Modeling of Information Processes in Emergency Management With Intelligence and Web Based Systems Implementation

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Abstract

In the report the application of a system approach in problems of support of decision making in emergency situations is considered by usage of intelligence methods, semantic and computer modeling. The main issue of report is a functional and systems analysis of web based information support process in emergency management. Usage of a system approach for data mining with interdisciplinary integrated methods, algorithms and information technologies allows effectively to use large amounts of information and knowledge bases with allowance for of last achievements of computer science, vehicle of databases and knowledge, computer networks both computer modeling and decision making. Other issue is a development and application of an intelligence decision support system in emergency situations with use of modern information technology. In the report there is attempt of a classification of the functional characteristics emergency of objects from the point of view of possibility of a formalizing and organization of processes of purchase of knowledge. The main method of studies is a multi disciplinary approach to intellectual decision support systems development allowing creating effective tools in the area of complex processes described by large volumes of the analyzed information. The solution of problems of use of large information flows about a state of the natural environment and natural disasters is a key point for decision making in emergency situations. All of those problems connected with using Web of technologies for organization of a storage, access and analysis of data, metadata, information and knowledge for emergency management.

Introduction

The main method of studies is a multi disciplinary approach to intellectual decision support systems development allowing creating effective tools in the area of complex processes described by large volumes of the analyzed information. The solution of problems of use of large information flows about a state of the natural environment and natural disasters is a key point for decision making in emergency situation [1].

The broad area of Emergency Management objects is connected with problems of an environment, high waters, floods, marine and ocean environment. For Emergency Management in these areas the systems operating with are widely used is space - temporary information. In process Emergency Management used the broad class of GIS, different kind intelligence systems (KNBS - Knowledge Based Systems).

All of those problems connected with using Web of technologies for organization of a storage, access and analysis of data, metadata, information and knowledge for emergency management.

In connection with realization of operations on creation of such systems there is a necessity for development of main principles both methods their operation and separate program units, which with necessity will enter their structure [2]. To number of originating problems, in particular, concern:

- Development of problem-oriented mathematical models, and also more general methods of processing and analysis of data.
- Creation of effective methods of support of decision making, in that, number in conditions of the insufficient information and different levels of its reliability.

Systems Approach to Emergency Management

For solution of a problem of construction autonomous specialized DSS in Institute for Systems Analysis of Russian Academy of Sciences is developed an information system "Archimedes" [3]. Data area of the system is the environment in diverse it manifestations. "Archimedes" allows creating a specialized informational - analog system on various sections of sciences about the Earth, such as oceanology, seismology, geology, ecology, meteorology etc. A collection of the system, directory and simulating parts will develop a special tool for the expert - expert in concrete data domain. The tool is directed on increase of an overall performance of the expert - expert with various types is space - temporary of data by use of modern software of submission and analysis of data, methods of a simulation modeling. The Archimedes system granites the user a full complex of means for input, storage, processing and visualization of data about the natural environment have space or space - timing. One from main properties of the created system is it the openness and interactivity. The openness means possibility of simple connection of additional databases, models and handlers. Interactivity means the extension of the dialogue possibilities in the party of use of more advanced means both systems of interaction of the person and computer. In particular it means broad use of possibility multimedia tools.

The information subsystem provides submission of data about the natural environment as cards of selected plots of a surface of the Earth or World Ocean with put isolines of the necessary parameters. The large volumes concern to number of main features of developed informational - analog systems is space - temporary of data. Is space - temporary data are results of direct measurements of some physical parameters (or results of processing of such measurements), have concrete temporary, coordinate and depth (high-altitude) binding. For realization of fast access to, is space - temporary to data, specific on a regular grid, and with allowance for specifies of such data, the specialized data base management system (DBMS) «Grid» was developed. The complex of programs of visualization includes programs of submission of data; as the schedules, diagrams isolines and three-dimensional surfaces.

