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ADVANTAGES OF CREATING DEMOGRAPHIC ATLASES USING GEOINFORMATION SOFTWARE

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Abstracts. The modern mapping process has significantly increased the capabilities of advanced geoinformation technologies, which have significantly increased the capabilities of manual work. Electronic demographic mapping is increasingly relying on Geographic Information Systems (GIS) to accurately and realistically reflect reality. This article proposes a methodology for creating a demographic dashboard (control panel) based on ArcGIS Online, ArcGIS Pro and other programs. Such dashboards allow you to visualize and analyze the demographic location of a selected area using interactive maps, graphs and models. When creating population map atlases, it increases the efficiency of integrating data sets, forecasting and strategic planning. Recommendations are given for the development and use of demographic dashboards for the purpose of visualizing demographic data

Keywords: ArcGIS Online, ArcGIS Pro, web map, demography, panel monitoring.

Geoinformatsion dasturlar yordamida demografik atlaslar yaratishning afzalliklariga nazar

Annotatsiya. Zamonaviy kartografik jarayonlar ilg'or geografik axborot texnologiyalarining imkoniyatlarini sezilarli darajada kengaytirdi, bu esa o'z navbatida qo'l mehnati samaradorligini sezilarli darajada oshirdi. Elektron demografik xaritalash haqiqatni aniq va real aks ettirish uchun tobora ko'proq geografik axborot tizimlariga (GIS) tayanadi. Ushbu maqolada ArcGIS Online, ArcGIS Pro va boshqa dasturlardan foydalangan holda demografik boshqaruv panellarini yaratish metodologiyasi taklif qilinadi. Bunday boshqaruv panellari interaktiv xaritalar, grafiklar va modellar yordamida tanlangan hududning demografik holatini vizualizatsiya qilish va tahlil qilish imkonini beradi. Aholi atlaslarini yaratishda bu ma'lumotlar to'plamini integratsiyalash, prognozlash va strategik rejalashtirish samaradorligini oshiradi. Demografik ma'lumotlarni vizualizatsiya qilish uchun demografik boshqaruv panellarini ishlab chiqish va ulardan foydalanish bo'yicha tavsiyalar berilgan.

Kalit so'zlar: ArcGIS Online, ArcGIS Pro, veb-xaritalar, demografiya, boshqaruv paneli.

Обзор преимуществ создания демографических атласов с использованием геоинформационных программ

Аннотация. Современный картографический процесс значительно расширил возможности передовых геоинформационных технологий, что, в свою очередь, существенно повысило эффективность ручного труда.

Электронное демографическое картографирование все чаще опирается на географические информационные системы (ГИС) для точного и реалистичного отражения реальности. В данной статье предлагается методология создания демографической панели (панели управления) на основе ArcGIS Online, ArcGIS Pro и других программ. Такие панели позволяют визуализировать и анализировать демографическое положение выбранной территории с помощью интерактивных карт, графиков и моделей. При создании атласов населения это повышает эффективность интеграции наборов данных, прогнозирования и стратегического планирования. Даны рекомендации по разработке и использованию демографических панелей для визуализации демографических данных.

Ключевые слова: ArcGIS Online, ArcGIS Pro, веб-карты, демография, панель мониторинга**.**

Introduction. As the population changes in our country, there is a need to change and update demographic maps. Visualization of demographic maps is becoming one of the main criteria of modern cartography [1], [2], [3]. It allows researchers to obtain the necessary resources based on the analytical results of the necessary resources created by specialists and cartographers in determining the level of population growth. Demographic mapping uses GIS technologies to determine the geographical location of the territory and the dynamics of population change [4], and to visualize them based on analytical observations and analyzes. In our development of this area, we use the following practical technological approaches.

Geographic Information Systems (GIS): This demographic atlas creation system provides information on the visualization of population growth dynamics and graphical representations based on analytical results using user-friendly interfaces.

Real-time monitoring: Integrating data obtained using GIS technologies with other indicators in real time allows for the assessment of change indicators, visualization over a wide area, and analytically effective decision-making [5], [6].

Demographic dashboards: A comprehensive application that processes demographic data using charts, graphs, plots, and interactive maps, and visualizes them using analytical results. The application provides information on several population change indicators, such as population density, sex composition, race, growth rate, age, population migration, and education level [7], [8].

