INFORMATION SYSTEM FOR EVALUATING THE SAFETY CONDITIONS OF MINING OBJECTIVES

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Abstract

The evaluation of the safety conditions of the areas bordering mining objectives can be achieved through the development of an information system that allows the integration within a common database of information regarding the constructive and development characteristics of mining objectives and information resulted from monitoring activities. To elaborate the information system, the constructive technical data specific to each mining objective as well as data periodically obtained from measurements, monitoring activities, inspections, etc. are required. In the case when measurements and values of monitored parameters are transmitted in real time then the system becomes the main source of information necessary in order to make decisions in case of emergency situations.

Key words: *information system, GIS, mining objective, monitoring.*

1. Defining the information system characteristics

To define the characteristics of an information system one should take into consideration the attainment of the general purpose followed by the creation and implementation of this system.

The desired general purpose refers to the evaluation of the safety conditions of mining objectives and the influence of mining objectives upon the environment which can be attained through:

- Creating a database at the national level with information about mining objectives being under development, conservation or closure
- Monitoring the environment problems and mining sector level processes;
- Creating a decision making support for the management of emergency situations based on:
  - o Identifying the critical points and situations;
  - o Possibilities of early warning;
  - o Highlighting the effects of mining activities on the environment;
  - o Estimating the effects produced in the case of critical situations arising

To attain the general goal, the information system must contain at least three basic modules:

- **Management**, destined for the unitary management of information referring to mining objectives
- **Monitoring,** destined for the collection, centralizing and interpretation of data resulted from the monitoring activities
- **Decisional support,** destined for the periodical generation of analysis, situations and reports

From a constructive perspective, the architecture presented is specific to a geographic information system, generically titled GIS, the data and information being specific to the mining sector.

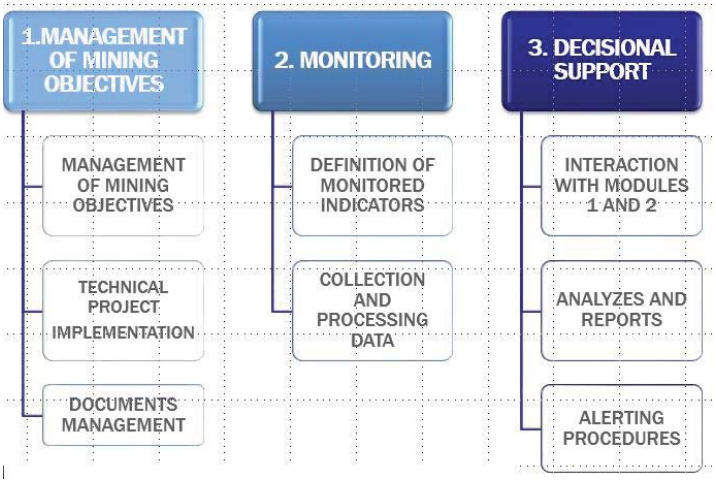

Fig.1. *Basic modules of an information system for evaluating the safety situation of mining objectives*

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2. Description of the functional components of the information system

a) The management of all information referring to mining objectives, including:

- Geographic localization of the objective;
- Filling out the basic description attributes: objective code, objective name, build date, development commencement date, date of end of activity, topographic number, cadastral number, type of property and ownership of the deed, condition of the objective (active, activity terminated / abandoned, in conservation, closure / greening, post-closure monitoring).

b) Managing execution projects: work localization, filling out the constructive characteristics (mass, area, volume, cross-section) date of construction, date of closure.

c) Managing the documents, respectively registering all the documents and associating with the mining objective (activity commencement plan, technical project, approvals, construction approval, demolition permit, mining register, etc.)

d) Monitoring (defining the monitored indicators, collecting and processing the monitoring data, specifying the admitted data and alert thresholds, alert procedure);

The basic functions of the monitoring module must ensure the application of the following operations:

- Spatial localization of the tracking alignments for the support and connection reference points;
- Descriptions of placement and materialization method;
- Measurement method used;
- Selection of the monitored indicator category
- Definition of the influence factor category;
- Inputting the measured values (time series);
- Automatic association and import of information from the monitoring sensors, import of measurement files;
- Visualization of the monitoring stages and plan (indicators, frequency).

In case the monitoring plan is modified during the process, either by including new parameters or by eliminating certain parameters that are no longer of interest, the monitoring plan must be updated while at the same time maintaining the original version. The modification of the monitoring plan is imposed by the measurement results in the sense that if there is a determination that in a significant period of time the values of the measured parameters are constant, then there can be modified either the number of indicator or the monitoring frequency.

e) Decisional support (periodic generation of analysis and reports).

The basic functions of the decisional support module must ensure the analysis of safety condition of the mining objective through:

- Identification of the defining monitoring stages;
- Reporting the monitoring parameters on the time periods;
- Reporting the critical time series, including their limits;
- Displaying the date of last modification for the safety condition
- Displaying the results of monitoring for the selected object;
- Displaying the list of critical monitoring parameters and their individual states;
- Generating the recommendation and intervention procedure list in case of critical situation intervening;
- Generating the list of persons that must be warned and sending the warning methods through different methods.

