

КАРТОГРАФІЯ І АЕРОФОТОЗНІМАННЯ

CARTOGRAPHY AND AERIAL PHOTOGRAPHY

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INTERACTIVE CARTOGRAPHIC WEB APPLICATION “SITES OF COMMEMORATION OF THE UKRAINIAN REVOLUTION 1917–1921”

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The aim. The aim of this research is a conceptual approach processing and elaboration of methodological designing principles of the interactive web application “Sites of commemoration of the Ukrainian revolution 1917–1921”, its structure and content; and the processing of a project implementation technical plan. **Methods and results of work.** The Ukrainian revolution 1917–1921 was a significant step in the history of Ukrainian state formation. An effective way to inform the society about these events is publishing and spreading through the Internet of the interactive cartographic web application, developed by means of Geographic Information System technologies. The principles of organization of the information about the sites of commemoration of the Ukrainian revolution have been processed and data distribution in two levels has been suggested: time-based (three forms of state government are established in chronological order) and event-based (within these forms of state government). Geological Information System is considered not only as a set of geoprocessing and geodata management tools, but also as a method of communication and information delivery to users through the Internet. The ESRI Inc software product line has been used in the development of the interactive web application. The works on creation of a source geodatabase, basic and thematic maps development and editing, have been carried out in the ArcGIS for Desktop software environment. The initial preparation of the map web-layers (styles, signatures and display scales setting) and web-layers publishing are performed in ArcGis Pro. The ArcGIS Online cloud service and the ArcGIS Online site designer have been used at the final stage of the cartographic web application development. The requirements to the specialized online-product have been defined and the advantages of web-mapping technologies usage have been justified. The development of such a product is performed by creating of an interactive cartographic web application (Web-App) on the ArcGIS Online platform. Web-App is complemented with and connected to the media-content (photos, illustrations, videos, texts). The Web-App’s functionality is ensured by usage of customizable widgets that not only provide the web-map interactivity (timeline map, pop-up windows) but also give the possibility of map analysis (advanced search by the map objects, finding of objects within a given radius). The collection of data on commemoration sites can be distributed among different state academic institutions. The database development is recommended to execute in digital tables MS Excel or Google tables / Forms which can be exported into attributive tables of spatial data classes in GIS. All the received information is processed and organized into the file geodatabase, consisting of the sets of object classes, for the purpose of holistic preservation and effective commemoration of sites’ data management. The sets of object classes are created in the WGS 1984 Web Mercator (Auxiliary Sphere) coordinate system, which is used while creating web maps and web applications. Two databases are used for base mapping in the project: with a basic scale of 1:100 000 for the territory of Ukraine and a basic scale of 1:10 000 for large cities. A demo version of the mapping interactive web application “Sites of commemoration of the Ukrainian revolution 1917–1921” for Kyiv city has been developed as an example of implementation of the processed conception. **Scientific novelty and practical significance.** For the first time in Ukraine the development conception of the interactive web map “Sites of commemoration of the Ukrainian revolution 1917–1921” which is based on modern geoinformation mapping methods, has been processed in order to restore and preserve the nation’s memory. Methodological principles of the interactive cartographic web application, its structure, and content development have been elaborated.

Key words: geological information systems, interactive web-application, web-mapping, sites of commemoration, Ukrainian revolution, ArcGIS Online.

Introduction

Ukrainian institute of the nation’s memory is implementing a project “Sites of commemoration of the Ukrainian revolution 1917–1921” [Pro zat-

verdzhennia ..., 2016] in order to inform society about the events of the Ukrainian revolution which became a significant step in the history of Ukrainian state formation. The project is designed to raise

public awareness of the little-known chapters in the Ukrainian history during this period and to perform educational activities. Accumulation of a considerable amount of spatial information and various materials is expected. Therefore, the necessity of a correspondent geological information system development became apparent to organize and preserve the collected materials. The task was to create an information product which would be based on such a GIS and would be accessible for people through the Internet in order to share information.

