The Third International Conference "Problems of Cybernetics and Informatics"
September 6-8, 2010, Baku, Azerbaijan. Section #2 "Intellectual Technology and Systems"
www.pci2010.science.az/2/16.pdf

MULTILEVEL SYSTEM FOR INDUSTRIAL OBJECTS STATUS MONITORING

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Continuous monitoring the status of the potentially dangerous objects and the adjacent area is one of the obligatory activities aimed at assuring security of the inhabitants and environment. The last decades experience and the actual data analysis witness that the most frequently emergency situations occur at chemically dangerous objects. This causes the necessity for improving the systems for continuous control of the technological process and also of the atmospheric pollution over the territory of the industrial site assuring maximal efficiency of the dangerous emissions detection.

Within the framework of the unified state scientific and engineering policy in the area of the emergency situations prevention and elimination being implemented by the Ministry of Emergency of the Republic of Belarus for this purpose the multilevel computer-aided system has been developed for monitoring the duty personnel activities when accidents occur at the stationary chemically-dangerous enterprises.

The solutions laid in the system foundation are based on integration of telecommunication technologies, expert systems and special geoinformation technologies for processing spatial information. The latter form the basis of applied facilities for efficient decision making support aimed at accidents consequences elimination.

The aggregated system structure is shown in figure 1. The system is of the expressed hierarchical structure: object, city (regional) and republican levels. The separate levels of the system interact with each other using communication networks under the specialized software control.

On the object level the automatic monitoring the atmospheric pollution is assured using the toxic substances concentration sensors. Regularly the meteorological conditions of the object are recorded (temperature, wind velocity and direction). Sensor information is encoded and transferred to the object computer. In case the emergency situation has been detected (sensor triggering) the concentration level is analysed and if necessary the system for warning and protecting the object personnel is initiated automatically. For this purpose the hardware system for automatic warning is used. In the accident progress the continuous refinement of the received information is performed by the contamination degree and meteorological conditions. The system can comprise facilities for automatic transmission of the messages being generated by the computer in compliance with the situation releasing the operator from the routine operations execution.

In parallel the information is transferred to the regional level with the automatic initiation of the system second level. On this level the decision making is assured by warning and protecting inhabitants, calculating the attracted forces and facilities. In the similar way the information is transferred to the regional and republican levels for conditions monitoring.

The system software-&-hardware implement the following functions:

– automatic detection of emergency situation on the early level of its progress and automatic transfer without the object duty personnel participation of the information to the subdivisions for emergency situations;

– instantaneous response to the incoming signal about the accident including the preliminary estimation of its scale and differentiation of the subsequent actions;

