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INFORMATION SYSTEM "ECO-IS": DESCRIPTION OF SOME ELEMENTS AND PRINCIPLES OF THEIR FUNCTIONING

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***Abstract*—*In contemporary world it is really necessary to provide long-term ecological monitoring of environment because of increasing tendency of chemical pollution either in industrial regions, or after the accidents or armed conflicts, etc. Chemical pollutants can be dispersed in cases of explosions, fires, other emergencies, as well as in cases of ruining of chemical enterprises, fires of gas and oil cycle enterprises, others. Some elements of information systems for environmental monitoring "EcoIS" and "CRC" were described briefly in this article as well as some details of their organization and principles of their functioning. In present article we continue detailed description of information system "EcoIS" structure and functioning, designed for the revealing, testing and identification of chemical substances – pollutants of environment. The purpose of present study was to design some functional units for networked "EcoIS" with distributed databases and describe them in details.*

Index Terms—Information system; physical model; explosions; fires; chemical substances; chemical pollution of environment.

I. INTRODUCTION

Long-term ecological monitoring of environment is really necessary in contemporary world and different information systems (ISs), technical systems; devices were invented and developed especially for these purposes [1] – [7]. This happened due to the growing tendency of chemical pollution of industrial regions, as well as pollution after the accidents or armed conflicts, others. Chemical substances-pollutants can be dispersed in environment either in result of explosions, fires, other emergencies, or in cases of ruining of chemical enterprises, fires of gas and oil cycle enterprises, others. This sphere of technical systems developments includes usually a lot of novelties – expert systems based on different principles of data analysis and processing [8] – [10], usage of biosensors of different types [11] – [14], and so on. We had developed an information system "EcoIs" (with "CRC" subsystem) for the purposes of long-term ecological monitoring few years ago and had described already its structure and the structure of some its elements, as well as principles of its functioning [5] – [7], [9], [10], [12], [14].

II. PROBLEM STATEMENT

"EcoIS" system was designed for the revealing, testing and identification of chemical substances – pollutants of environment. Some detectors of "EcoIS" are biosensors (neuro-like biosensors); they obtained the data about chemicals from the environment. "CRC" is subsystem of "EcoIS"; it was developed especially for this data processing. "CRC" can function either separately, or being incorporated into the "EcoIS". In present article we would like to describe the principles of functioning of some other units of "EcoIS", their organization in this ecomonitoring system together with some details concerning program supply for them. *The purpose* of present study was to design some functional units for networked "EcoIS" with distributed databases and describe them in details.

III. PROBLEM SOLUTION

A. "EcoIS" and "CRC" as networked information systems with distributed databases

Characteristics of networked systems with distributed databases "EcoIS" and "CRC". The "EcoIS" and "CRC" systems are networked information systems with distributed databases [5] – [7] [9], [10], [12]. Distributed databases were constructed from several fragments placed in different nodes of the network. They can be managed by different databases managing systems DBMS. From the point of view of programs and users accessing the distributed database outside the system itself, each such database can be imagined as single local database (Figs. 1 and 2). Information about the location of each part of distributed database and other service information were recorded in the data dictionary. Such dictionary can be stored in memory

in one of the nodes ("CRC" system) or to be distributed ("EcoIS" system). To ensure correct access to the distributed database, the protocol of two-phase fixation of transactions was used.

Access to general data in these systems. The main objects of access in the "CRC" and "EcoIS" systems can be: databases as a whole by themselves, separate tables, records, and etc. [5], [10], [12]. When accessing general data, DB management tools provide two main access methods: monopolistic and collective. Since the applied DBMS had the possibility of development, the access objects in the "CRC" and "EcoIS" systems were also the specifications of reports and screen forms, requests and programs.

B. Medical and biological information system in the local network and corporate system "CRC"

In process of organizing of local network of medical and biological IS for ecological monitoring, we see as obvious condition the construction and perfect organization of local networks of biological IS, which was able to ensure the possibility of effective organization and cooperation of groups of scientists and other professionals. Local computer networks have already been constructed in all domestic scientific institutions, which give users the possibility of more effective group works, and simultaneous use of hardware resources - printers, scanners, modems, others, as well as software and information resources, including databases.