American Panorama – Atlas of United States History [Heppler, 2017], where the most recent research and innovative methods of interactive mapping are combined, is a striking example of an interactive presentation of history maps on the Internet. The “Atlas of the Historical Geography of the United States” [Paullin, 2013] constitutes another example of an interactive historical e-atlas, which is a new understanding of old maps. Analogue maps have been attached and animated maps and clickable maps have been added. The digital Atlas of Ukraine program is undertaken by the Ukrainian Research Institute at Harvard University together with partners in Ukraine. Digital Atlas is based on the use of GIS (ArcGIS Online) for illustrating and explaining economic, historical, political, and social transformations that occurred in Ukraine, using spatial and temporal analysis [The MAPA]. Several resources with interactive historical maps showing changes of time-borders are also available on the Internet, for instance the European History Interactive Map [European History], and TimeMaps History Atlas [TimeMaps].

Aim

The aim of this research is a conceptual approach processing and elaboration of methodological designing principles of the interactive web application “Sites of commemoration of the Ukrainian revolution 1917–1921”, its structure and content; and the processing of a project implementation technical plan.

The main objective consists in providing of an overview of the events taking place in the territory of Ukraine during the Ukrainian revolution 1917–1921 to the society. **The object of study** and representation within the project is the sites of commemoration of the Ukrainian revolution, particularly:

- location of buildings of the public authorities of the Ukrainian states, Ukrainian revolutionary formations representative offices of political and public association;
- locations, related to the events of the Revolution, such as, places of battles, meetings, demonstrations, or other important events;
- houses where the icons of the Ukrainian revolution were born, lived, or conducted activities;
- places of burial of the icons of the Revolution, to include officers and soldiers of Ukrainian national military formations.

Methodology and results of work

Methodological principles. The implementation of project “Sites of commemoration of the Ukrainian revolution 1917–1921” is based on the following *principles*:

- **Ukrainian centricity** – Ukrainian vision and interpretation of events in the foreground.
- **Territorial levels of geodata collection, generalization and visualization**:
 - *global* – events in other countries around the world which concern the events of Ukrainian revolution, develop understanding of the world, particularly the European context of events in Ukraine, among users;
 - *state* – a generalized representation of the sites of commemoration at the republican level; the data collection should also include ethnic Ukrainian territories that constitute today a part of other states;
 - *regional* – district, region;
 - *local* – population centers;
 - *big cities*, it would be reasonable to differentiate them as the crossroads between regional and local territorial levels, where the events were significant – Kyiv, Dnipro, Odessa, Lviv;
- **spatial reference of the sites of commemoration** – they should have a clear localization with a certain physical location reference. In case of population centers – an address reference is optimal;
- **validity** – the presented information should be valid and its verification should be ensured.

The accumulation of a significant amount of information, spatial information on the sites of commemoration of the Ukrainian revolution, as well as various materials describing and characterizing some sites, is expected following the

results of this scientific research. There appears a necessity to organize and store the collected materials, and to develop their administration and information dissemination to general public. The development of Geographic Information System (GIS) which serves as a basis for publishing of the cartographic application on the Internet designed on the principles of web-mapping is an obvious solution for processing and organizing of special data. Methodological principles of an interactive cartographic web application, its structure and content development are tested within Kyiv city by the web application demo version development.

Geoinformation systems usage is a common practice today, which simplifies the development of cartographic materials, particularly thematic maps [Geographie, 2006], geodata integration in other types of activity, and the visualization and dissemination of results. GIS usage continues to spread in different fields of scientific research, in historical science in particular [Gregory, Kemp, Mostern, 2010; Gregory, Healey, 2016]. GIS-technologies ensure processing, analysis, and administration of a wealth of baseline information, ensure presentation and dissemination of results by final map printing, and by online resources; ensure access to geographical data, its usage and correlation with personal data for other users. Taking into account the objectives of the project, “geological information system” is to be understood as a tool (specialized software) to accomplish the objectives of the project, and a geological information product as a user-oriented means of communication and information dissemination for users [Burrough, McDonnell, Lloyd, Christopher, 2015].

Technical structure, types of data, functional possibilities and peculiarities of geological information systems are considered in detail and presented in foreign and national professional literature. [Rudenko, 2011 2011; Samoilenko, 2003; Bill 2016; Burrough, McDonnell, Lloyd, Christopher, 2015; DeMers, 2008; Longley, Goodchild, Maguire, Rhind, 2015; Tomlinson, 2013 and others].

Software used in work is a ESRI Inc. company software product line – ArcGIS for Desktop, ArcGIS Pro, ArcGIS Online i WebApp Builder for ArcGIS (www.esri.com).

Process steps of geoinformation system development and web application publishing are the following:

1) Sites of commemoration geodatabase formation include primary data collection about the

sites of commemoration and formation of a geodatabase.