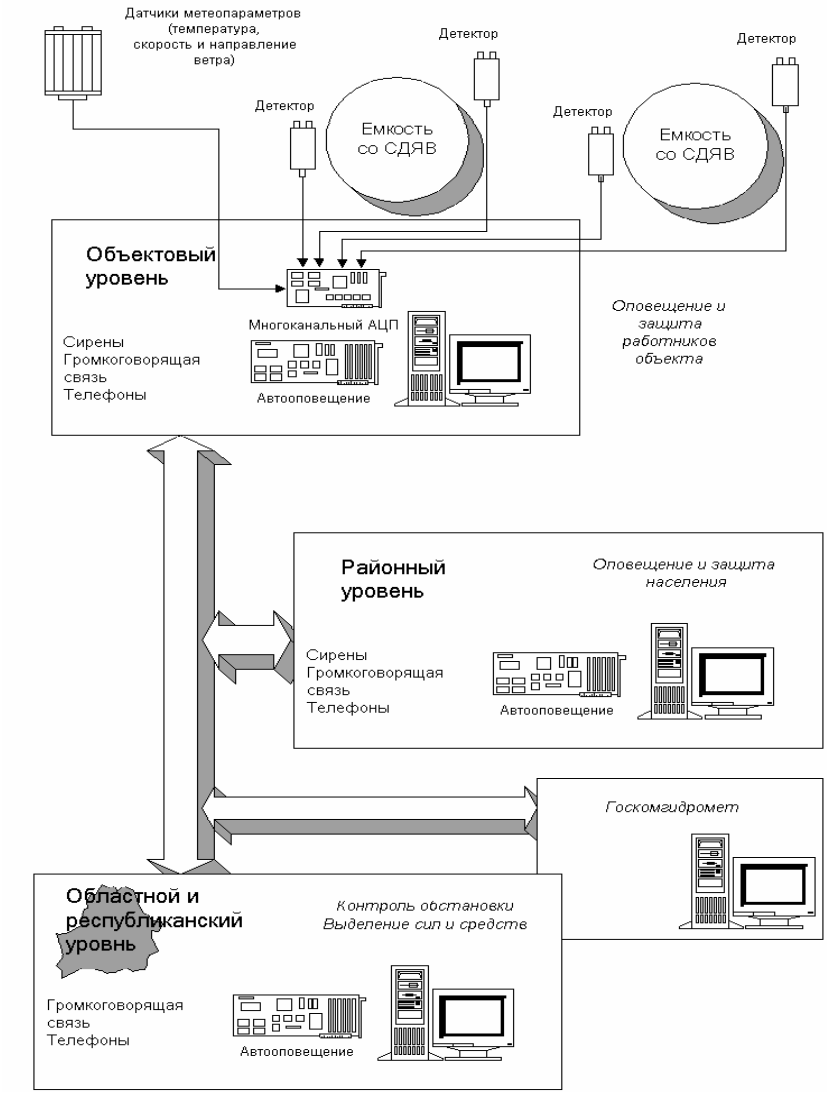

Figure 1. Structure of the system for monitoring

– working out efficient solutions by attracting forces and facilities for localization and elimination of emergency situations consequences, providing medical care, supporting the law and order with correction of these solutions depending on the situation progress dynamics;

– informing the higher organizations and coordination of different services activities with automatic transfer of information to their mobile phones.

For the specified functions implementation the hardware-&-software facilities perform:

– continuous monitoring the objects status including automatic detection of the poisonous substances accidental emissions and automatic registration of the meteorological parameters within the area of object location;

– estimation of the poisonous substances amount emitted into the atmosphere;

– forecasting the shape, dimensions, location and spreading dynamics of the damaged area with its depiction in the electronic map of the terrain (figure 2);

– selection of objects getting at the current moment into the area of damaging with their ranking by the time period of the contaminated cloud approaching and by the criterion of importance (figure 3);

– working out the sequence of the object duty personnel actions with maximal automation of the typical routine operations;

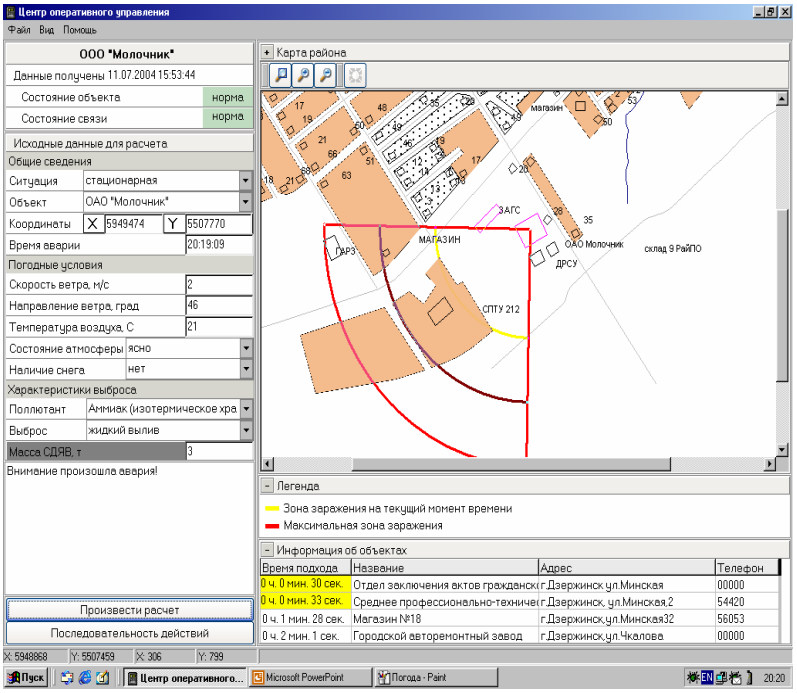

Figure 2. Mapping the situation in the terrain map and generation of the ranked list of objects within the area of contamination

