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REAL-TIME INTELLIGENT DISPATCH SYSTEM FOR MINING **ENTERPRISE**

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ABSTRACT:The identification of technological situations for the mining enterprise dispatch control is a complex problem, because each event is described by a lot of varying on time parameters. To solve this task, the object-oriented expert shell and system have been developed. The tree-structured models with temporary delays on branches were used to create the knowledge base. Also the temporary parameters were added in the inference engine. It permits to take into account the dynamic changes of control object, providing sufficient share of adequacy. The offered model of the knowledge base allows to describe the reason-consequence aspects of the event identification, to recognize various situations simultaneously. The proposed knowledge base model, created on base of object-oriented approach, generalizes the properties of frame-production knowledge representation. The functional structure of system is considered. The system supports two modes: "off-line" and "on-line". The mode "off-line" is intended for modification of the knowledge base. The mode "on-line" executes the scanning of the knowledge base in real time scale, automatic diagnostics of technological situations. This mode is supported by communication subsystem, connected with data units and technical devices. This subsystem mode allows to receive the information and to collect statistics, as well as to operate industrial object, changing the parameters of device functioning.

The increase of mine enterprise functioning efficiency requires the qualitatively new approach to statement of tasks decision making in operative-dispatching management (ODM). The experience of ODM automated systems designing shows that an inclusion of expert system into the control loop is very perspective at present, that allows to increase the intelligent level of accepted decisions. The flexible combination of object-oriented methodology and knowledge bases, and using of modern meanings of information visualization have allowed to define the new approach to statement and resolving of decision-making tasks in ODM-systems At present the process of decision-making on recognizing of situations remains one of the most difficult tasks for operative staff, especially at occurrence disturbance situations. Specific character of discussed subject area are: necessity of work in real time scale; large volume of knowledge; restrict computing resources in control contour.

The using of structural elements of description - cause-effect trees with time delays are proposed, named by real-time knowledge trees (RTKT). The RTKT is a binary tree, so its nodes are the points of branching having one input and two outputs (or no outputs). Each node corresponds to some condition being analyzed in the process of diagnosticating. The analysis permits to choose branch of the further moving along RTKT. As a result the movement along RTKT is applied to one of the possible output branches: along the "Yes" branch if the condition is supposed or along "No" branch in the opposite case. The output branches of a node are the input branches of other ones. The absence of node output branches means the situation analyzing to be completed. Such nodes are appointed as RTKT leaf nodes. They include analysis resulting messages or corresponding instruction items prescribing control actions to be applied at diagnosticated object. The condition attached to a RTKT vertex is a knowledge unit The event identification implies the condition test which may be referred to one of fourth types [1]

Jn general kind the model of subject area for task of recognition non adequate situations on intelligent ODM system of mining enterprise is presented as

M = { (T,N,P)/t}, where t- time factor;

T = { Ti} (i =1 ,m) - a set of tasks or subsystems

N ={N1,…, N4 } - a set of data for every task and vertex;

P = { Pj } (j = 1.0 - a set of inference procedures of knowledge tree.

System software support is created in object-oriented language C++. The object-oriented methodology allows to work out the most complete and precise model of real technological management subject. Such features as polymorphism, encapsulation and inheritance hierarchy permit to describe entities and relationships of subject domain in more conceptual style. Object-oriented software has more compact code.

The expert dispatch system is operating in two modes: autonomous (off-line) mode and operative (on-line) mode. In off-line mode filling and updating of knowledge base occur. In on-line mode analysis and identification of technological situations occur.

The method of step-by-step iterations is offered as a inference engine. This method differs from well-known inference algorithms of treelike knowledge base structures. It takes into account specific character of the consider domain (real time scale, lot of complex interconnected parameters, etc.). It necessary to reduce field of decision search. It is reached by strict requirements to knowledge base creation. Thus treelike knowledge base model is induced from expert rules-productions on the base of decision table. Essential parameters is revealed, and recorded into root Vertexes of knowledge tree. Causal-sequential connections between various objects (parameters) is investigated. As a result, compact knowledge model TREE is created. Each concrete situation is identified by specific tracing tree path. (Vertex of knowledge tree are opened, conditions are checked up, on each step from vertex to other vertex decision 'yes-no' is made). If deviations of essential technological parameters are not fixed, normal status of management subject is registered; in case of insufficient information the inquiry to the user is produced. Thus the situation is identified in accordance with change appropriate technological parameters without searches in knowledge base.

On Fig. 1. functional structure of software and the expert system blocks is illustrated. The submitted software supports knowledge representation method and gear of situation identification considered above and in reference more detail.

