AP19680292 "Development of an expert system of decision-making on the issues of fastening and maintenance of mine workings" - p.m. Tomilov A.N.

Relevance:

The main difference of the created software product is the use of both heuristic and algorithmic methods, which allows to give the most optimal result of queries.

The knowledge base of an expert system contains rules (or other knowledge representations), using them as a basis for decision making. The inference mechanism contains general knowledge about the scheme of task solution management. This mechanism contains two components: the interpreter and the dispatcher. The first of them determines how to apply rules to infer new knowledge, and the second one establishes the order of application of these rules. The knowledge base editor is intended for modifying the rules of the expert system, as well as for entering new knowledge into the expert system.

The project purpose:

The project purpose is to create a domestic expert system aimed at presenting solutions to the issues of fixing and maintaining mine workings using both heuristic and algorithmic methods, which allows to give the most optimal result of queries. The knowledge base and the main software of the expert system are supposed to be hosted using cloud technologies.

Expected and achieved results:

- A prototype of the user interface (UI/UX) of the expert system for fastening and maintenance of mine workings was developed, which includes the following functional modules of the system.

• The geologic data input form allows you to enter and edit information about the geologic conditions of the mine workings.

• The form for entering data on excavation design allows to set parameters of excavation design.

- The software of the Knowledge Base of the expert system for fastening and maintenance of mine workings has been developed. The knowledge base module is a key component for storing and managing critical information. Including databases on rocks, excavation structures and support materials, as well as calculation algorithms and expert rules, this module allows to perform detailed analysis, generate recommendations and predict excavation behavior. As a result of the development of the knowledge base module of the expert system, the efficiency and accuracy of decision-making on the selection of the characteristic of the applied support of the mine workings is increased.

A Knowledge Base Editor Module has been developed that allows engaged mining experts to create, update and manage the information required for the effective functioning of the system. Experts can easily add new records, modify existing data, and delete outdated information, ensuring that the knowledge base remains current. Built-in automatic data update mechanisms help keep information current without additional effort on the part of users. The ability to search and filter information allows you to quickly find the data you need and link it to other elements of the knowledge base, which facilitates deeper analytics and a better understanding of current conditions.

1. Prepared 1 article or review in a peer-reviewed foreign or domestic publication recommended by SHEQAC:

Mutovina N.V., Smagulova, A.S., Demin V.F. (GF), Kalinin A.A., Tomilov A.N. "Optimization of parameters of anchoring of mine workings taking into account factors of operating conditions: analysis of mines of Karaganda coal basin". Journal "Proceedings of the University", publishing house Abylkas Saginov Karaganda Technical University.

2. 1 article was submitted to a peer-reviewed scientific publication in a scientific field indexed in Science Citation Index Expanded and included in the 1st and 2nd quartile of the impact factor in the Web of Science database and having a CiteScore percentile in the Scopus database not less than 65: "Developing the technology of driving mine workings with a combined support and friction anchors in ore mines".

Demin V.F., Bailuldin M.M., Tomilov A.N., Smagulova A.S., Mutovina N.V., Kalinin A.A., Shokarev D.A., Aliyev S.B., Nikonova T.Yu., Demina T.V. Издательство MDPI, Journal Applied Science. JCR - Q2 (Engineering, Multidisciplinary) / CiteScore - Q1. Quartile 79.

3. 1 article was prepared for publication in a peer-reviewed scientific publication in a scientific field, indexed in Science Citation Index Expanded and included in the 1st and 2nd quartile by impact factor in the Web of Science database and having a percentile by CiteScore in the Scopus database not less than 65:

Demin V.F., Bailuldin M.M., Tomilov A.N., Smagulova A.S., Mutovina N.V., Kalinin A.A., Shokarev D.A., Aliyev S.B., Akpanbaeva A.G., Demina T.V. "Development of Mining Technology with Combined Support and Friction Anchors on Ore Mines". Publishing House MDPI, Journal Geosciences. CiteScore - Q1. Quartile 79