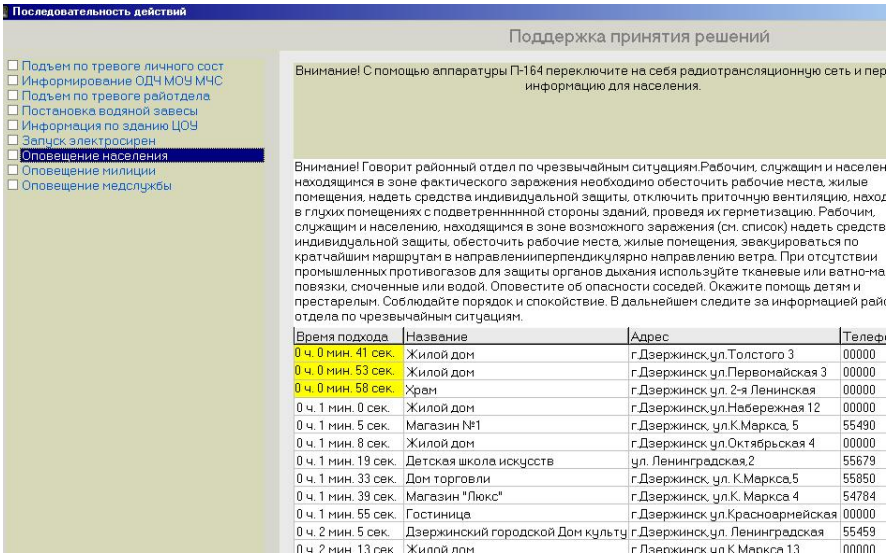

Figure 3. Generation of the duty personnel actions sequence

- automatic transferring data on the accident to the emergency situations operative control center with application of radiometers of different standards;
- recording the situation dynamics and the duty personnel activities;
- running data bases about the danger sources, ways of protection, forces and facilities available, objects cadre, phone reference book.

In the Republic of Belarus around 150 objects located on the territory of all the regions are equipped with the facilities for monitoring. By using modern computer and telecommunica-

tion technologies the system allows the operative control centers of the Ministry of Emergency to conduct round-the-clock monitoring the efficiency of the automatic objects safety systems and also to detect in proper time the potentially dangerous emergency situations and automatically respond to their appearance.

Unfortunately, the system does not cover all possible situations of the toxic substances emission. In particular, the Ministry subdivisions remain without the efficient operative control in cases of accidents at the stationary objects having no the monitoring system of their own or for example while transporting of the toxic substances.

For solving such tasks in accordance with the Union State Program "Kosmos-SG" the Belarusian and Russian experts have developed the mobile complex [1-3] being mounted on the car chassis of the improved maneuverability.

The mobile complex establishes communication and performs data transfer using the system of the satellite and cellular communication standards, environmental status monitoring at the spot of deployment with recording in real time the dynamics of the noxious gases concentration in the atmosphere, operative determination of the meteorological situation main parameters, depicting data in the digital terrain map and working out recommendations for the duty personnel.

Basic components of the complex for monitoring are the device-&-hardware facilities and the system for gathering and processing the measuring results on the basis of the notebooks equipped with the appropriate software and also the complex of techniques for observation results analysis.

Above all, this is the set of the toxic substances concentration sensors equipped with the radio facilities for data transfer and it can be located in the focus of possible damaged area and ensure data transfer via the radio link. The receive block of the complex mounted on the car assures gathering data from sensors and also receives data about the atmosphere status from the meteorological station mounted on the chassis.

The software assures gathering data, their preliminary analysis with the deliberately erroneous information filtering, running data bases, handling cartographic information represented in the MapInfo format, calculating characteristics of the possible area of damaging, its mapping and working out recommendations by activities of the mobile control point duty personnel. Besides that, the gathered data and the prepared textual and graphical materials are prepared for being transferred via the communication links to the operative control point of the Ministry of Emergency appropriate territorial subdivision – the next monitoring level of the system.

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