Mobile applications: Mobile geographic information systems expand the possibilities of using them in creating demographic atlases by transmitting the collected data directly to the territory. This application is of great importance for scientific researchers, for obtaining statistical information, and for employees working in government organizations to obtain information about the population, and to conduct planned and operational activities based on the information obtained [9], [10], [11].

Demographic dashboards serve as robust systems for visualizing important data when creating population atlases. Demographic dashboards can provide comprehensive information about the population using visualization tools such as 2D, 3D, and even multi-dimensional graphical images (photos) (e.g., 4D, 5D, 7D). Based on geoinformation technologies, by integrating interactive maps and dashboards, researchers can model socio-economic processes, analyze population atlases, and assess the territory on the ground. Demographic dashboards are an indispensable tool for simplifying data assessment and visualization, and for identifying demographic growth trends, identifying emerging problems, and identifying solutions to eliminate them. In developing a population atlas, recommendations are given for creating demographic dashboards based on ArcGIS Pro and ArcGIS Online and for visualizing complex demographic data [12], [13].

The creation of demographic maps using GIS technologies has developed significantly. Modern digital cartographic methods are no longer performed only in the old traditional way (manually), but are based on advanced technologies, namely visualization and GIS platforms. Methods for developing demographic dashboards using ArcGIS Pro and ArcGIS Online software are presented, focusing on visualizing population-related data using interactive maps, diagrams, density

maps, and infographics. These tools allow researchers to usefully assess population growth trends and sustainably improve predictive modeling by location [14].

The creation of a population map atlas uses contextual data sources obtained using remote sensing images and space satellites. When creating an information panel, attribute data of the population is created, as a result of which we have the opportunity to see population growth indicators by layers. By integrating the resulting layers, researchers will be able to analyze various geographical changes and population growth processes [14]. **2 Methods.** The demographic dashboard allows you to visualize population data on interactive maps. These maps allow you to dynamically change the viewing angle, while also providing a full view of real-time data. They clearly illustrate the locational density and intensity of demographic changes in the study area. The demographic map uses color gradients to represent data concentration, making it easier to find hotspots and clusters.The dashboard summarizes key data and provides concise, visual infographics based on population-specific data. The dashboard uses the ability to dynamically filter and select demographic data using specified criteria or parameters. Researchers can create custom population segments by changing menu settings to group the population into specific groups. This segmentation helps to gain a deeper understanding of the population and facilitates the analysis of various necessary elementary areas. Changes made to the population maps visualized with the help of the software are automatically reflected in the necessary diagrams and graphs. The Dashboard application offers functions for adjusting colors, cartographic symbols and legends, increasing visual efficiency. It allows you to improve the quality and readability of population data visualization.

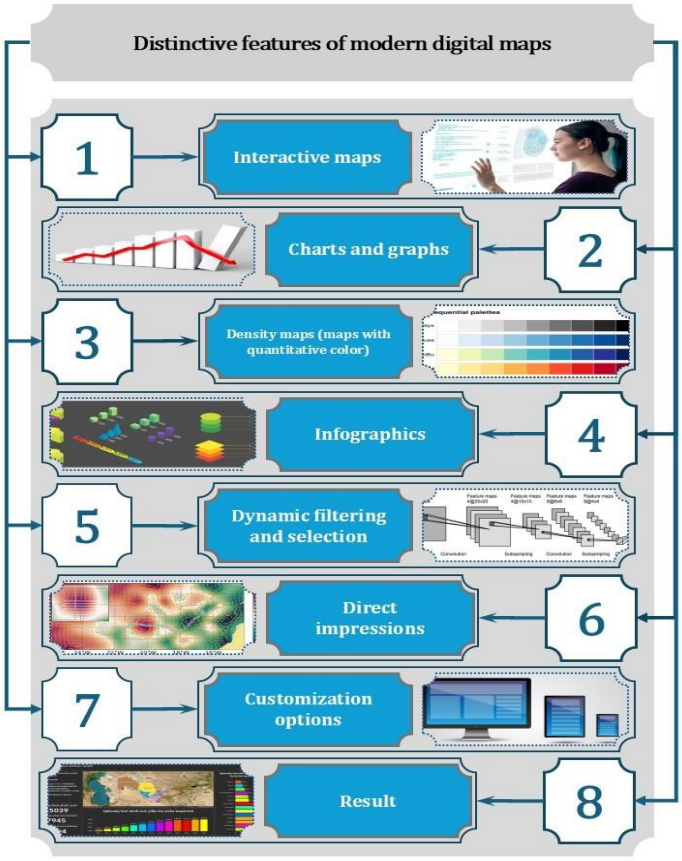

Figure 1. Distinctive features of modern digital maps.