As on a separate computer, in a local computer network, the user can manage the database using DBMS means. In general, the application program can be executed under the control of the DBMS or its core, or to be independent. Actually, the "CRC" system, upon its construction, was based on the ready-made local computing network of the scientific institute and contained exclusively client-server databases in the local network. Further it was transformed into a corporate system in the Intranet. Such a system, in contrast to the client-server system, was not focused on the data, but on information in easily accessible form for scientist-biologist; and it combined the advantages of centralized systems for many users of the client-server type. However, individual programs of the "CRC" system and contents of some databases - simulation and animation models, etc. – have their value outside the local IS as well; for example, have their value for universities. Therefore in future, it would be desirable to visualize data and information from the "CRC" system in the Internet.

C. Organization of medical and biological databases of "EcoIS" system in the Internet

Developing the EcoIS system, we had assumed from the very beginning, that the data in its databases should come from many points (biostations, field expeditions, amateurs, others), and information from IS should be visualized in the Internet [5] – [7]. Therefore, the idea immediately began to develop from the construction of corporate Intranet system. Its approximate scheme was given, substantiated and described in [5] – [7], [9], [10], [12]. Such a system combined the advantages of centralized systems for many users of the client-server type. It was characterized by following features: 1) usable information was generated on the server (but not the data; for example, in the case of DBMS – the DBs records; 2) open standard protocol was used for the exchange between the client and server parts; 3) application system was located on the server, and therefore for the user who worked on the client computer, it was enough to have a program – navigator [5], [12].

For databases accessing on the client side, the main means of implementing the mechanisms of interaction between the Web–client and database server was Java language. The elements of ActiveX control can be used in addition. Scripting languages JavaScript, Jscript, VBScript are used often as auxiliary means of information processing from client side (but not for the interaction with the database); these languages were developed to expand the capabilities of the HTML declarative language on the base of the addition of some procedural means. Programs - scripts were executed on computers using a Web–browser in interpretation mode. JDBC standard had been developed to access database servers from Java programs; JDBC mean Java DataBase Connectivity – database compatibility for Java. JDBC is a standard, based on the ODBC concept. The JDBC standard was developed by Sun/JavaSoft and provided universal access to various Java databases using Java language.

In the database access model on the server side, the access to the database server was performed usually by calling the Web–server programs that are external to them. This access was realized in accordance with the agreements of one of the CGI and API interfaces. Programs, which were developed in accordance with CGI interface, were called CGI–scripts. External programs interact with the database server in SQL language, for example, by contacting a specific server directly or using an ODBC driver [5], [12].

External programs were written in programming languages C++, and PHP.

Access to the database on the server side of application programs was used when using the servers of these programs. The main language for developing distributed application programs in this case was Java.

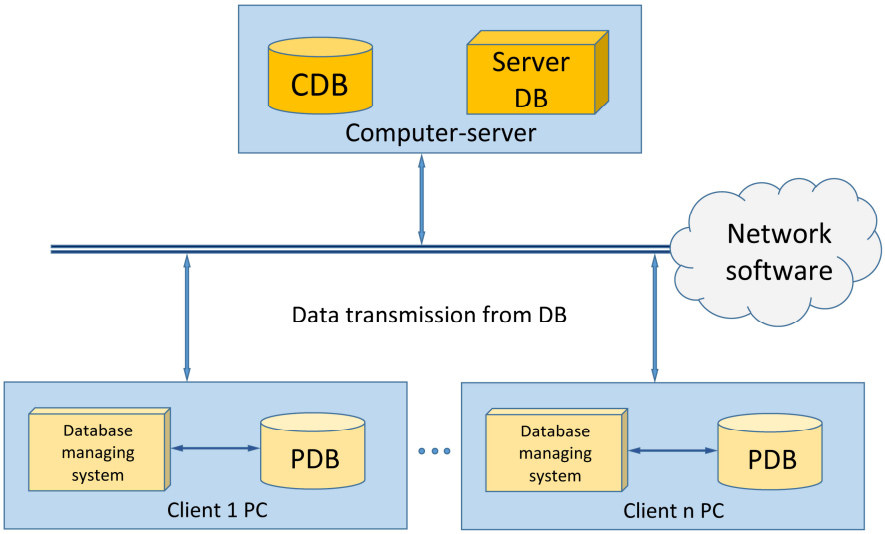

Fig. 1. The simplest IS scheme with DB server: CDB are computer databases; DB are databases; DBMS is the database managing system; PDB are personal databases (details see in text)

