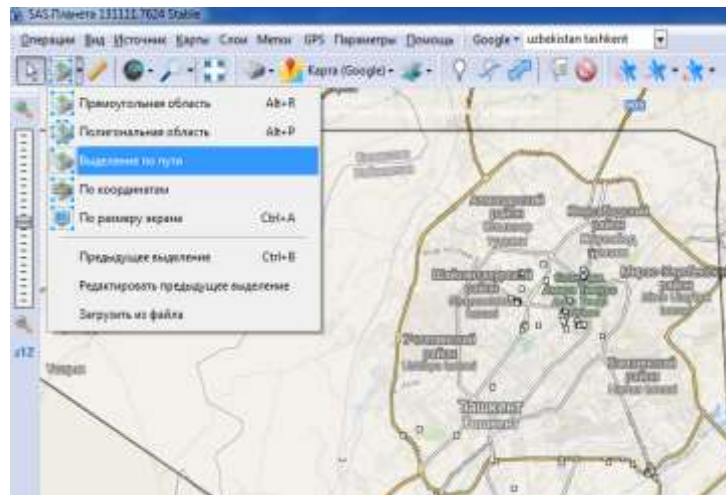

Figure 4 Select the desired part of the maps.

The next step is to save the selected part in the desired format and select the desired layers (Figure 5).
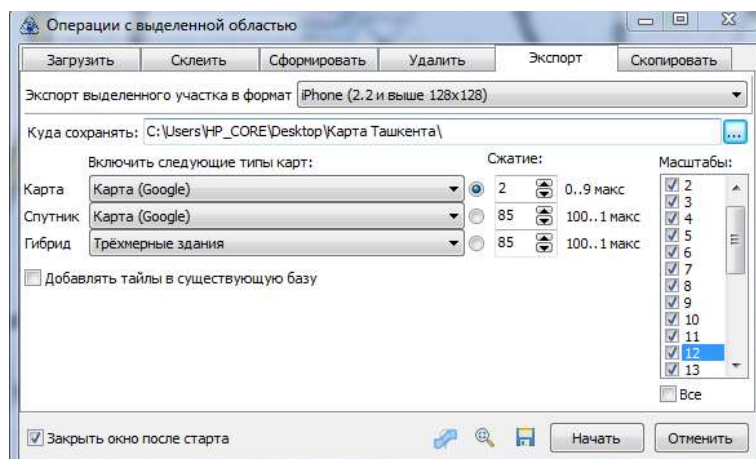
Figure – 5. Edit and save the selected part of the program.

It is also possible to save the data of the selected section through the program in the form of a database management system file.

V.Conclusion

The need to use GIS technologies in the system of domestic geographical education is obvious. It is also obvious that GIS must be considered as one of the important innovative resources for the further development of the system of national geographical education. However, to realize this potential, certain organizational decisions of the Ministry of Education and Science of the Republic of Uzbekistan are required to optimize the transition from the activities of individual enthusiastic teachers to the targeted implementation of GIS technologies in the educational process of universities and schools. A reasonable standardization of all activities in the field of GIS education is needed: from the training of geography teachers to the introduction of technologies in school geographical education. The priority area of activity in the field of GIS education should be the development of educational and methodological support, the development of the structure and content of training of specialists - geography teachers in the field of GIS technology. The development of the structure of educational and methodological support should take into account the achievements of leading domestic pedagogical universities. It is advisable, in our opinion, to determine the leading GIS technology software on a competitive basis with the participation of geographers, teachers of pedagogical universities and geography teachers.

Further training of teachers can be carried out via the Internet, with the placement on the website of teaching materials and methods of their use for school education. The availability of materials on the Internet will significantly expand the number of trained geography teachers, compared with the traditional method of advanced training.

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