Possibility of Application of Situational Awareness in Energy Research

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Abstract[1]

In this article is briefly considered a new approach to work with geospatial information that is named Situational Awareness (Neogeography). Also is described a possibility of application new approach in energy research. For some fields is formed several tasks.

1. Introduction

The first decade of XXI century was marked by appearance of new geographical web services in the Internet, sharply distinguished from usual geographical maps and GIS. The first of such services was Google Earth which was opened for the public use in June 2005. After 2 years the amount of download new web service exceeded 250 million pcs. It is necessary to explain such popularity.

The giant numerical jump by "amount of users" indicator from other geographical software, widely presented in the Internet, allows to say about quality distinction of the new web service from forerunners either by availability of new technology or a new approach to work with geospatial information.

A simple analysis shows that new revolutionary technology in the considered web service is not used. New approach to work with geospatial information resulted from joining of some known technologies. This approach is named Situational Awareness or Russian analogue Neogeography and underlies all presented at the moment web services (for example, Nasa World Wind by Nasa, Virtual Earth by Microsoft). Such an approach has been described in detail for example in article "Neogeography: features and facilities" [2].

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2. Novelty of approach Situational Awareness

Neogeography (by definition Eremchenko, 2007) – new approach to work with geospatial data which is distinguished from the previous (map, GIS) by 3 sign:

- using geographical rather than cartographical coordinate system;
- application raster rather than vector presentation of geospatial data as a main format;
- using public hypertext formats for spatial data presentation.

All those technologies aren't revolutionarily new. The originality of the approach is the unification of all those technologies. This unification gave new quality for work with geospatial information in such web services. It is showed by several main signs:

- rejection from limitations assigned by cartographical projection;
- erase of the distinction between geographical and cartographical maps at the expense of ability of scaling in wide limit – from global to extreme detail scaling;
- securing of not orthogonal, but at the same time metrically precise and three dimensional presentation;
- appearance of environment for public making and aggregation of geospatial data.

One of the main distinction of new generation geo services is using the single, geographically precise surface of the Earth. The spatial resolution of the raster cover image corresponds to the resolution with which human sees an environment terrain.

It allows us visually perceive the terrain on satellite imagery such as it was in fact, i.e not mediated by obligatory conventions of geographical and topographical maps. This, in turn, significantly simplifies a perception of visible images on a screen and a real terrain, and the

consequently identification of object attitude position.

Great number of GIS and similar systems use cartographical projections of a described terrain. By territorial coverage global GIS, sub-continental GIS, national GIS, regional GIS, sub-regional GIS and local GIS are distinguished [3]. Each works in own scale of terrain. Joint use of GIS may activate a problem conditioned by the deformation of data during the projection.

In geo services, such as Google Earth, territorial delimitation is absent. A user sees Earth sphere at screen soaring on the black background, which can be turned, scaled by help of intuitively understandable and simply memorable mouse control. The viewpoint choice is realized in real-time and directly depended on the conditions of a research task. A user can instantly change the scale and viewpoint: from generalized (seen all Earth sphere, scale 1:10000000) to extreme detail (roughly scale 1:10). Changing viewpoint (a great number of GIS offer only orthogonal projection), smooth flight between objects, reflection of the terrain relief also provide a new level of information perception. Fig 1 shows Ust-Ilimskaya hydro power station, short information about it and the marks indicate the level of head-water and tail-water.

Fig. 1. Ust - Ilimskaya hydro power station

However, conventions of maps also demand presentation, which is realized in layers. Switched on or off the layers Users can instantly receive different information about objects or terrains interesting for them. Fig. 2 presents the information about making dynamic of electro and heat-power energy from New Irkutsk heat station.

On the assumptions mentioned above we would draw a conclusion that Geo service may be a convenient, universal instrument for information representation.

2.1 Import of data

The majority of geo services support the KML language. This is scripting language, such XML, oriented for making and editing object that is needed for represent in the geo service. This language is open for research and well documented [4].

