INTERNATIONAL KNOWLEDGE BASED SYSTEM FOR EMERGENCY DECISION SUPPORT

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ABSTRACT

The computerized support of decision-making is a necessary condition of making qualitative decisions during emergency situations when dealing with complicated problems with large amounts of information. Intelligent computer systems with telecommunications and networks used for knowledge accumulation can be efficient tools in this area.

INTRODUCTION

The computer support of decision-making is a necessary tool for emergency situations. To work out decision support systems (DSS) effectively we should develop acquisition technology. As usual emergency events are very seldom in one place. But if it were possible to collect all information about some kinds of emergency issues around the world we could create a more complete knowledge base. So globalization of emergency management and engineering is the main stream of Emergency Decision Support Research and Applications.

To solve this problem it is necessary to develop an international information network for emergency knowledge exchange. There are many computer networks which are possible to be applied to this purpose. A key issue of this direction is the data 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, machine–retrievable data format that permits data to be transferred, without transformation, from a decision application in one location to an application in another location.

Another key issue of the task is the finance and organizational problem of such kind of systems development. The key idea of this approach is involvement of an insurance company in this activity. There would be some benefit for an insurance company to develop such kinds of systems. In this case it is possible to decrease the loss from emergency events. An international association created by researchers, users of those systems, and insurance companies is an effective way of solving the finance and organizational problem.

INTELLIGENT METHODS OF DECISION SUPPORT SYSTEMS DESIGN

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. To work out decision support systems (DSS) effectively we should make and use special program tools: generators, shells, and modern programming technologies. A decision maker will succeed using DSS if the system has intelligent features. These two directions in intelligent DSS design are investigated in this paper.

In view of the announced crisis in programming technologies new approaches to raise programming efficiency are intensively worked out. They include modern programming–mathematical means. 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 methods, methods corresponding to the subject matter, methods of handling a concrete problem and methods depending on the decision maker.

Methods of artificial intelligence and, in particular, expert systems arrange these means into a system. Great hopes in this field are given by 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 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 inference rules.

COMPUTER SUPPORT

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 decision making. Considerations include:

- the improvement of informational support for computer systems as well as the availability of such support, for almost the whole range of scientific disciplines dealing with the Earth and ecology;
- large amounts of accumulated unprocessed and uninterpreted information;
- the importance of rapid accessibility and efficiency of utilization of corresponding data bases in order to successfully address a wide variety of social, scientific and economic problems; and,
- the existent high level of modern computer hardware and software which allows us to efficiently collect, store, retrieve and process a large knowledge base.

The development of such systems which is presently underway brings about the need for the working out of the basic principles and mechanisms of their functioning as well as for the development of special program modules which would necessarily have to be included in such systems. Among the

emerging tasks which will have to be implemented are the following:

- creation of regional centers;
- development of computerized workstations and terminal stations on the PC base to be used by specialists from various fields of knowledge in their work;
- development of problem–oriented mathematical models in parallel with the development of more general techniques for data processing and analysis; and,
- creation of efficient decision making techniques including those which could be applied to cases with insufficient information or to cases with varying reliability levels of information (Britkov 1991a).

Among the major advantages of this approach are openness and the use of advanced man–computer dialogue techniques. Openness implies the possibility of an easy coupling to the System of additional data bases, models and data processing routines. The System's man–computer dialogue interface is oriented towards the use of more advanced devices and facilities for man–computer interaction with a wide exploitation of multimedia methods (Britkov 1992).

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According to the conventional methodology (Britkov *et al.* 1980) the first stage of design is subject area modeling. A subject area knowledge base is developed at this stage which can be divided into three parts (Britkov 1991b):

1) general knowledge;
2) specific subject matter knowledge; and
3) research specific task knowledge.

The boundaries between these databases are relative and are determined by the mode of use of proper knowledge (Britkov and Vyasilov 1994). This knowledge is used at the subsequent stages of development using formal and non–formal methods of design (Cauvet 1988). The E–R approach (Chen 1976) has recently been the most popular for subject matter modeling of information systems. Despite its limited nature and drawbacks it is widely used in projecting tasks. A vast score of attempts to develop and generalize the E-R approach have been taken (Gutzwiller 1988), but none of them has reached the stage of being well developed.

According to this methodology it is necessary to develop the special structure of a 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 objects of the same kind or the same branch of industry.

There is positive experience between mathematicians and insurance companies collaborating in an actuary society. The international aspects of such activity are very important, because emergency situations may not be very frequent in every country (fortunately). International experience and collaboration will give a good chance for the development of knowledge based emergency decision support systems.

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