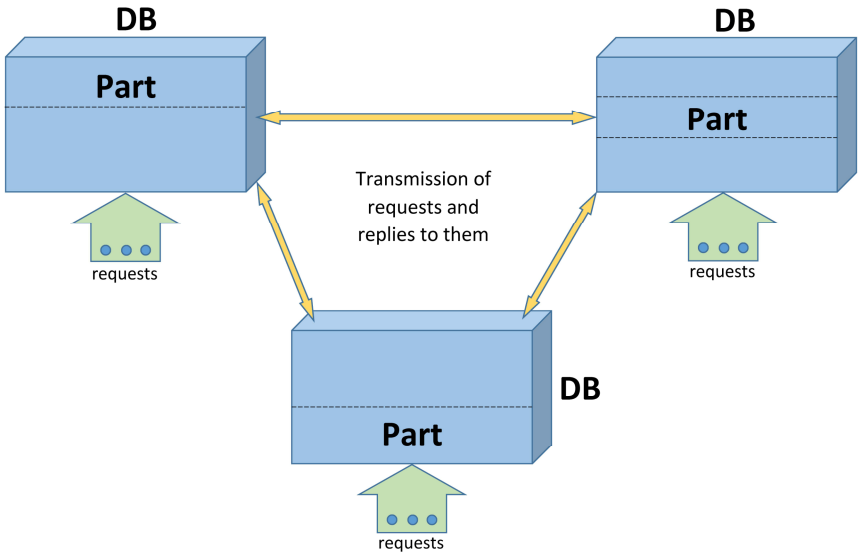

Fig. 2. Distributed databases in the "CRC" and "EcoIS" systems: DB are computer databases (details see in text)

Publication of information on the Internet. Visualization of information from the "EcoIS" on the Internet was done using technologies commonly used today. It is necessary to mention only that for such publication it was necessary to solve a number of common problems faced by all software developers of global networks [5], [12].

1) Construction of IS in the Internet based on a multi-level database architecture.

2) Organization of DBMS interconnection on different platforms.

3) Use of information from existing local network databases in the Internet. These tasks aroused when it was necessary to publish information from local intranet networks in the global network.

4) Construction of local intranets – networks based on technology of publication.

Databases in the Internet. At the same time, local networks were built on the principles of the Internet with the availability of access to the global network, if necessary:

1) Using a database to organize information and using the SQL language to search for the necessary information in the database.

2) Using DBMS tools to ensure data protection.

3) Standardization of the user interface based on the use of Web browsers and development of friendly interface. It should be noted that no standardization of the user interface was done for "EcoIS", this task has to be solved in future [5], [12].

IV. CONCLUSIONS

"EcoIS" information networked system with distributed databases was designed for the detecting, testing and identification of chemical substances – pollutants of environment. In present article we have described more in details the system for ecological monitoring of environment "EcoIS". Together with it there were described the principles of "EcoIS" and some of its units functioning, their organization in this ecomonitoring system as well as some details concerning used program supply for this. "EcoIS" obtains some data from biosensors, and "CRC" subsystem was developed especially for this data processing. "CRC" can function either separately, or being incorporated into the "EcoIS". We had described above the ways of design of some functional units for networked "EcoIS" and describe in details them and interrelations between them. For the purpose of these systems construction some contemporary mathematical methods were used [15], [16]. Some mathematical and program models were developed in process of the work [17], [18], basing on the usable in contemporary biomedicine methods of computer simulation [19], [20]. Finally, the theoretical basis for "EcoIS" and "CRC" design was provided in present article taking into account that these systems have to be based on the information obtained from biosensors, sensitive to harmful chemical molecules in environment.

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О. М. Ключко, В. М. Шутко. Інформаційна система "ЕкоІС": опис окремих елементів та принципів її функціонування

У сучасному світі дійсно необхідно забезпечити тривалий екологічний моніторинг навколишнього середовища через зростання тенденції хімічного забруднення або в промислових регіонах, або після аварій чи збройних конфліктів тощо. Хімічні забруднювачі можуть розсіюватися у випадках вибухів, пожеж, інших надзвичайних ситуаціях, а також у випадках руйнування хімічних підприємств, пожеж на підприємствах газонафтоциклу тощо. У статті коротко описано деякі елементи інформаційних систем моніторингу навколишнього середовища «ЕкоІС» та «ЦРК», а також деякі деталі їх організації та принципів функціонування. У цій статті ми продовжуємо детальний опис структури та функціонування інформаційної системи «ЕкоІС», призначеної для виявлення, тестування та ідентифікації хімічних речовин – забруднювачів навколишнього середовища.

Ключові слова: інформаційна система; фізична модель; вибухи; пожежі; хімічні речовини; хімічне забруднення навколишнього середовища.

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