There are principles of formation and organization of the primary geodatabase in GIS “Sites of commemoration of the Ukrainian revolution 1917–1921”. Sites of commemoration constitute the main content for the web application design. The main form of geodata presentation is points on the map that indicate specific sites of commemoration. Cartographic representation of all the sites of commemoration mentioned above will give the opportunity to provide an overview of the events of the Ukrainian revolution that affected the whole territory of the present-day Ukraine and its ethnical lands, which are parts of other countries today.

A relatively short period of time – 1917-1921 – is rich in diverse events. That is why in order to present data in a logical and coherent way the sites of commemoration of the Ukrainian revolution are organized in two levels with the following dissemination of data:

I Upper Level– based on time periods, when power in the country belonged to different political forces:

- Central Council of Ukraine – March 1917 – April 1918;
- Hetmanate (The Ukrainian State of Pavlo Skoropadskyi) – May – December 1918;
- The Directorate of Ukraine – November 1918 – 1921.

II Lower Level– thematic dissemination of data within the forms of state into the following categories:

- State building;
- Social and political life;
- Military actions;
- Interventions;
- Diplomacy;
- Culture;
- Commemoration.

Sites, marked on the map should be confirmed with different additional cartographic materials, documents, illustrated by photos, videos, and infographics, and explained in the accompanying text. In general, all the data in GIS which constitutes the content in the cartographic web application “Sites of commemoration of the Ukrainian revolution 1917–1921” can be divided into either cartographic or media, depending on the presentation form.

Cartographic materials which are the main components of web maps:

- Sites of commemoration, classified according to the aforementioned principle.

- Additional thematic layers that may show the related events, phenomena, facts; different ways of map use.

- Basic maps based on vector data; basic maps that are the background for sites of commemoration presentation depict the current state of the area and serve for spatial orientation. Basic maps should contain such elements as administrative borders, population centers, main roads, hydrographic network, and forest areas. Historic maps that present the context and the terrain state during the events of the Ukrainian revolution are also used as basic ones.

Cartographic materials are organized in the file geodatabase for the purpose of holistic storage and management. The data is distributed into thematic sets of spatial object classes in WGS 1984 Web Mercator (Auxiliary Sphere) coordinate system (used in ArcGIS Online to display web maps).

Media support of the points on the map specify and explicate in details the context of events and demonstrates the image of historical figures. Media-content refers to all the illustrative and text

materials that go along with and characterize the sites of commemoration and provide more detailed information on a particular place. These include photos, infographics of any type, and video sequences. Such materials can be prepared and optimized for inclusion into the mapping application. Texts and media can be complementary to the general content as a reference material without being directly related to the map itself. However, the priority is the reference of a media to a particular location so that the site of commemoration could be characterized in detail. Therefore, a data collection form and the appropriate attributes table structure (Table 1) are developed for the “Sites of commemoration” spatial data class (Feature classes).

The data included into the attributes table serves to display a standard set of features in the pop-up windows and to set the widgets of the web-application. The textual information is written down into the table, and URL-addresses of the resources with the media-files (photos, images) displayed are written down. The event dates are also recorded in the «date» format to create a TimeLine Map.

Table 1

Attributes table structure of the “Sites of commemoration” spatial data classes

Field name	Field description	Type of date
OBJECTID	OBJECTID (command window)	Object ID
Shape	Shape(command window)	Geometry
Id	Id (command window)	Long
F_0	Period of the Ukrainian revolution (I Level)	Text
F1	Paragraph, according to thematic distribution of the Sites of commemoration (II Level)	Text
F1_1	Event filter/ Institutions	Text
INDEX	Site of commemoration identifier	Double
ID_TAB	Index for the source Excel table data reference	Double
F1_101	Site of commemoration name	Text
F1_102	Site of commemoration description	Text
LINK	Reference to the Internet article about the site of commemoration	Text
F1_1041	Data (new style)	Text
F1_1042	Data (old style)	Text
F1_105	People, complicit in the event, administrators, officers and others	Text
F1_1061	Address (current name)	Text
F1_1062	Address (former name)	Text
F1_1063	Information about the building	Text
f1ink1	URL-references to media-file for the illustration display in the pop-up windows of the web application (1)	Text
f1ink2	URL-reference to the media-file (2)	Text
f1ink3	URL- reference to the media-file (3)	Text
Start	Start date of the event	Date
End	End date of the event	Date

2) Cartographic materials preparation. The step consists in the display style setting for the sites of commemoration map layers and the basic map, and their publication as web-layers (Web Layer) on ArcGIS Online. Style design and publication are made in ArcGIS Pro. Map legend – markers and their shape, signatures, minimal and maximal visible scale, transparency – are arranged for the sites of commemoration.