The situation analysis is initiated by the continuous main technological parameters control program. It always starts by entrance in a root knowledge tree, executed block of tracking on knowledge tree. When vertex is opened, the block of tracking marks it in the tracking list, path registration block then passes the control to vertex opening block. Timer control block and condition test block are used in process of vertex opening. Required knowledge tree unit is received with the help of input-output element knowledge tree block. Current technological parameters values are received from technological monitoring system, that gauges pickups, concentrates data and collect statistics, as well as to operate industrial object, changing the parameters of device functioning.. When having found the 4-th type condition node the vertex opening block makes query to dispatcher, by message and inquiry output block. When 2-th type node is tested for the first time, it is necessary to delay the inference algorithm fulfillment for a time declared by expert. The delay is realized by a restart organization block. The control is returned to the block of tracking on knowledge tree. As soon as the vertex opening is finished. The restart time is determinate by timer block. This significance is passed to the operating system supervisor. If the block of tracking on knowledge tree reaches a leave, the message encapsulated in the leave is appeared on the control monitor. The path registration block compares current and previous paths before outputting of message. If these paths are identified, the message is not displayed.

The system operates in the interactive mode. The marked block on illustration (creation, edition and updating knowledge base) are used for maintenance of the off-line mode. The rest program blocks are the part of system orientated for the real-time work (on-line mode).

CONCLUSIONS: This expert system was tested and it operates in Windows 3.X, Windows NT, Windows 95, HP UX 9.X. Communication subsystem of technological monitoring is constructed on base OWL 2.0 with use Visual Solution Pack 1.0, X-Toolkit. Flexible the combination of object-oriented approach and knowledge bases for representing of real information essences of subject area in kind of tree-sample structures is the most by justified approach to intellectualization in given subject area. The end user, in result, receives the simple opportunity for working with essences of subject area, as with objects, used in skilled activity, and such properties of object-oriented methodology as polymorphism, inheritance, encapsulation permit to reach the compactness of program code of system. Considered methodology need be used in information support of dispatchers system engineering at acceptance of decisions in various subject areas.

REFERENCES

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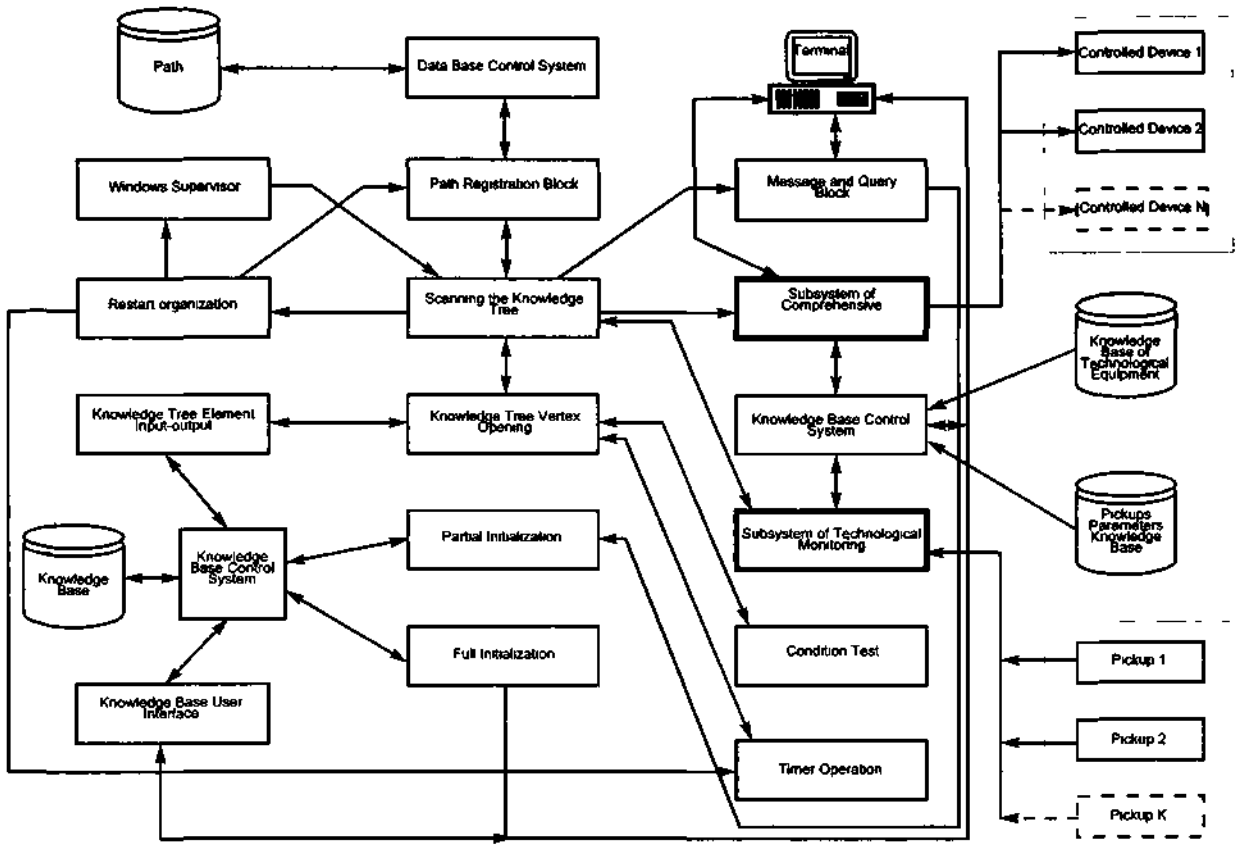

Fig. 1. Functional structure of intelligent dispatch system