

STRUCTURE OF A CENTER FOR PROCESSING INFORMATION FROM AN URBAN ECOLOGY MONITORING SYSTEM

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We discuss the controlling center of an ecology monitoring system of "GorodB type. We set out here the basic requirements which should be taken into account when constructing such systems. The problems to be solved by the center as well as its software and net structures are proposed.

1. INTRODUCTION

The necessity of improving the quality of natural medium, especially in industrial centers, requires creation of systems for operative monitoring of the atmospheric pollution. Such a system must acquire the initial data needed for realizing the environmental protection measures. One of these systems has been proposed in Ref. 1. In our earlier paper² we estimated the data streams, which can circulate in the system of "GorodB type, and formulated some recommendations on the use of communication links. Here we consider the structure of the center for system control. Let us remind the basic requirements imposed on the system. It should have a distributed structure and an open-type multicomponent architecture, which would allow to extend the system capabilities by incorporating additional modules. The system must ensure the possibility of being integrated into other information systems and provide for simultaneous access to data for several users. Moreover users can be outside the information and processing center.

2. THE TASKS TO BE ACHIEVED BY THE CENTER

All the requirements mentioned above were taken into account in designing the information processing center, which is intended for solving some basic problems:

- reception of various initial information obtained from measuring systems of different types by various measurement methods with unequal periodicity, transformation of this information into the uniform spatiotemporal structure;
- perform necessary processing of the incoming information;
- providing the effective and reliable storage of the data obtained;
- enable a user to get a convenient format of output data, independent of the user's location;
- analysis of the ecological situation, timely identification of the emission sources, and estimation of the scales of pollution propagation;

- formation of the short-term and long-term forecasts of the environmental situation on the base of thus obtained data with the help of various mathematical models and consulting systems;

- provide an intellectual support of the decision making for the realization of the environmental protection measures needed.

3. STRUCTURE OF THE INFORMATION AND PROCESSING CENTER OF THE URBAN ECOLOGY MONITORING SYSTEM

Figure 1 shows the block-diagram of the information and processing center of the urban ecology monitoring system. It is designed taking into account the above requirements to the center structure, and also considering the tasks fulfilled by this center.

As it seen from Figure, this system consists of a set of modules, each module performs its own set of functions. Let us consider the functions of each system module.

The module of users' interface

This module supports the interaction of the system with users: accepts the control commands and the authentication requests, receives the information, and sends the data requested. This module is the server for client's programs of users working, as a rule, at remote computers. It uses the stack of TCP/IP protocols for the data exchange between the system and users. When constructing this module, it is possible to use the Web server and to apply the principle of "thin client, B which is in use of the Web browser as a program-client at working stations. Advantages of this approach are the possibility of using cheap computers (sufficient for installation of a Web browser and not necessarily implementing the WIntel-architecture) at working stations and simplicity of organization of data exchange via Internet. However, in this case this module also performs the function of data formation and transformation into the format, which is convenient for users. Besides the efficiency of work can decrease at

intensive requests to the module, especially when the information is represented as the maps of high resolution, because of significant time needed for graphical data transfer. Therefore besides the work with

a “thin clients, it is necessary to realize the possibility of interacting with the “busy” working stations, involved in taking in and printing out bulky graphical information.