The next step is a publication of new map layers as web-layers by means of the geoprocessing tool in ArcGIS Pro (Fig. 1, a). Web map in ArcGIS is an interactive display of geological information, consisting of web layers. The web map can be designed using the existent web layers or personal data layers (web layers will be published together with the web map). Publication format is vector layers that support requests to the objects, visualization, and editing. The layers' extent, order and visibility, style and pop-up windows setting should be preserved at the source map while publishing the web layers. However, there is a number of restrictions. Layers composed of several ones are not supported, and there are restrictions in usage of the map legend (dashed lines cannot be displayed). In order to avoid mistakes, it is preferable to use the "Analyse" option before the publication so that the program could detect inconsistencies and suggest the methods of their solution (Fig. 1, b).

Basic maps. An own cartographic basis – basic map – is used for development of the interactive cartographic web application "Sites of commemoration of the Ukrainian revolution". Its purpose is to provide guidance for the user at each location, it is the basis for thematic spatial data. Two source databases: more detailed for large cities (basic scale of 1:10 000), and more generalized for other territories (basic scale of 1:100 000), are used during the project development. Such elements as population centers, neighbourhoods, buildings, main roads, driveways in population centers, railway stations, landscape elements (hydrography, woodlands) are presented on the map. The maps content is saved at all scale levels, but image generalization/detailing while changing the map scale is achieved by setting the map styles for the map legend and display scales (See Fig. 2).

Development and setting of basic maps is executed in the following programs:

1. ArcGIS for Desktop: editing and correction of the vector data and database, mapping setup, map project setting and saving in .mxd).

2. ArcGIS Pro: import in the project, refinement of the range of the symbols and inscription display scales, the symbols drawing level refinement. The scale line adopted in web maps ArcGIS Online is used in this map. The configured map is saved as a vector sheets or vector files package in .vtpk format using the «Create Vector Tile Package» geoprocessing instrument. The advantages of this format are: small file size and fast contour drawing while using in web maps. It's the optimal format for the basic map publication on ArcGIS Online and using in web maps and web applications.

There exist additional basic and historic maps that were made during the Ukrainian revolution. The purpose of their inclusion to the web application is the reference to the past events for the maps of that time display the location, the population centers and, especially, streets names applicable at the time of events. The following materials are used as basic historical maps (See Fig. 3):

3) Interactive cartographic web application development. Another important objective of the project is dissemination of the information about the sites of commemoration of the Ukrainian revolution for general public in Ukraine and beyond. The most effective method of information dissemination is the Internet which is the main basis for designing, spreading, and viewing different information. Geographic Information System with the possibility of mapping in the Internet (web mapping tools) – is the software aimed to build geologically coordinated data in the network [Bondarenko, 2005]. These also include web services that give the possibility to view, edit, and create new geological spatial data. The choice of a certain software product depends on requirements to such a mapping service and is limited to resources available for developers.

For the geological information online product in the "Sites of commemoration of the Ukrainian revolution 1917-1921" project the following requirements are defined:

- interactivity
- possibility of place/object/person search
- multi immensity
- ease-of-use
- data safety
- optimal development costs.

The objective regarding the mentioned requirements is completed through *the interactive cartographic web application* (Web-App) development at the ArcGIS Online platform.