The simulating subsystem will realize possibility of connection of simulation models of physical processes and handlers of data written on the various programming languages. Within the framework of further development of the system the possibilities of inclusion in structure of handlers of data of the program of the statistical analysis, classification and recognition, specialized consulting model of interpretation of results of processing were considered. With the purpose of achievement of greater visualization of submission of results have coordinate binding, the cartographic subsystem (specialized GIS) is developed. In the basis of the subsystem the segment storage of plots of boundaries is necessary. The system was realized in two variants for operation on mainframes and on personal computers and is intended for obtaining the most full modern

information about the statistics characteristics. The system gives submission about synoptic of variability in various regions, contains models large-scale and synoptic termo hydrodinamic processes, visualize a seasonal course middle climatic parameters and changes of large-scale circulation, demonstrates, results of the forecast of evolution of ocean fields on hydrophysical ranges. The system was oriented both to the experts, and on the users of a broad structure, is useful in practical operation of the contributors and practitioners, valuation, colliding with necessity, of a state of the ocean environment and its variability.

The problem-oriented database is, is designed for a storage of the information about the natural environment as regular 4-dimentional grid. It essentially accelerates information retrieval in a mode on-line. Imaging 4-dimentional scalar files regular in space and time obtained with the help of processing of ship observations meteorological and oceanography characteristics. These data are represented as the forms - cards of open parts of the sea with a grid of observations. In a legend to a card the annual amount of shootings and structure of observations on each category and other necessary information is underlined.
Besides the system provides:

- Construction cross-section for the many-dimensional analysis on the fixed horizons.
- Imaging the characteristics in specific is space - temporary to a point.
- Imaging on a geographical card on a Mercator projection of main parameters.
- Construction of a map and coastal feature with the different sanction (accuracy and detail) depending on computer resources and class of soluble problems.
- Adaptation of the many-dimensional database for operation in the Windows 95/98/NT/2000 environment intended for storage of the regular arrays oceanography to the information.

On each from sections the following structure of subsections is offered: the normative documents regulating realization of observations behind appropriate parameters; techniques of realization of observations; the catalogue of information materials, included in the allowance. The last section is key for creation of the request and search of inclusive materials contained in the allowance. The database of observations contains a past primary control of results of observations of the specific characteristics in the arrays of two kinds. First represent one-dimensional files obtained on coastal hydrometeorologic stations. They should be represented in tabular form, schedules, files for accounts. Each table and the schedule should accompany with the description about, where, as, when, who obtained data.

Second is four dimensional files irregular in space and time obtained with the help of ship observations meteorological and oceanography characteristics. These data are expedient for presenting as the forms - cards of open parts of the sea with a grid of observations. In a legend to a card the amount of shootings and structure of observations on each category is underlined annually.

Data Publication in Internet

Obviously, that modern DSS should have possibility for the publication of data in Internet [4]. Really such possibility has appeared not so long ago. It has become possible due to appearance new high speed data links and development of new computer systems. The publication of geo data in Internet is possible by several paths [5]. Let's try to consider some from them.

The most primitive and simple method is a review of pictures in graphics formats, such as GIF, JPEG, PNG. The interface of interaction of the user with the WEB-server is in this case

rather poor and is reduced to simple choice pictures. Advantages of such method of the publication of data is:

- Low requests to the Web-server.
- Channel of low throughput.
- Availability on a customer place only Web browser.

More complicated method is the creation systems of review of the cartographical information. On the WEB-server there is a database representing a set of thematic categories. Each category contains the certain set of thematic cards stored in graphics formats, such as GIF, JPEG, PNG. The user, catching on such server, by means of Web browser by choice of a theme and region, and also appropriate conditions forms the request to the database. Result of the request to the database is imaging that or other image of a card on the screen of the computer of the user. In comparison with the previous method the given variant presents higher requests to the server, and in turn provides the more structured approach to imaging cartographical data.

The third method of the publication of geo information data in Internet is the creation of the interactive environments of interaction of the customer with the geo information server. It allows the user himself to select on sites for imaging in own Internet- browser. On each customer place the additional unit for the extension of being available graphics functions browser is placed. On the server the set of server programs ensuring interaction with the customer, analysis of operations of the customer and creation raster pictures of area indicated by the user is placed. The model of interaction of the customer with the server represents the following: the generalized site of a card is offered to the user, and, selecting more small-sized sites, the user receives more and more detail imaging of district. Such operational mode is convenient only for want of availability of a fast-track data link and of rather high-power computers on customer places. Accordingly, the interactive interaction requires more high-power servers.