3. GIS Applications for managing mining objectives

The functional components specific to managing mining objectives are realizable through the use of the presently existing GIS applications. With regard to the monitoring and decisional support component there must be ensured a personalized interaction between the monitoring equipment, the information program and the users interpreting the monitoring results and assure decisional support. In this case the information program must be personalized by creating communication interfaces between modules, so that the user can interact in a short time with the geographical information and monitoring data.

One of the applications used in the management activity of mining objectives is Ingeea Iwork (Hexagon Geospatial). To evaluate the safety condition of an objective, the application can manage the connection with a measurement and transfer equipment in real time, for example the RIMonitor system (produced by RIEGL GmbH) that allows the permanent monitoring of areas, the data acquired being simultaneously processed, analyzed and compared with previously determined reference data.

The system is based on the terrestrial scanner RIEGL VZ-1000 and the client application – RIMonitor. The monitoring application includes an alert system that transmits warning messages at the moment when certain values are exceeded.

The warnings can be transmitted as phone messages or by email. The messages transmitted by email are recorded by the Ingeea Iwork platform that allocates a unique identifier and a priority code on the basis of which the message is redirected to the list of persons that need to be warned. The warned persons can immediately access the list of recommendations and trigger in a timely manner the warning and notification operations for authorities and existing population in the decisional support module and later can apply the intervention methods according to the priority code.

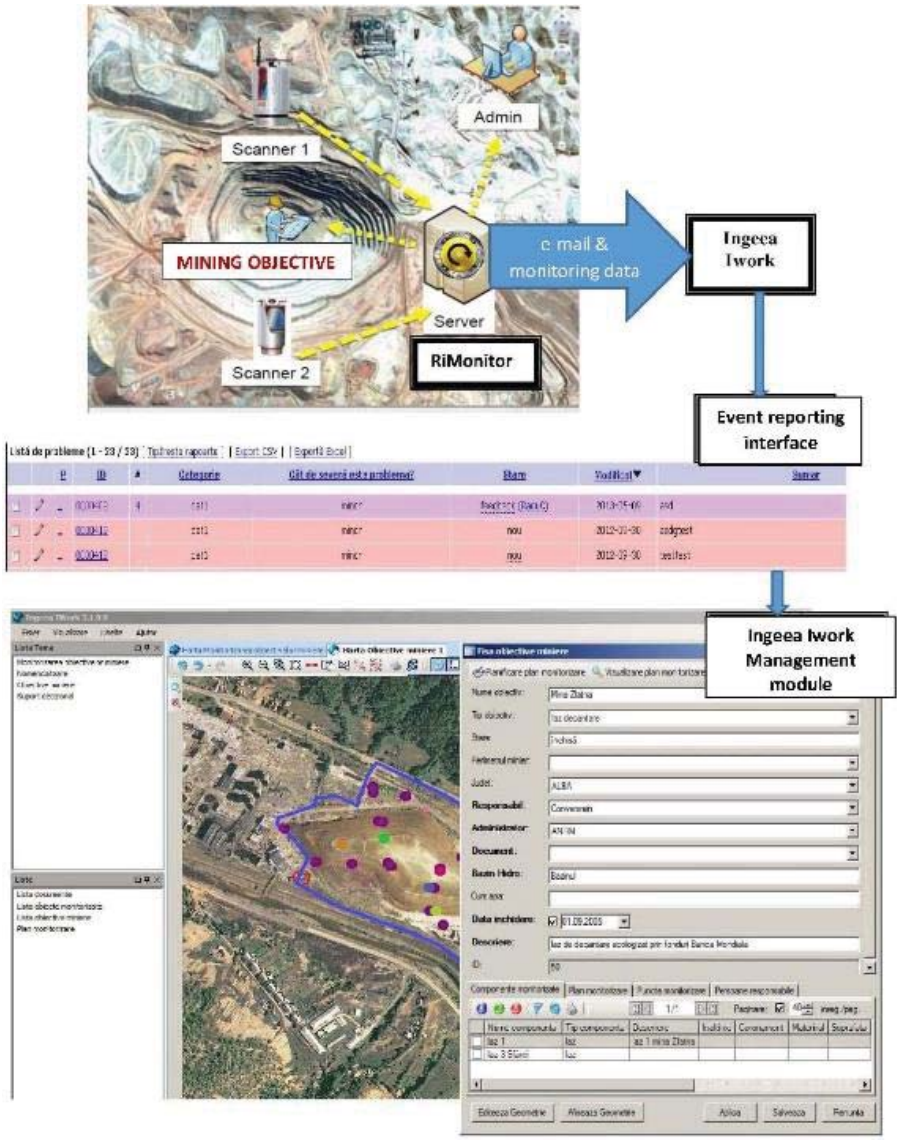

Fig. 2. *Diagram of information flux between the monitoring equipment, the data app and the users that interpret the monitoring results and ensure the decisional support through the use of the program*

4. Conclusion

In order to efficiently use the geospatial data resulted from the monitoring activity it is necessary to develop and implement an information system specific to the mining sector that allows the evaluation of the safety conditions of mining objectives in real time, with the possibility of transmitting immediate warnings in case critical situations arise.

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