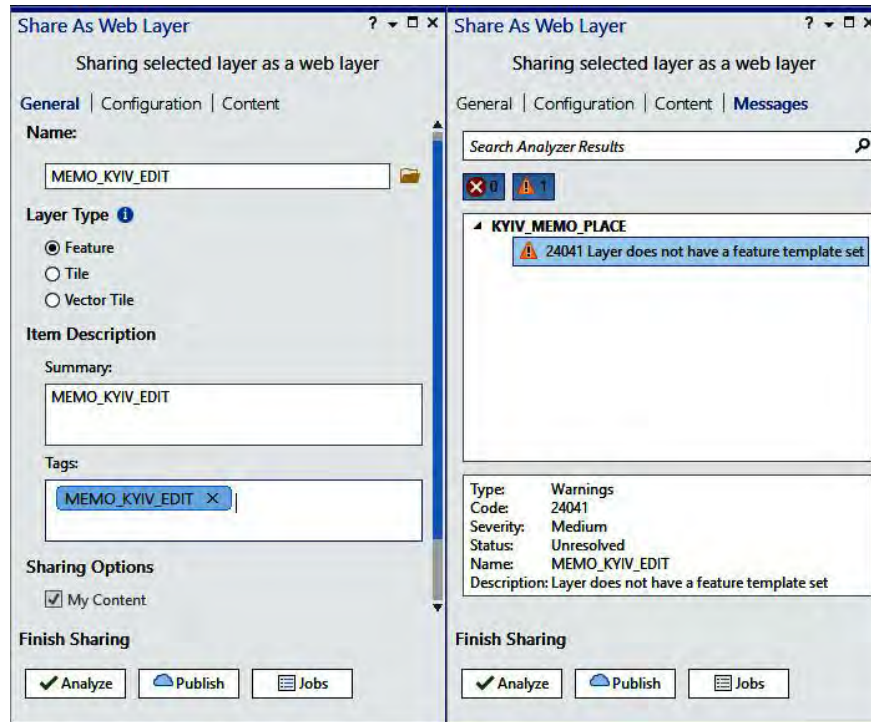


Fig. 1. Dialog box of the geoprocessing tool “Share As Web Layer” for a web layer publication in ArcGISPro (a – publication options setting; b – error analysis)



Fig. 2. Generalization/detailing of a basic map while changing the scale (a – 1:18000 scale; b – 1:144 000 scale)



Fig. 3. Basic historical maps

(a – Map named «KYIV AND THE SUBURBS», 1:21 000 scale. Edition of the Mapping Department of the Main Geodetic Administration, Kyiv, 1918; b – KIJEV, 1:20 000 scale. Bearbeitet v. Vermess. Abb.16, Heeresgr. Eichhorn, Juli 1918; c – Kyiv city plan, 1:2100 scale. Image of the District facilities committee of Kyiv, Kyiv city 1923–1931)

The web application development does not require the programmer’s work. Herewith once the program code is open, it can be refined and placed on the own resources. There is no need to buy valuable software and server equipment: all the geological data and other materials are placed and processed on the secure servers of the ESRI cloud services and the users will have access to them any time (if they have access to the Internet). No special software is required to view the cartographic web

applications as they are supported by the all most common Internet browsers (Chrome, Mozilla, Opera, Safari and others).

The Web AppBuilder for ArcGIS online-builder, which is the ArcGIS Online platform component, is used to design the demo version of the cartographic application for Kyiv city. The builder gives the possibility to create a web application without writing a code, but the usage of their own settings and options selection is necessary. The

main prerequisite for correct functioning of the web application is the proper source geodata preparation, appropriate web-layers and web-map setup, and the media files preparation.

Web AppBuilder gives the possibility for the following settings:

- The application of theme, style, and layout choice;
- Extent and visible map scales setting, editing of the web-map itself, and the web-layers in it is available in the builder;
- Adding and customizing widgets, that are displayed in the main panel and in the map window; customizable widgets (tools for interacting with the web-map), that not only ensure the web-map interactivity (scale management, timeline map (TimeLine Map), pop-up windows, thematic map-layers management etc.), but provide the possibility of map analysis (advanced search by the map objects, filter usage).
- Writing the application attributes, add logos and references to the related web pages;
- Setting up the social media channels;
- Web application display testing on mobile devices that are the most common smartphone and

tablet models. This is an important option because the interface can change depending on the device, which is used for the view. See Fig. 4.

In figure 4 are indicated:

1. The web map window;
2. Map scale management: zoom in or out the map scale; return to the original extent of the map;
3. Search window. Search of the sites of commemoration by keywords – you can type the keyword and the places related to the search request will appear in the dropdown list. Search by address – it is better to type the text in the “city, street, number of the building” format to obtain the correct results;
4. Additional data on the sites of commemoration in the pop-up windows that open when you click on the map symbol or when you pass to the object from the search window. A structured description of the location is provided according to the attributes table, including the images that are displayed through the URL-links;
5. Legend – sites of commemoration symbols. Turning on and off of the map layers display: choosing of all or particular layers is possible;
6. Basic map replacement (base-map). A modern basic map is displayed by default.

