

## **Methodology and Technology of WebGIS Server Development for Distance Learning in Geoinformation Sciences**

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Web- and GIS-technologies integration (WebGIS server) is the most effective and promising approach to manipulate and deal with geospatial data and knowledge via Internet for education purposes.

There are many different technological, functional and informational decisions in current WebGIS-based education courses on GeoInformation Sciences and other GIS-related disciplines. The insufficient or even weak functional components of them are the low ability to provide users (students) to get on-line practical skills in GIS through Internet access.

Therefore enhancing of training skills for education WebGIS server based upon interactive geoprocessing and mapping is actual problem.

The methodology of the practical part of WebGIS server development could be based upon an idea of the four levels of GIS education material arrangement and user interfaces (UI) building (with active practical facilities):

1st Level. Simple and pure GIS basic terms and definitions (elements, structure, relations) presented in "ascetic" HTML scripts design form.

2nd Level. GIS basic functions and procedures (SDBMS Managing, Thematic Mapping, Spatial Analyzing): input/output, editing, visualization, analytical procedures, result representation, etc.) presented mainly in icon "clickable" form characterized "classic" GIS component architecture and facilities.

3rd Level. Commercial GIS UI imitation (with idea to modify interface if student want to learn appropriate or preferable GIS software interface): menus, windows, icons and their location and arrangement on the screen, etc (Java Scripts is applied).

4th Level. Applied GIS UI which is oriented on the appropriate problem solution (Environment, Urban Planning, Business Issues, etc.) with different design approaches (depends upon the problem specification).

From the functional point of view the architecture and navigation principles of UI are conformed to logic technological sequence of thematic mapping process and provide to solve the following issues:

- to define mapping territory;
- to define base map layers (boundaries, roads, rivers, etc.);
- to define map content (thematic mapping object);
- to describe required source geographical data;
- to choose the methods of cartographical representation (symbolization);
- to design and specify cartographical characters and symbols both for thematic and for base map layers.

The main problem for developers is to design many UI for education WebGIS server which have different content, structure, as well as different logical and technological relations and references between them. Many efforts are made to provide interactive mode of dialog between student and WebGIS server.

The prototype of education WebGIS server based upon presented principles is developing in the framework of one of R&D Projects of Russian Ministry on Education.

UI developed on the HTML Script basis (CGI generated) with Java Script elements. GIS Applied software which supports the "client-server" approach is called Intermap GIS Server. It is our original application and it uses Russian commercial GIS software GeoGraph/GeoConstructor as GIS Core. Intermap GIS Server has now some implementations in Russian Internet Map Projects and was examined in different technological conditions.