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THE MAIN PRINCIPLES OF THE DISTRIBUTED GROUP DECISION SUPPORT SYSTEM IMPLEMENTATION

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Abstract

The article is intended to describe the main principles of the developed distributed group decision support system, its features and implementation. The developed distributed group decision support system provides technical and informational support for decision-makers, while allowing to teach, test and evaluate group of users.

Анотація

Дана стаття призначена опису головних принципів розробленої розподіленої системи підтримки прийняття групових рішень, її особливостей та реалізації. Розроблена розподілена система підтримки прийняття групових рішень забезпечує технічну та інформаційну підтримку осіб, що приймають рішення, дозволяючи навчати, тестувати і оцінювати групу користувачів.

Introduction

Distributed group decision support systems are designed to provide a collaborative work environment for distributed users, and enable them to interact with each other in real time. For greater mobility and flexibility of the system and the connection of users that are geographically distributed it is necessary to use the latest technologies that allow combining multiple users into a single network. It is also necessary to take into account possible delays in time for decision-making, arising from the use of distributed technologies.

The process of supporting the group decision making in such a system contains a large number of elements which should be taken into account during development, especially if these systems allow to connect users that are geographically distributed.

Principles of the distributed group decision support system

The distributed group decision support system is an interactive automated system that allows users to collaborate, make group decisions and simultaneously use data to identify and solve problems. The main advantage of such systems is the ability to combine computing resources of geographically distributed computers into a network to ensure the efficiency of group decision making. The main disadvantage of such systems is the need to account for a large number of factors affecting the operation of the system (conflict situations, delays, etc.) [1, 2]. The developed distributed group decision support system implementation is based on the client-server technology and uses the Windows Communication Foundation to exchange the data between users over the network. The main features of the developed distributed system are:

- Selection of the decision-making process mode.
- Identification of users.
- Decision-making process organization.
- Determination of the number of correct and wrong decisions.

The system has been developed to provide collaborative work environment for the group of users, during the construction of software code modules in the correct sequence. The process is divided into several steps. During each step the users are given a certain amount of time, after which the results are formed and analyzed. The system ensures the operation of two modes of the group preferences: the Majority principle mode and the Bayesian network mode, which allows to compare the effectiveness of decisions and the number of conflict situations arising in the process of decision making [3, 4].

The use of mathematical apparatus of Bayesian networks allows the system to make complex decisions based on recalculation of a priori probabilities of appearance of blocks of test code and user decisions. Each user's decision affects the overall system decision. This is done by introducing new evidences to the existing Bayesian network. Each user's decision increases the probability of the current alternative and its dependent alternatives. This rule also works in the opposite direction: that is, every non-confirmed alternative reduces the probability of occurrence of the next dependent alternatives [3].

The experimental research of the developed distributed group decision support system confirmed the efficiency of the system in connecting distributed users. Time delay in selecting alternatives was minimal and was not distracting from the overall decision-making process. During the research of the developed system, it was also established that system decision-making time at each stage of the selection of alternatives during the Bayesian network mode was in general 15% less than the Majority principle mode (Table 1 and Figure 1).

Table 1 – System decision making time at every stage of the decision-making process

System decision time (Majority mode, milliseconds)	**System decision time (Bayesian network mode, milliseconds)**
25150.4078	14228.2859
31631.9138	34222.3072
27377.4517	24535.3605
30510.7554	22113.6973
30779.2818	25295.8664
24626.2601	22828.8182
33591.5552	26675.1556
22329.7059	26202.7793
Total decision-making time	
225997.332	196102.27

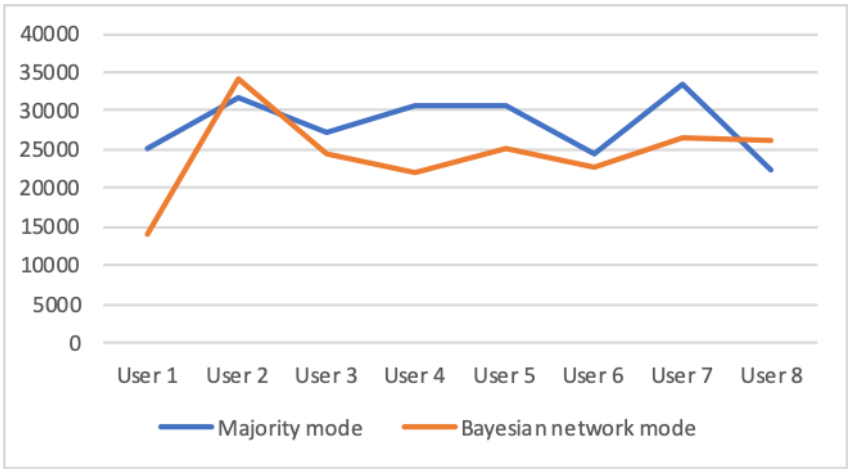

Figure 1 – The comparative chart of system decision-making time using the Majority and Bayesian network modes

As a result of experimental research, it was also revealed that the use of Bayesian networks allows to significantly increase the efficiency of decision-making process. The decision is made by the system in 100% of cases, avoiding conflict situations that occur while using the Majority principle mode. In particular, it was established that only 12 decisions were made out of 43 during the Majority principle mode, as there were 31 conflict situations and users had to repeat the same step until the majority was formed. During the Bayesian network

mode, no conflict situations arose and the decisions were made 43 times out of 43. In other words, the Majority principle mode is only effective for 28% of decisions, and the use of Bayesian networks allows increasing the efficiency of decision-making process in distributed systems by 72% (Figure 2, where 1 – decision was made, 0 – the decision was not made).

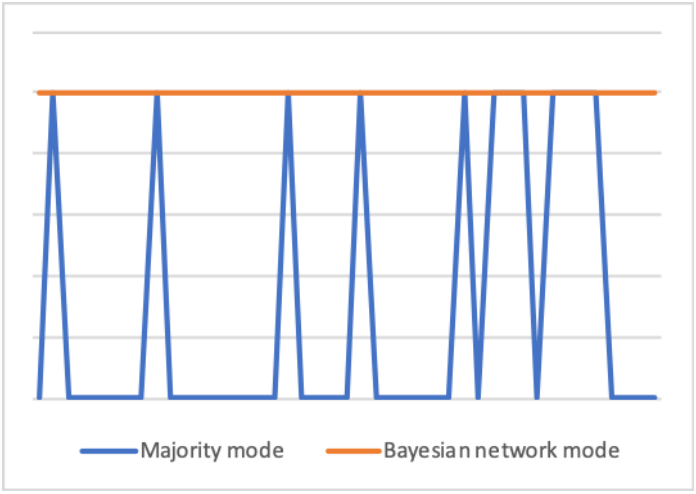

Figure 2 – The comparative chart of decisions made or not made by the system using the Majority and Bayesian network modes

The described features of the developed distributed group decision support system will allow effective usage of the system in educational processes, due to a possibility of distance learning and control of students' knowledge. A distributed group decision support system will also allow a large number of students to work together simultaneously, for example connecting different groups of students involved in Software development classes [5].

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