Geospatial data presentation of road infrastructure in Kherson region

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The article describes the software platform, on the basis of which was created a distributed geo-information system, monitoring the roads of general assignments condition in Kherson region.

Introduction

General transporting of consignment by vehicles in Ukraine, according to the data, has a tendency to increase [1], and for Kherson region for the period 2005-2010 years in figures were accordingly 11.4 - 13.6 million tons. During this period the passenger turn of buses and the number of cars had been increasing, but the length of roads of general assignment remains unchanged.

The problem of roads development is multi-aspect, including economic, technological and administrative issues. Development of roads in Kherson region will assist:

- improvement of intercity communication;
- development of regional areas and investment;
- possibilities of free movement for citizens;
- development of the regional economy;
- development of international transport corridors.

Relevance of the research

To ensure the effectiveness of decision-making is necessary to use auxiliary tools, such software complexes as decision-making support systems, information-analytical systems (IAS) [2], expert systems, geo-information systems (GIS). Because of the high cost of repair and reconstruction of roads and road infrastructure rational decision-making in this area is a crucial feature [3].

A separate important component is the problem of timely information, monitoring and reporting using information resources: IAS, web-portals and so on. The most convenient and illustrative way of presenting information about the objects (roads and engineer infrastructure constructions) is a geospatial data presentation with problematic environment [4]. Electronic map that provides ability to display, edit and analyze data on geo-spatial objects (roads, bridges, roadside infrastructure, places of road accidents concentration).

Functional possibilities of GIS

The developed system of presentation the geospatial data is created with the accounting of such possibilities:

- the distribution of access rights between users;
- simple application of geographic data on a map with the ability to edit information about objects;
- stylization of map by users without any necessity of learning SLD (Styled Layer Descriptor);
- the ability of adding new system functions without changes in a main code due to the system modularity.

GIS should perform the following functions:

- maintaining and accumulating database;
- quick search and access to necessary data;
- keeping of information about geographic objects in the database.

GIS must suit the following requirements of work with geographic objects:

- linking information about objects to their geographical coordinates;

- keeping information in a database of geospatial objects of different types: points, lines, polygons;
- rendering of images for creating geographical maps.

Software means of information visualization and geospatial analysis

To display and edit geospatial data of electronic map in Kherson region software and map layers with the application of server technologies (AJAX, php, Javascript), requests to the database (structured language of requests — SQL) were developed.

GIS on server is implemented by using the standard software of web-servers realization (Apache http server, MySQL, Apache Tomcat Server). In order to post, edit and publish geospatial information GeoServer was selected — server software with open code, written on JavaScript language. To keep information about objects MySQL database is used [5], which is connected to the GeoServer due to ability of connection of additional modules (in this case MySQL extension).

The client part is implemented by using the WEB-interface [6]. The developed CMS (Content Management System) provides the performance of tasks associated with creating, editing, styling, publishing and visualization of geospatial information on the map. The CMS was developed by using the principle of modularity, with the ability of connection of additional components (modules) without any changes in the software part of the system.

Visualization of geospatial data with easy styling of the client part is developed by using OpenLayers - a library with the open code, written on JavaScript language. Electronic map provides the ability to edit data for all objects included in the database, and also make new objects.

Computer platform and its implementation

GeoServer provides a set of special modules for connecting different databases (MySQL, ORACLE, POSTGRESQL etc.). It is possible to create and keep files of stylization SLD [7] and link them to the selected layers. The main task of GeoServer is to transfer geocoded images, generated on the server by using such services as WMS (Web Map Service), WFS (Web Feature Service), WCS (Web Coverage Service) and others.

All information about geographic objects is saved in MySQL database. In the database data about the following types of objects are included:
- roads of general assignment;
- bridges;
- roadside infrastructure;
- places of road accidents concentration.

Scheme of interaction server with client part is depicted on figure 1.

In GIS the possibility of distribution rights of the users are provided, namely the creation of unlimited number of roles with defined rights for each and the issue of them for all users.

For easy map stylization generator of files SLD is developed. By using the developed generator, users can classify geospatial data on the map, depending on the parameters, by "coloring" maps without special knowledge of SLD.

This software (beta-version) is tested and implemented in Road Service in Kherson region with the accounting of requirements and specifications of the customer.

Conclusion

The developed GIS allows to increase decision-making efficiency, provides tools for generating reports on the accounting of roads of general assignments in Kherson region, for presence of the artificial structures and road service objects on them, and also for the need of technical service of roads.
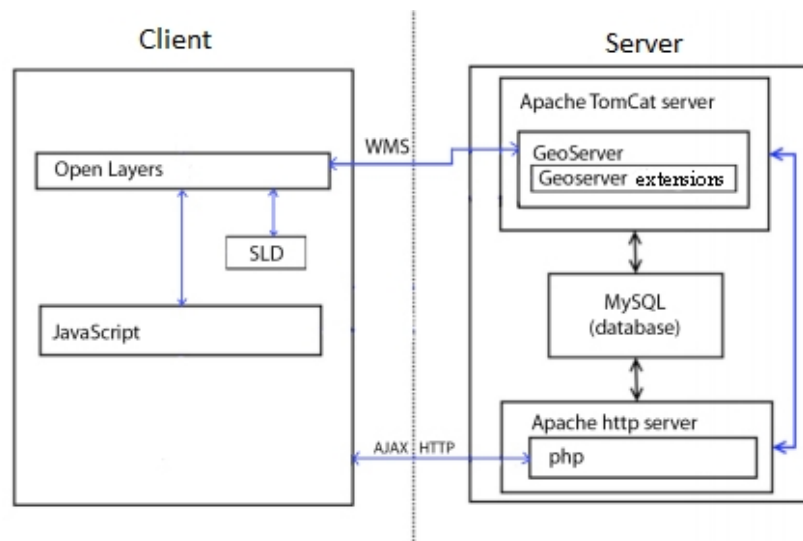
Figure 1. Interaction of geo-information components.

Useful information about the condition of roads in the open access can be one of the priority directions of GIS development. For realization of this direction it is necessary to develop a web-portal — the open part for public access over the Internet to the information resources of the system. And so, a single additional module will be added to GIS for synchronization of data with the web-portal.

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