Analysis of approaches for “Geological heritage of Ukraine” geoportal creation

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SUMMARY

The paper presents the results of the analysis of approaches to the creation of the geoportal "Geological Heritage of Ukraine" and developed its own version of the geoportal. The structure of the site is based on the interaction of the user with interactive maps, which allows its use to users of low skill. The technology used for portal development allows you to organize a network of linked sites that are edited from one admin panel.

Geological Heritage of Ukraine is a WordPress Multisite (WPMU) network of sites and provides the ability for the user to extend the functionality of the development environment by installing plugins designed for the IntelliJ platform or by developing their own plugins.
Introduction

The realities of today are that over 60-70% of the data used by enterprises, institutions, state and municipal authorities and ordinary citizens in their activities or daily life have a spatial component. It is known that geoinformation systems (GIS) and geoinformation technologies (GIT) are used to process and analyze this data (Zatserkovnyi, 2016).

As the developed software of such GIS is not cheap and requires special knowledge on its use, the actual practical task is to develop approaches to simplified access to spatial data, their processing, analysis, visualization, updating and management for various purposes. The solution can be found through the use of information portals.

Originally, the term "portal" meant the architectural designation of the front entrance to a building. With regard to network technology, the portal is the main entrance to some virtual space with its specialized resources, which is user-friendly and easy to use. A distinctive feature of geoinformation is that it simultaneously includes a coordinate (metric) and attribute (semantic) description of the object (Zatserkovnyi, 2016). This gives you a visual geospatial model that can be used to analyze the connectivity of objects, their neighborhoods, orientation, and more. Portals that allow you to arrange the search in the web (individual network resources) based on linking geo-information properties have naturally become known as geo-portals.

The today's problems of rapid access to geological information of Internet users one should attribute the high dispersion of this type of information between different entities operating on the network. As evidence, you can cite the online service "Mineral Resources of Ukraine" (Internet resource: http://minerals-ua.info/), which provides comprehensive information about mineral resources and mineral deposits of Ukraine, but contains insufficiently detailed information about geological sites. Only thirty out of the more than six hundred geological sites are listed, and there are only photographs and titles, without description. Another resource (Internet resource: http://irbis-nbuv.gov.ua/) provides information in the form of a PDF document with scanned pages of the book "Geological sites of Ukraine" (Bezvinny et al.,) containing data on geological sites in particular regions of Ukraine, which requires many operations with the service in order to find the right sights. This form of information is not convenient for the ordinary internet user. Other resources provide only a cursory description of the concept of "geological sites of Ukraine", without a detailed description of them. This condition is due to many factors, including significant rates of accumulation of information by government entities, geological entities, disordered placement of information on the world wide web, duplication of the same data by professionals and amateurs using GIT, who are trying to improve existing services.

Creating online sources of information, including geodata, will meet the needs of society (educational and scientific institutions, business structures, public organizations) in obtaining and using high-quality geospatial data, will facilitate the integration of information within a holistic system and provide open public access to it.

Essentially, the geoportal is an innovative location information and communication platform that provides access to geoinformation through the use of web services.

Using the geoportal enables the user to access the web service with interactive maps and the ability to operate with these maps and the data contained in them (search for spatial data / objects, sorting them, highlighting zones / objects, displaying various layers of certain types on the map, zooming, reflecting, etc.).

As you know, geological information accumulates, changes, complements and spreads rapidly. Geoportals are the main means of disseminating such information not only for public use by ordinary users, but also for use by GIT professionals for the purpose of conducting research, structuring information within their information systems, and updating information. Spatial Data Infrastructure (SDI) is a set of technologies to provide access to geo-information resources, as well as to disseminate and exchange data.

The aim and goals

The purpose of creating a geoportal is to develop modern tools for processing geological, geographical, mapping, geoinformation data, as well as their visualization, public accessibility, by storing spatial data and other data in databases and providing them through web services.
Method and/or Theory

Geoportal according to the authors should:
- provide comprehensive, accurate information about Ukraine's geo-monuments and make it public and accessible to the general public;
- to be a software product, a web service that meets modern standards of functionality;
- it must contain a complete, filled database of data of different types and enable obtaining, modifying, adding, deleting data from the database;
- must contain up-to-date information and ensure uninterrupted access to information from the database;
- should ensure the mobility and efficiency of the web portal, contain a set of interactive maps and be compatible with most modern browsers; quality implementation of usability for users;
- Must support Web-mapping standards (WMS, WFS, ISO-19115).

Examples (Optional)

Geoportal is implemented with a clear structure and the presence of relationships such as "user interface", "database interface", "database interface", "user interface".
From the point of view of the user working with the geoportal, this structure is completely logical, because it reflects the basic interactions that occur during the use of this web service. To access the geo-portal, the user needs an electronic device with an installed Internet browser and access to the internet. You can open a geo-portal by going to [https://geo-heritage.info/](https://geo-heritage.info/) (Figure 1).

Further, the user operates with the geo-portal interface, browses interactive maps, obtains information from them, gets acquainted with data on geo-monuments of Ukraine, etc. (Figure 2).

**Figure 1 Algorithm of work with geo-portal**

**Figure 2 Example of work with geo-portal “Geological heritage of Ukraine”**
All the information the user needs is extracted from the database on the server. The main requirement for a database is its smooth functioning. The user can request the information he needs by interacting with the web service interface, and if such information is available in the database, it will be displayed and accessible for viewing. This is how the basic (simplified) version of user interaction with the geoportal looks. This does not take into account the specific features of the interaction of the web portal with the WordPress multisite network, as well as the details of working with interactive maps. Regarding the structure of the geo-portal, it was supposed to have the information on the web service, as well as hierarchy, logical distribution and typing of elements of the system itself. The block diagram of the structure of the elements of the geoportal is presented in Figure 3.

