

**DISTRIBUTED SYSTEM FOR EMERGENCY DECISION SUPPORT  
WITH SYSTEMS ANALYSIS AND MODERN INFORMATION  
TECHNOLOGY IMPLEMENTATION**

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**KEYWORDS**

Systems analysis, emergency situations telecommunications and networks, decision support systems.

**SUMMARY**

The systems analysis and multidisciplinary approach are a necessary tools of making qualitative decisions during emergency situations when dealing with complicated problems with large amounts of information and many active agents, who influence on the consequence of events. Intelligence computer systems with telecommunications and networks using for knowledge accumulation can be efficient tools in this area.

1. Introduction

The systems approach to decision-making process is the necessary condition for successful decision in emergency situation. To work out decision support systems (DSS) effectively we

should develop knowledge collection and acquisition technology. Fortunately for people emergency events are very seldom in the same place. But if it were possible to collect all information, knowledge and successful rules about some kind of emergency issues around the world we can create more complete knowledge base. So globalization of emergency management and engineering is the main stream of Emergency Decision Support Research and Applications.

Artificial Intelligence methods and telecommunication networks allow to solve the knowledge base problem development. There are many computer networks, which are possible to be applied to this purpose. Key issue of this direction is the date of interchange protocol and systems communication technique. There are some achievements in this field in computer communication networks. But it is necessary to develop a structured, machineretrieval data format that permits data to be transferred, without transforming, from decision application in one location to an application in another location.

## 2. Background and main sources of decision support

The computerized support of decision-making is a necessary condition of making qualitative decisions when dealing with complicated problems with large amounts of information. Computer systems can be efficient if they are quickly made, well-adapted and disposed to the changing conditions and take into consideration some personal features of a decision-maker.

The main stream of modern technology for intelligence decision making is systems approach in telecommunication and knowledge based systems implementation (Britkov 1995).

Background and main sources of decision support systems design are:

- systems analysis;
- decision support systems (DSS) methods;
- artificial intelligence & knowledge based systems;
- modern information technology.

To work out decision support systems (DSS) effectively we should make and use the special program tools: generators, shells, modern programming technologies. A decision-maker will succeed using DSS if the system has intelligent features. There are the new approaches in programming technologies to raise programming efficiency are intensively worked out. They include the modern programming-mathematical methods. Logical, object-oriented and functional programming are the modern tools to solve such difficult problems. These tools make it possible to create interactive systems which allow a user to formulate a problem and store knowledge about problem-solving methods. Such methods are subdivided into general, corresponding to the subject matter, handling a concrete problem and depending on the decision-maker.

Methods of artificial intelligence and, in particular, experts systems arrange these means into a system. Great hopes in this field give the usage of CASE-technology which is fruitfully used for IS design automation. One of the major directions of future computer systems is integration of artificial intelligence technologies and information systems (Brodie 1988). Future Intelligent Information Systems: AI and Knowledge base and knowledge base management systems (KBMS) are the necessary element of artificial intelligence systems. No industrial samples of KBMS have been recently devised, data base management systems (DBMS) being well developed at the same time. The use of the latest achievements in data base technology, allows to use relational DBMS as the first version of KBMS. The use of relational algebra methods makes it possible to formalize operations over the KBMS information, to use the inference rules.

### 3. Computer aid design and support for the whole cycle of information and knowledge engineering

The modern advancement of computer technology and computer science has put forward the task of developing such computer hardware-software systems that would provide the user with appropriate computer support for the whole cycle of information processing — from the collecting of information and knowledge acquisition to the decision making.

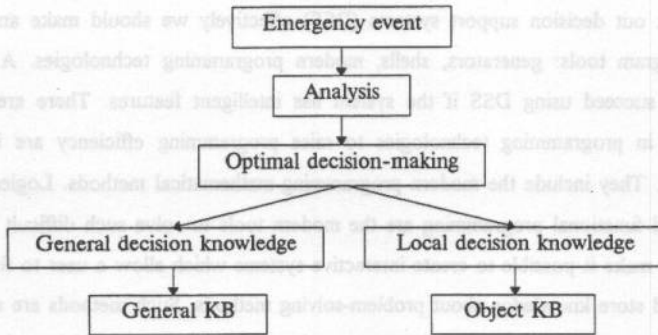


Figure 1. The Process of New Knowledge Loading  
The Decision Support System for Emergency Management

- 1) general knowledge
- 2) the specific subject matter knowledge
- 3) the specific task (object) knowledge.

The boundary between these knowledgebases are relative and are determined by the mode of use of proper knowledge (Britkov and Vyaslov 1994). This knowledge is used at the following stages of development using formal and non-formal methods of designing (Cauvet 1988).

According to this methodology it is necessary to develop special structure of network and some subnetworks. There are some levels of exchange of experience and knowledge about emergency situations and decision making in these cases. Every subnetwork connects the objects of the same kind or the same branch of industry. We should develop acquisition technology. As usual emergency events are very seldom in the same place. But if it were possible to collect all information about some kind of emergency issues around the world we can create more complete knowledge base. So globalization of emergency management and engineering is the main stream of Emergency Decision Support Research and Applications.

5. Communication and cooperation in distributed decision-making system

It is very important global (international) aspects of such activity, because in every country emergency situation may be not very often (fortunately). International experience and collaboration will give a good chance for knowledge based emergency decision support systems development.

Recent advances in intelligent distributed decision-making system (Pinson, S. and Moaitis, P., 1995), particularly in the field of communication and cooperation, display very promising ways of problem-solving in the field of emergency decision making. We consider a methodology for building distributed decision-making system with some typical objects and exchange knowledge (Figure 2).

There are many computer networks, which are possible to be applied to this purpose. Key issue of this direction is the date of interchange protocol and systems communication technique. There are some achievements in this field in computer communication networks. But it is necessary to develop a structured, machineretrievable data formats that permit data to

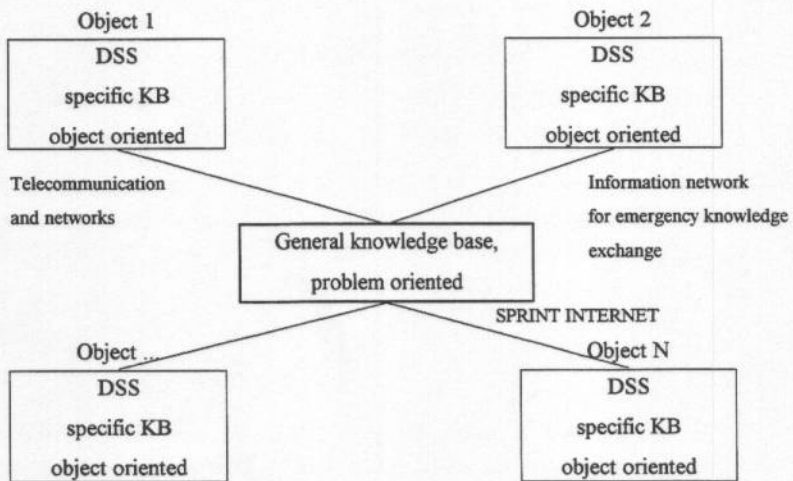


Figure 2. System architecture of developing approach

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