Example of interaction of the customer with such geo server can be the following scheme. The generalized card is offered to the user, on which it can select a site for the consequent detaling. As on web-page of the server the set of functions for information retrieval on defining tag is offered. It can be as the list of streets, cities and field for input of criterions of search. After a set of necessary data for attributive search before the user occurs or required object in the graphics form, or list of the found objects. Selecting objects, the user receives their cartographical image. In addition there is a possibility to select graphics object and to receive all attributive information attached to graphics object. The realization of data of possibilities is based on the newest technologies of the publication of databases in Internet. The technology of interaction with databases is most critical point of view from the point of view of speed of the geo information WEB-server.

Submission Of Geo Data Software In Internet

In most cases, the modern geo information systems are equipped with a means of the publication of data in Internet. In main such means are specially developed of the WEB-server. Such server works with the arrays of the information of own GIS-systems. And only some support formats other GIS. To the main developers it is possible to relate the following companies: Intergraph, Bentley, MapInfo, ESRI. Below we shall consider main of them [6].

Intergraph for a long time attends to geo information systems and takes in the market one from leading places. Intergraph offers a complex of products under the name MGE (Modular

GIS Environment). All data MGE place in so-called MGE the project. For the publication of geo information data contained in the project, Intergraph has issued on the market a product under the name GeoMedia Web Map. A feature of the given product is that it installs the new standard for GIS technology on the basis of a new vector format of submission of the cartographical information active CGM. A feature of the given format is the possibility of connection of the information to a vector element in the file. Thus, there is a possibility to create "snapshots" of geo data dynamically in accordance with their change in the main project.

Advantages Web Map:
- It is not required transformations of the active project.
- Possibility of the publication of "intellectual" cards through Web.
- Ease of review of cards and fulfillment of the requests.

Geo Media Web Map allows to publish data of the project MGE, FRAMME, MGE Data Manager, it is simple files in a format DGN, ARC/INFO, ARC/View. For review of these data on a customer place it is required browser compatible with MS Internet Explorer. And also it is necessary to install the additional unit, which allows to look through active CGM. Bentley has issued a product ModelServer Discovery, which is intended for the publication of geo information data in Internet. A feature of the given product is that it allows to publish in Internet not only data own GIS in the GeoGraphics environment, but also data of any other project basing on technology of DGN-files. In the given category the structure MGE of the project Intergraph falls also. ModelServer is intended for organizations working with the geo information and cartographic documents. The given product on the properties is similar to the described above product of firm Intergraph; they differ only in the approaches to realization.

For operation of the customer, as well as earlier, is necessary Internet-browser, and installation of the additional unit allowing browser to work with the server. The distinctions begin for want of consideration of a server part. In difference from GeoMedia Web Map, ModelServer bases on Netscape Enterprise Server. Advantages ModelServer Discovery:
- Possibility of the publication of data in formats JPEG, PNG, SVF, CGM.
- Possibility of the publication of data from the various projects to the various users simultaneously.
- Possibility to involve in process some machines simultaneously, support of multiprocessing systems.
- Possibility of deleted administration of the server.

Principle of operation ModelServer Discovery:
ModelServer will transform basic data of the geo information project to a format indicated by the user. ModelServer consists of 3-rd units:
- Dispatcher - represents the unit in Netscape Enterprise Server. It answers for interaction of the server with internal processes ModelServer. By receiving the request given the unit transmits it further to the Shepherd unit.
- Shepherd - will organize management of processes Publishing Engine. Monitors behind start, restarting of data of processes.
- Publishing Engine - makes transformation of source geo information data to a format demanded by the user. As it answers for realization of a number of functions of the space request:
    to connect / disconnect cards;

on and off switching of cards;
geographical localization;
intersection of objects;
space search.

After the Dispatcher unit receives from the Engine unit the information in a required format, it sends it through the Netscape server to the user. As already it was marked above, ModelServer Discovery can issue the information in several formats: JPEG, PNG, CGM, SVF.