**Figure 3 Block-scheme of basic structure of information on geo-portal**

The structure of the site is based on user interaction with interactive maps. It is implemented for convenience of the user with a geo-portal. This approach will not require a high level of professional user experience to work with the cards. Users who do not have experience with such systems will be able to quickly get used to the interface and how to interact with the elements of the interface. The calculations and test results made it clear that getting used to the geo portal interface is fast and clear. The system has its own peculiarities because the geoportal is not a single site, but a whole network of WordPress Multisite (WPMU) sites. According to the opinion of the authors the developed and described structure of the geoportal is clear, logical and consistent, which made it possible to develop a quality web service.

The tools and development tools involved in creating the geoportal are listed below.

**JetBrains PhpStorm** is a commercial cross-platform integrated environment development for PHP of JetBrains company based on the IntelliJ IDEA platform. PhpStorm is an intelligent editor for PHP, HTML and JavaScript with capabilities for on-the-fly code analysis, code error prevention, and automated refactoring tools for PHP and JavaScript. PhpStorm code autocompleting supports the PHP 5.3 / 5.4 / 5.5 / 5.6 / 7.0 / 7.1 specification (current and traditional projects), including generators, subroutines, namespaces, circuits, types, and short array syntax. There is a full-fledged SQL editor with the ability to edit the received query results. PhpStorm is developed based on the IntelliJ IDEA
platform written in Java. Users can extend the functionality of the development environment by installing plugins designed for the IntelliJ platform or by writing their own plugins.

**PHP (Hypertext Preprocessor)** is a scripting programming language for generating HTML pages on a web server side. PHP is supported by the vast majority of hosting providers and is an open source project. PHP is interpreted by the web server as HTML code that is passed to the client. Unlike JavaScript, the user does not see the PHP code because the browser receives the HTML code.

**JavaScript (JS)** is a dynamic, object-oriented prototype programming language. Implementation of the ECMAscript standard. It is most commonly used to create web page scripts that allow the client-side (end-user devices) to interact with the user, manage the browser, communicate asynchronously with the server, change the structure and appearance of the web page.

**jQuery** is a popular open source JavaScript library and is the most widely used JavaScript library today [6]. jQuery is a free software licensed under the MIT.

**Hypertext Markup Language (HTML)** is a standard markup language for creating web pages and web applications. With Cascading Style Sheets (CSS) and JavaScript, it forms a triad of core technologies for the World Wide Web.

**CSS (Cascading Style Sheets)** – is a special page style language used to describe their appearance. The pages themselves are written in data markup languages. CSS is the world's leading web technology, along with HTML and JavaScript. CSS is most often used for visual presentation of pages written in HTML and XHTML, but the CSS format can be applied to other types of XML documents.

**Bootstrap** is a free, open source toolkit designed to build websites and web applications that contains CSS and HTML templates for typography, forms, buttons, navigation and other interface components, as well as additional JavaScript extensions. It simplifies the development of dynamic websites and web applications.

**Leaflet** - An open source JavaScript library for displaying maps on HTML pages. Self-contained, modern (HTML5, CSS3), small in size, with a wide range of license agreements, easy to use. The library supports map layers that are built on technology: WMS, GeoJSON, Tail, or vector surface mapping. Other types of map projections are supported by applications.

**SQL (Structured query language)** - a declarative programming language for user interaction with databases, used for querying, updating and managing relational databases, creating a scheme database and its modification, a system for controlling access to the database.

**phpMyAdmin** is a PHP-based open source web application with a graphical web interface for administering MySQL or MariaDB. phpMyAdmin allows you to administer MySQL server through a browser, run SQL queries, view and edit the contents of database tables.

The main core of the geo-portal is CMS WordPress.

**WordPress** is an open source content management system that, because of its ease of installation and use, is widely used to create websites. Scope - from blogs to complex websites. The built-in theme and plugin system, combined with good architecture, allows you to design virtually any web project based on WordPress. Written in PHP programming language using MySQL database. The source code is licensed under the GNU General Public License.

It is on the basis of this content management system that the entire structure of the geo-portal is built, its logic and decisions are made for the implementation of the stated functionality.

The developed geoportal is implemented with the help of WordPress Multisite (WPMU) architecture.

**Multisite** is a WordPress mode that allows you to use existing kernel files and an existing database to build a network of WordPress sites. In this case, each site on the network has its own settings, and plugins, themes and users become common. It's a technology that allows you to manage multiple sites from the same control panel.

This decision was made thanks to the excellent implementation of this technology and its capabilities. The structure of WPMU technology is shown in Figure 4.
Figure 4 The structure of Wordpress Multisite technology

Conclusions

This technology allows you to organize a network of sites that are linked together and edited from one admin panel. This greatly facilitates the handling of large volumes of information. Geoportal has one main site with an interactive map of Ukraine and each site-member of the multisites network corresponds to one region of Ukraine. In turn, each such site-member of the multisites network is placed on a subdomain and has not only an interactive map of Ukraine, such as the main site, but also an interactive map of the region.

References

http://irbis-nbuv.gov.ua/
http://minerals-ua.info/
https://geo-heritage.info/