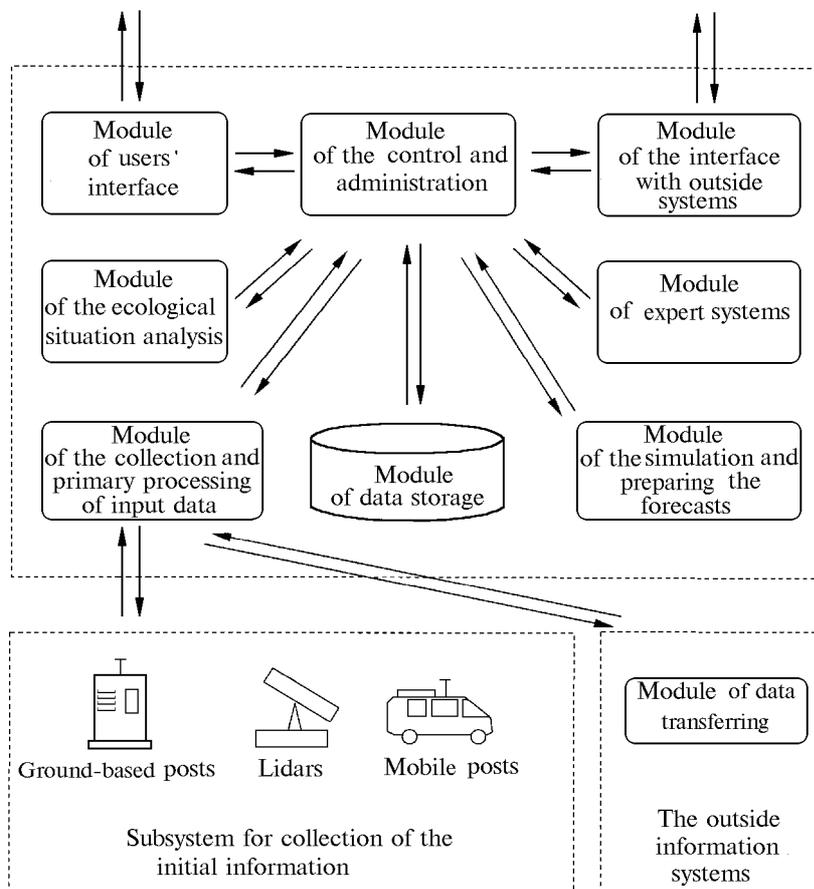


FIG. 1. The block diagram of the urban system for ecological monitoring.

The module of data storage

This module performs the functions of data storage and among its basic functions there are: storage of the initial information coming from the subsystem of data collection and from the outside information systems; storage of the cartographic information for a given region; the organization of storage and effective access to the data of the modeling module; storage and effective access to available knowledge in the field of atmospheric and ecological processes, which are needed for estimating the ecological situation over the inspected region; the storage of data obtained from outside systems, connected through the interface module.

The basic requirements to this module are: reliable and effective storage of the information, and also the multiuser access to the data stored. In constructing such a data storage it is expedient to use one of the industrial SQL-servers, such as InterBase, Oracle, or a Microsoft SQL-Server.

The module of simulation and preparing the forecasts

The data, acquired by this block, are used by the module of the ecological situation analysis to prepare a forecast of the atmospheric pollution.

This module performs simulations on the base of both the initial information and a complex of models, which shows the forming regularities and evolution of the atmospheric situation; the cartographic analysis and simulation of both the spatial processes and structures in the atmosphere; delivering of the short-term forecasts of the atmospheric situation.

The module of the ecological situation analysis

Basic tasks of this module are: to estimate the current level of atmospheric pollution based on the initial information acquired; to forecast the evolution of the atmospheric pollution using the complex of prognostic models (hydrodynamic, photochemical, and physical-statistical ones); to form warnings, when the pollution concentration reaches some specific value, or the messages about the existing environmental situation.

The module of expert systems

This module enables the functions of intellectual support of the processing and analysis of heterogeneous information acquired, which is needed for the formation of prognosis and forecast of atmospheric pollution processes; the development of organizational measures directed to the modification of the ecological situation; the acquiring of new data, the modification and the addition of available knowledge.

The module of collection and primary processing of input data

The module provides for remote control and it setups the initial information sources (posts, lidars, etc.). It is needed in organizing the data channeling with the initial information sources. It also performs primary processing of the heterogeneous input information, acquired both from the subsystem of data collection and outside the information systems.

The requirements to this module are: the security and reliability of the data channel for connection with the information sources, support of various data sources, the possibility of using various channels for information transfer, and the adequate and acceptably fast processing of the input data.

The control and administration module

It realizes the control functions over the system, and authorization of the users. This module plays a communicator role, which controls the interaction and share work of all system components. This module should guarantee the possibility of remotely controlling the system and the simplicity of incorporating additional modules.

The module of the interface with outside systems

It allows to expand the functions of the system at the expense of the use the outside modules. For interaction with outside modules we use the DCOM technology, which enables the accumulation of the distributed computerized systems because of the component approach.

4. NETWORK STRUCTURE OF THE INFORMATION AND PROCESSING CENTER OF URBAN ECOLOGY MONITORING SYSTEM

The network structure of the information processing center is shown in Fig. 2. As is seen from Figure, this system is the distributed one and consists of the several servers. The components of this system

are interconnected in the local network and use the stack of TCP/IP protocols for data exchange. The use of this protocol is stipulated by the following: practically any modern local network supports this stack of the protocols; these protocols are used in the global computer network Internet, therefore it is easy to organize the data transfer using its channels.