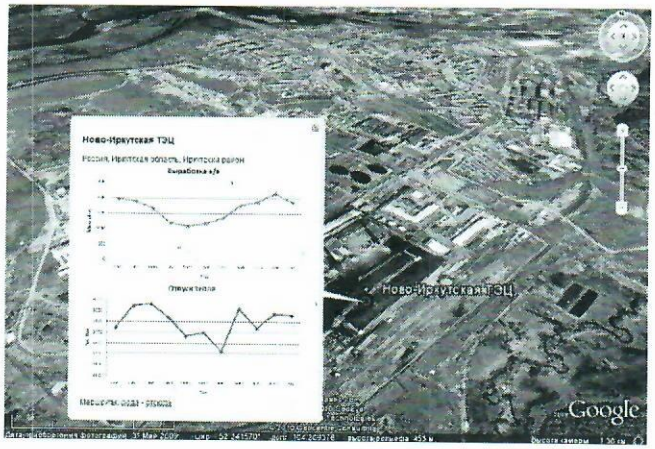

Fig. 2. New Irkutsk heat station

3. Possibility of application of Situational Awareness (neogeography) in energy research

In the energy, such as other sciences, that is operated with geospatial data is possible to apply the neogeographical approach for efficient reflection of the necessary information.

Analysis of modern condition and forecasting long-term development demand the visualization of the information on different level: such as district, region, constituent territory, energy plants (power plant, boiler, coal pit, oil- and gas-pipeline, transmission facilities), consumer of fuel and energy.

On present time revealed the several task for which reasonability apply such approach (neogeography).

3.1 Hydropower engineering

- Medium-term forecasting of hydroelectric potential (stream power),
    1. Estimation of the spring flood,
    2. Risk of the near-accident,
- Modeling of the flooded area by new reservoir and changing of a HPP's reach;
    1. Estimation of the reach level,
    2. Correction of the reservoir level,
- Monitoring of the level;
    1. Near-accident at an energy plants,
    2. Modeling of a near-accident with the preset condition,
    3. Detection of the compensating action.

The hydropower engineering is a very perspective field for neogeography, i.e it is possessed large quantity of the

beautiful tasks, but the majority of input data is hard in receive and there are a forecasting problem because of ambiguity and uncertainty of the data. Fig.3. presents the show prototype of the hydro power Plant on river Irkut near rapid Bull and the reservoir is modeled.

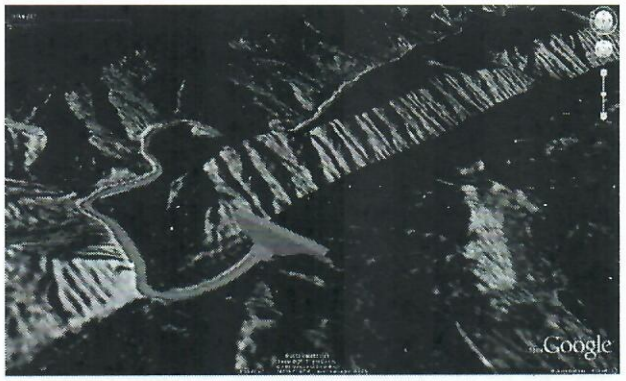

Fig. 3. Shown prototype of HPP and flooded area

3.2 Ecology

By the man impact on environment of energy plants arise a visualize necessity:

- For energy plants of region or constituent territory – installed equipment, degree of catching detrimental impurities, calculated emission and liquid discharge;
- Ranking of the terrain by degree of dirtying from the different admixture (contaminant) subject to height pipe, season, wind rose etc.
- List of possible nature-conservative measures with technical and cost rate;
- Consequences in environment after adoption of different nature-conservative measures.

3.3 Renewable energy sources

For this field need a visualization:

- For region or constituent territory - gross and technical potential of wind, hydro, solar power energetic, geothermal sources and theirs general characteristics (wind average speed, coming solar radiation, flow velocity, water discharge, temperature of water-stream mixture);
- For meteorological network – information for calculation of possibility of power and heat energy generation (probabilistic distribution of wind velocity, changing of coming of solar radiation, water discharge by month during the year);
- For renewable energy sources – types, performance capabilities, amount of power- and heat generation, cost parameters);
- For consumer – electric and heat demand, behaviors of exist power-supplier, fuel price).

3.4 Transport tasks

This field also need a visualization information. It is possible for reflect:

- Carriers routes of different type of fuel (coals, oil products) from different deposit with solving cost for consumer with shipping costs;
- Version of transmission lines, gas and oil pipelines, roads and etc;
- Design cost parameters of resource transport for securing economic gain.

4. Conclusion

- Modern approach to work with geospatial information is very perspective approach in energy research.
- Tasks for hydropower engineering and ecology was formed.
- Two shown prototype is prepared for primary fields of energy.
- Grant proposal is tendered into Program "GasProm VNII GAS" for support of realization the project "Intelligent geoinformational system, integrating situational analysis, cartographical support and neogeography approaches".

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