First two represent raster formats. Third - raster-vector. Last - vector. For review of the information in a format JPEG on a local place except standard browser it is not required additional software. Last three require installation special plug-in-play. Feature of a format SVF is the possibility of imaging of the information on names of layers and possibility of binding to vector elements of the information from the database. Functionally it is similar to the standard Intergraph active CGM, but visually objects represented in these formats differs. The firm MapInfo is known in the world as the manufacturer popular desktop GIS MapInfo. The MapXtreme product, made by them, is intended for the publication of GIS data of a format MapInfo in WWW. Used in MapXtreme the technology of visualization of dynamic geo information databases on use standard tags of language HTML. It allows in difference from the considered above systems to use for review of data really anyone customer browser on a platform of any operational system. And, that is important, there is no necessity of installation on what customer machine - or units of the extension. The server part MapXtreme represents open architecture MapXbroker optimized for maintenance of maximum productivity and expandability of the system. So, for want of increase of an amount of the customer requests to the server the additional resources as reserve servers of appendices can be involved. The base Web-server in the given architecture can be any WWW-server, as working under management Unix, and Windows. The requests from the base server can be redirected on auxiliary, where will be processed with the purpose of obtaining the required document HTML.

It is necessary to mark, that base MapXtreme is the command element MapX - standard element Active-X of the MS Windows environment granting full-function set of methods for integration of data of a format MapInfo with user's appendices. There is a basic possibility to use similar elements directly in HTML the documents. To ensure independence of represented data from a configuration of a customer job; MapXtreme is created as the multilevel system. On the layer MapX functions, providing access, analysis and processing of geo information data. For interaction MapX and Web-server the special Hahtsite environment is used granting a means for integration of the object Active-X in the static or dynamic HTML-document. All operations connected to the circulation directly to MapX implement only on the server, and their results are loaded to the user as graphics files. At the highest level obtained data as the text and graphics information are formatted in HTML are referred customers browsers. Advantages MapXtreme:
- Possibility of the publication of data in formats JPEG, GIF, WMF, BMP, TIF, PNG, PSD.
- Possibility of the publication of data on remote servers by means of FTP.
- Possibility use for want of creation of WWW-appendices of the various programming languages: Java, JavaScript/VB Script.
- Possibility scalability and flexibility for want of to processing of the customer requests ensuring high efficiency and minimization of used resources.

- Possibility of creation of various types of thematic maps.
- Possibility of sample of data as by means of the requests to external databases, and for want of help of special means of sample of objects inside ranges or inside specific radius.

MapObjects IMS (Internet Map Server) is the additional MapObjects unit of a package of the developer ГИС of appendices in the Windows ESRI environment. One from the most attractive new features MapObjects IMS 2.0 is the possibility to exhibit in Internet of a maps and data, accessible for ArcExplorer. ArcExplorer - program - browser of geo data having the following possibilities: functions of space sample, identification, search applied to cards, distributed through Internet. Besides MapObjects IMS 2.0 can distribute through Интернет itself ArcExplorer, as ActiveX the document. And the documents ActiveX work with Microsoft Internet Explorer, which now becomes the environment of application ArcExplorer for dynamic interaction with cards and loading ГИС of data. If necessary created with the help MapObjects IMS 2.0 appendices can interrogate Web browser and to install the document ArcExplorer ActiveX. Irrespective of in what kind ArcExplorer is used, as the usual appendix or as ActiveX the document - it is a ready customer place for MapObjects IMS.

The ArcExplorer-project determines a kind of a card (set of thematic layers with the characters, determined for each layer and scale). The possibility of operation with files of the project ArcExplorer facilitates granting cartographic services through Web with the help MapObjects IMS. MapObjects IMS 2.0 allows to distribute through Internet of a card both in raster and in a vector kind. The user independently determines what themes / layers of a card can be freely loaded with the help ArcExplorer. For example, it is possible to allow the customer to load a layer of boundaries of urban regions, but to prohibit loading a layer of streets. MapObjects IMS 2.0 includes the tool of administration of cartographic services through a graphics user interface. The managers can determine the rights on installation loading of data start and stop of appendix. Besides the managers can remotely, on global or local network to interrogate and to operate the system of the cartographic server.

Conclusion

The development of geo information decision support systems is connected first of all to the extension of a spectrum of researched problems including first of all a problems of an ecology, pollution, including monitoring of a state of an environment, in particular, analysis oceanography of a decor of World ocean. For it use of extended possibilities of data management systems, means of the analysis and submission of the information, inclusion in program systems of the statistical analysis, classification and recognition, methods of an artificial intelligence for the analysis and interpretation of results of processing is necessary. There is basis to expect that the further development of geo information systems will occur just in this direction.

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