The input and output of the data and the control over the system are carried out from working stations, which connect the information processing center through the local network, the telecommunication lines or radio channel.

The server for connection with users and outside systems

This server performs the following operations: the interface with the user, the control and administration, and the interface with the outside systems.

The server of the data storage

This module is a computer, that stores the data and a SQL-server. The use of the SQL-server as the data storage ensures high reliability of data storage and low traffic of their transfer through the network. We used a Microsoft SQL Server.

The server of mathematical models and consulting systems

This computer provides for modeling and delivering forecasts, analysis of the ecological situation, and the function of consulting systems.

The selection of a separate server for these tasks is justified by a need in significant computational power for their realization.

The server of primary processing of the information

This server works as the module of collection and primary processing of input data.

Its tasks are: the reception and transformation of heterogeneous initial information, acquired from both the module of the initial information collection and outside information systems, to the uniform spatiotemporal structure.

The Internet gateway communication and remote access server

This server enables data transferring through both the global Internet channels (the gateway communication in Internet) and the telephone channels (the remote access server).

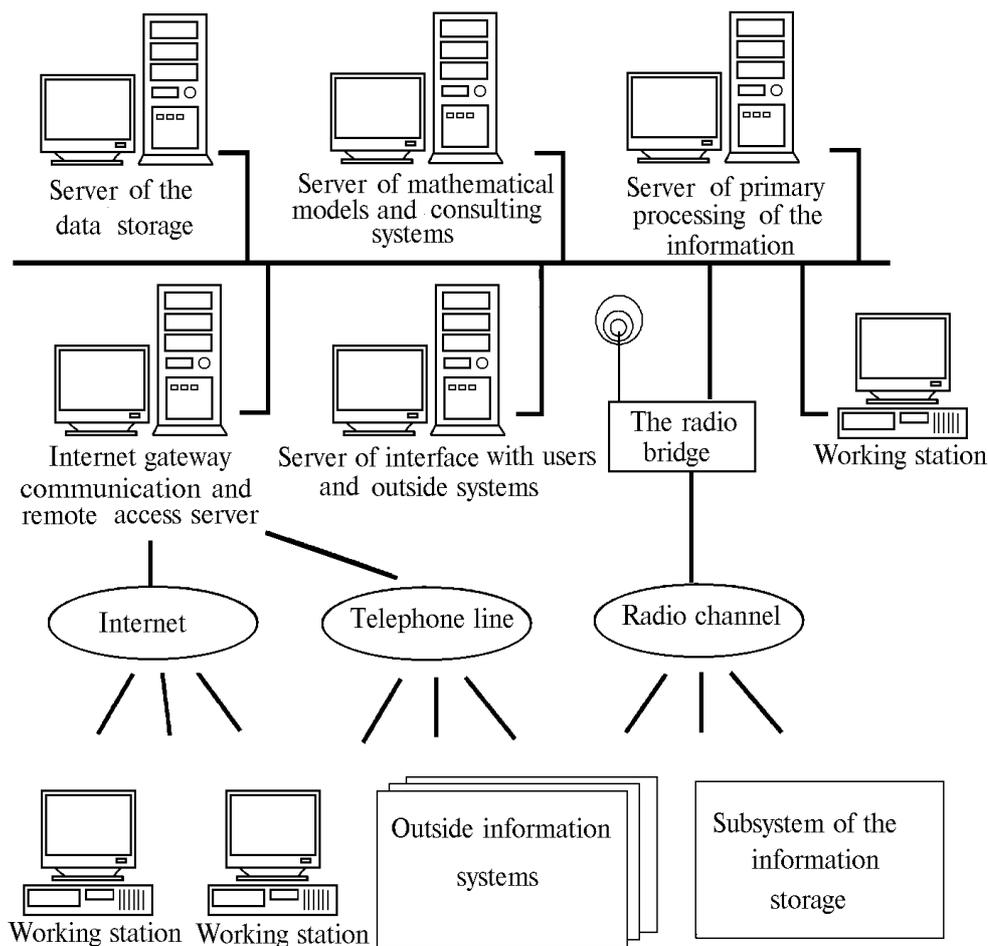


FIG. 2. The network structure of the information processing center of the urban system for ecological monitoring.

The radio bridge

It ensures the data exchange at the channel level with the help of radio channel.

CONCLUSION

Thus, the proposed above structural and network models of the information and processing center of the urban ecology monitoring system allows the

solution of the problems stated above and satisfy the requirements discussed.

REFERENCES

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