The demographic dashboard provides insight into the dynamic changes in population data. It provides a number of actions, such as interacting with the map, evaluating the work done, and reviewing the data.

3 Results and Discussion: The introduction of geoinformation technologies in cartography has enabled technological advances to digitize the creation of demographic maps. Using advanced technological tools and methodologies in the creation of demographic maps provides greater accuracy

and convenience. The integration of advanced software platforms in GIS has allowed specialists to simplify the stages from collecting relevant data to publishing maps.

There are several platforms for the creation of demographic maps, with the emergence of web-based platforms such as OpenStreetMap, Wikimapia, and Yandex People Map, which allow researchers to become more interested in and interact with digital maps. This crowdsourcing model ensures that maps reflect real-world dynamics. This approach has usefully bridged the gap between professional cartographers and the development of mapping.

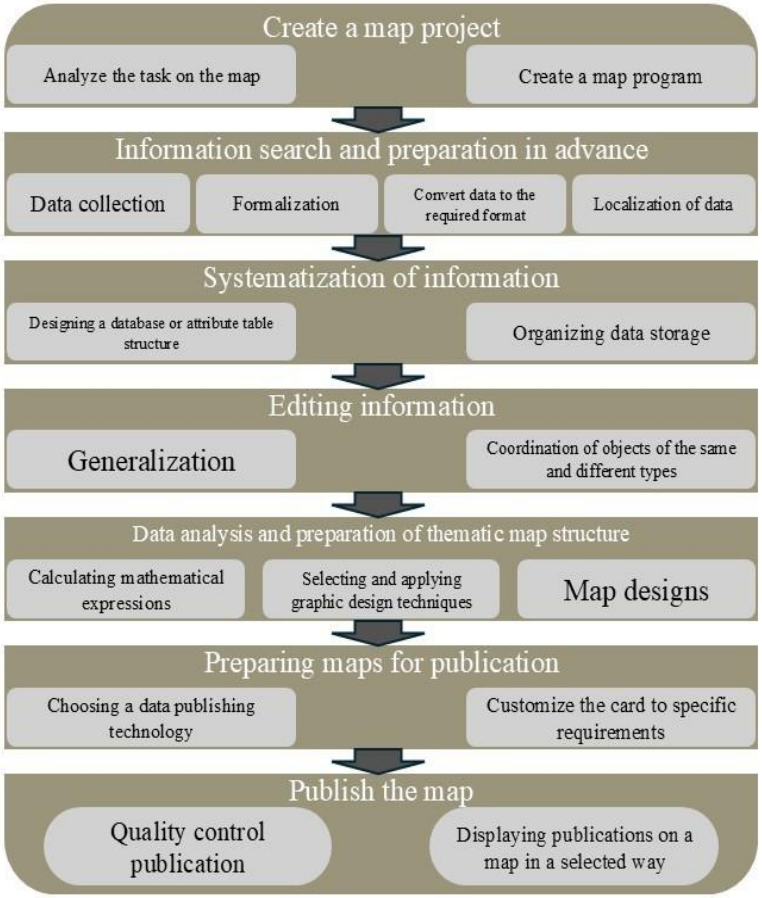

Figure 2. Methodological flowchart of the map creation

The traditional scanning process has been largely replaced by an automated stage of manual digitization. The use of digitized and georeferenced map data is a priority, saving time and labor. The transition to digital data collection methods, combined with the expansion of web-based statistical portals, ensures the integration of population-related resources into mapping projects.

Conclusion/Recommendations. The process of creating a population map based on modern technologies involves six stages: design, data preparation, systematization, editing, analysis, and publication. This structure ensures that each map meets certain technical and thematic requirements, as well as ensuring semantic accuracy of the location. When based on digital platforms, data confidentiality and the need for constant software updates pose challenges. In addition, the transition to electronic digital cartography requires high skills in cartographic design work in geographic information system programs.

Electronic mapping is also creating opportunities for other professionals in other fields, such as urban planning, emergency management, and public administration systems. The possibilities for visualizing demographic trends in cartography and creating web maps are increasing. Therefore, continuous improvement of training programs and software systems is important for the development of digital cartography.

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