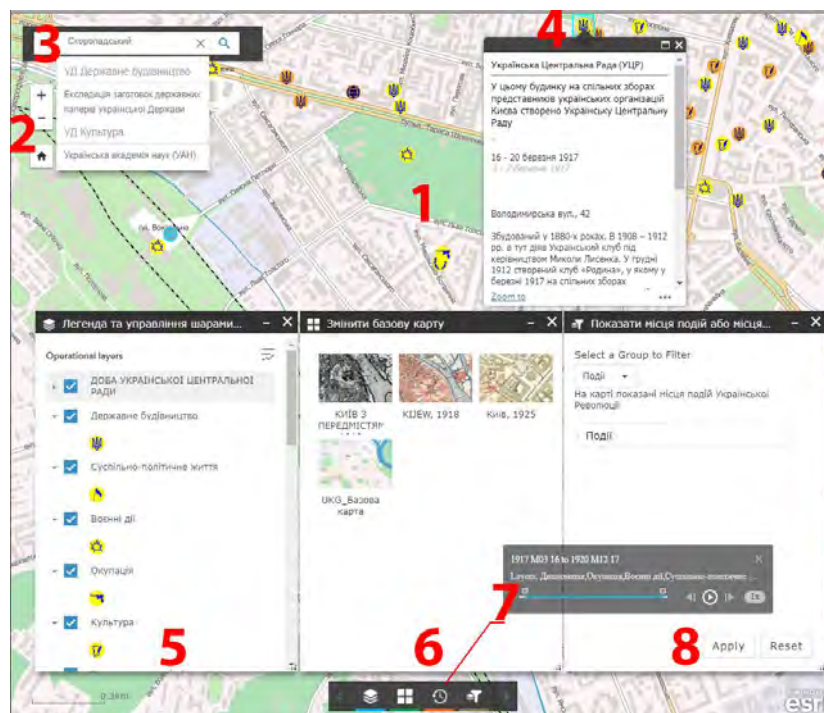


Fig. 4. Functionality of the demo version of the “Sites of commemoration of the Ukrainian revolution 1917–1921” interactive mapping web application (please follow the link to view the demo version: <https://goo.gl/1E7GGG>)

7. “Timeline map” view – interactive animation that shows the events and the time of creation and functioning of the institutions at the time of the Ukrainian revolution in dynamics. Time intervals and animation speed change is available.

8. Filter usage for the display of the sites of commemoration connected with the events of the Ukrainian revolution or different institutions.

Scientific novelty and practical significance

For the first time in Ukraine the GIS set of tools has been used and the development Conception of the interactive web map “Sites of commemoration of the Ukrainian revolution 1917–1921” have been processed in order to restore and preserve the Nation’s memory of the Ukrainian revolution 1917–1921. Methodological principles of the interactive cartographic web application, its structure and content development have been elaborated:

- Organization principles of the information about the sites of commemoration of the Ukrainian revolution have been elaborated;
- Data division in two levels have been suggested: time-based (three forms of state government are established in chronological order) and event-based (within these forms of state government);
- Requirements to the specialized cartographic online-product are defined;

The processing scheme of practical implementation of such a project have been suggested using the ArcGIS for Desktop, ArcGIS Pro and ArcGIS Online software.

A large body of information on the events and the sites of commemoration of the Ukrainian revolution 1917–1921 in Kyiv has been collected on the basis of the scientific research that was conducted. The collective of authors (S. Aleksandrova, O. Holubtsov, O. Kucheruk, V. Skalskyi, R. Sossa, L. Khmara) have designed the demo version of the interactive web map of Kyiv city, devoted to the sites of commemoration of the Ukrainian revolution 1917–1921.

The developed methods can be used for publication of the geological spatial information and different material for numerous multi-temporal and multivariate events for a wide range of topics.

Conclusion

1. On the basis of modern technologies and software the conceptual approaches to the organization of the designing work on the “Sites of commemoration of the Ukrainian revolution 1917–1921” interactive web map as a means of

dissemination of information about the events of the Ukrainian revolution have been elaborated that will contribute to scientific, promotional, and memorial revitalization in the regions for the purpose of renewal and preservation of national memory of the revolutionary events.