Figure 1 - Program code example

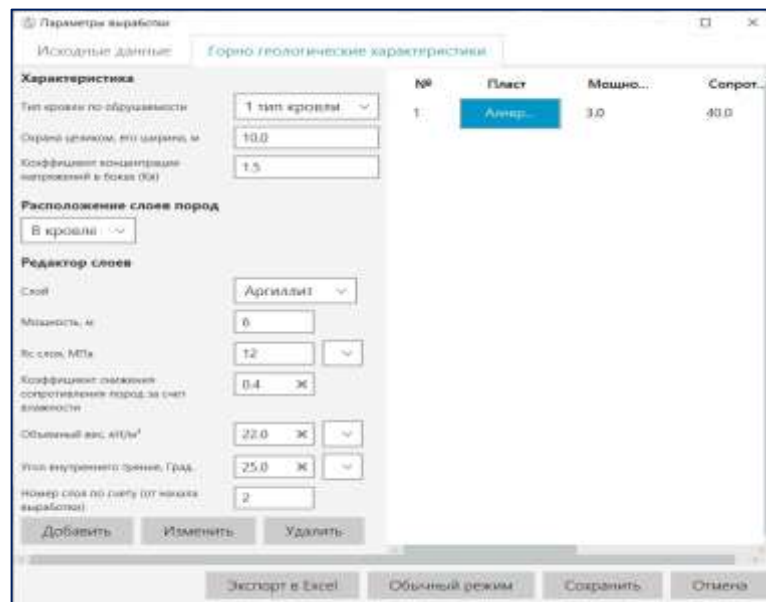**Figure 2 - Optimization of support selection**

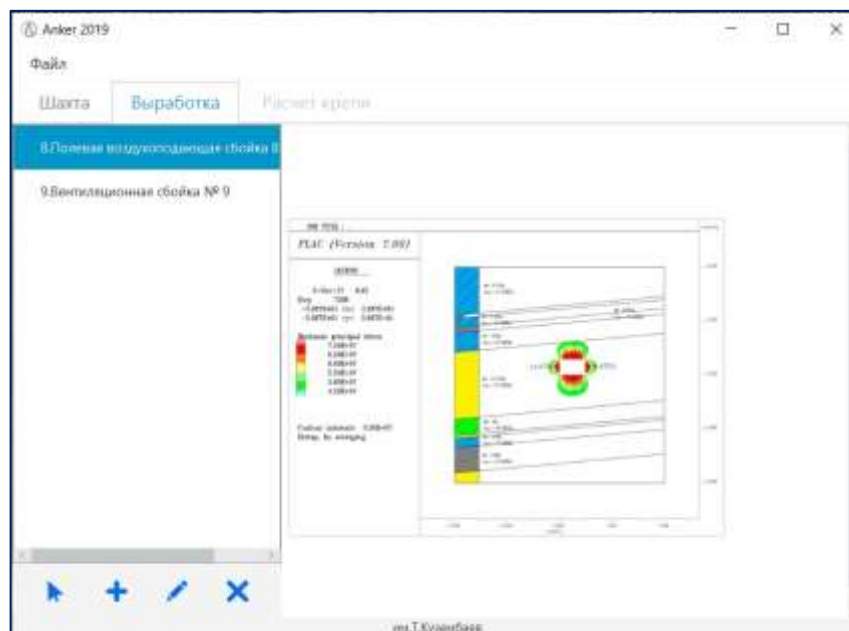**Figure 3 - Mining and geological characteristics**

Figure 4 - Definition of mine workings

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List of publications and expected publications:
- Mutovina N., Smagulova A., Demin V., Baimuldin M., Tomilov A. "Development of an Expert System for Fixing and Maintaining Mine Workings in the Mining Industry" / Proceedings of the University, No.3, 2023г С.400-406. DOI 10.52209/1609-1825_2023_3_400
- 4 (four) articles and (or) reviews will be published in peer-reviewed scientific publications indexed in Science Citation Index Expanded and included in the 1st (first) and (or) 2nd (second) quartile by impact factor in the Web of Science database and (or) having CiteScore percentile in the Scopus database not less than 65 (sixty-five);
- two (2) articles or reviews will be published in a peer-reviewed foreign or domestic publication recommended by SHEQAC.

Information for potential users:
The Expert System for Mine Support and Maintenance can be useful for anyone working or researching in mining and underground construction, providing rock analytical data, evaluating mine stability and developing maintenance methods. Companies specializing in the construction of mines, tunnels, underground structures and mining facilities can use the system to develop and apply optimal anchoring and support methods. The system provides the user with not only information and guidance, but also the tools to make informed and educated decisions that help improve the safety, efficiency and reliability of mining and construction projects.

Scope:

Field of application: surveying and geotechnical services of mining enterprises, allowing to make decisions on the issues of fixing and maintenance of mine workings in a short time on the basis of empirical and algorithmic methods. The normative methods of calculating the parameters of mine workings support included in the knowledge base ensure compliance with all safety rules during mining operations adopted in the Republic of Kazakhstan.

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