2. The methods and the processing scheme of the interactive web map designing can be used to resolve different social issues.

3. The suggested basic maps are to be used for other similar projects in order to accumulate diverse information for future research on temporal and spatial interconnection of different objects and events.

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КАРТОГРАФІЧНИЙ ІНТЕРАКТИВНИЙ ВЕБ-ДОДАТОК “МІСЦЯ ПАМ’ЯТІ УКРАЇНСЬКОЇ РЕВОЛЮЦІЇ 1917–1921”

Мета. Метою дослідження є опрацювання концептуального підходу та розроблення методичних засад створення інтерактивного веб-додатка “Місця пам’яті Української революції 1917–1921 років”, його змістовного наповнення та структури; опрацювання технологічної схеми практичної реалізації такого проекту. **Методика та результати робіт.** Українська революція 1917–1921 років стала визначальним етапом в історії українського державотворення. Ефективним способом інформування суспільства про ці події є публікація і поширення в Інтернеті інтерактивного картографічного веб-додатка, створеного за допомогою ГІС-технологій. Опрацьовано принципи організації інформації про місця пам’яті Української революції і запропоновано розподіл даних за двома рівнями: часовий (хронологічно виділено три державні утворення) і подієвий (у межах цих державних утворень). ГІС розглядаємо не лише як сукупність інструментів геооброблення та організації геоданих, а й як спосіб комунікації та донесення інформації до користувачів за допомогою Інтернет. Під час створення картографічного інтерактивного веб-додатка використовували лінійку програмних продуктів компанії ESRI Inc. Роботи із створення вихідної бази геоданих, розроблення та редагування базових та тематичних карт здійснені в середовищі програмного забезпечення ArcGIS for Desktop. В ArcGis Pro попередньо підготовлено веб-шари карти (налаштування стилів, підписів та масштабів відображення) та публікація веб-шарів. Хмарний сервіс ArcGIS Online і онлайн-конструктор WebApp Builder for ArcGIS застосовані на завершальному етапі створення картографічного веб-додатка. Визначено вимоги до спеціалізованого картографічного онлайн-продукту та обґрунтовано переваги застосування технологій веб-картографування. Завдання із розроблення такого продукту реалізується за допомогою створення інтерактивного картографічного веб-додатка (Web-App) на платформі ArcGIS Online. Web-App доповнений і поєднаний із медіаконтентом (фото, ілюстрації, відео, тексти). Функціональність Web-App забезпечується через використання налаштованих віджетів (widget), які не тільки забезпечують інтерактивність веб-карти (часова карта, спливаючі вікна та інші), а й дають можливість аналізу карт (розширений пошук по об’єктах карти, знаходження об’єктів у заданому радіусі тощо). Збір даних про місця пам’яті можна розподілити серед багатьох виконавців у різних державних на наукових установах. Формування бази даних доцільно здійснювати у цифрових таблицях MS Excel або Google Таблиці / Форми), які можна експортувати в атрибутивні таблиці класів просторових даних у ГІС. З метою цілісного збереження і ефективного управління даними про місця пам’яті, вся отримана інформація опрацьована і організована у файлової базі геоданих, яка складається із наборів класів об’єктів. Набори класів об’єктів створені одразу у системі координат WGS 1984 Web Mercator (Auxiliary Sphere), яку використовують під час створення веб-карт та веб-додатків. Для укладання базової карти у проєкті використовують дві бази даних: для території України – базовий масштаб 1:100 000 і для великих міст – базовий масштаб 1:10 000. Як приклад реалізації опрацьованої Концепції розроблено демо-версію картографічного інтерактивного веб-додатка “Місця пам’яті Української революції 1917–1921 років” для міста Києва. **Наукова новизна та практична значущість.** Уперше в Україні для відновлення та збереження національної пам’яті про події Української революції 1917–1921 років опрацьовано Концепцію створення інтерактивної веб-карти України “Місця пам’яті Української революції 1917–1921 років, що ґрунтується на сучасних методах геоінформаційного картографування. Розроблено методичні засади створення картографічного інтерактивного веб-додатка, його змістовного наповнення та структури. Технологічну схему практичної реалізації проєкту розроблено на основі програмного забезпечення компанії ESRI Inc.

Ключові слова: геоінформаційні системи; інтерактивний веб-додаток; веб-картографування; місця пам’яті, Українська Революція, ArcGIS Online.

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