

## COMPUTERIZED ASSISTANCE FOR DECISIONAL AND PROCESS CONTROL IN SURFACE MINING

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**Abstract:** The distributed achievement concept with information processing in real time along with open architectural system allows his use in different local and central minings monitoring (production dispatcher, energetic dispatcher). The distributed structure allows the entire process to be divided in many careers that are connected to the Mining Exploitation, meaning that many mining exploitation careers communicate with CNLO, the higher level dispatcher being integrated in the Informatic System of National Lignite Company (CNLO), thus support in taking the optimum managing decisions is being offered. The system presented is implemented in Romania, EM Husnicioara surface mining and is proposed for 2 minins in Turkey.

**Keywords:** data acquisition, transmission, management, open system, process control.

### 1. INTRODUCTION

Due to a higher complexity and also to the spreading of technological installations in larger areas came the necessity of information decentralization and the it's processing by a number of calculation subsystems that are coordinated from a central knot, which offers a larger autonomy and sufficient flexibility in taking the optimum decision for mining careers while direct interaction with electrical and technological installations. The distributed functions for the technological installations in the subsystem components will be hierarchical arraigned on many levels in a pyramidal structure that organize the managing strategy of CNLO. Due to the fact that the system must function as a whole-integrated system- the decentralization in many levels is not enough and it is mandatory that a new managing mechanism at all the hierarchical, maintenance, automatic function control levels, must be implemented. The existence of coordinated hierarchical levels presents the possibility of obtaining:  
-A higher flexibility of the system, which will continue to work even "hardly degraded" when the some equipment's do not respond to the commands due to the dynamic repartition of the tasks in the system

-An higher overall protection towards turbulence, because some local equipment's with some autonomy degree will respond quicker than a central equipment; also we can mention a higher viability.

Through out the construction of the system and the programs packet, the designer could decentralize the functions and allow them in a flexible manner, that are not fixed in the hierarchical levels, work stations and subsystems.

The general dispatch system has for goals:

- a centralized leading of the product
- process supervising of the equipment maintenance, career technological lines and also coal transport (storing and expedition)
- monitoring the primary technological parameters for electric stations 20/6kV
- maintenance surveillance
- alarming the dispatcher personnel if the value of the established parameters increase or decrease

## 2.BODY

The proposed system is capable to achieve the following functions:

- automatic acquisition of the equipment's and electrical stations parameters through transducers, adaptive blocks that generates unified signals or impulses
- primary processing of the measurements that are obtained from local stations and equipment's (scaling, monitoring, alarming, framing between margins)
- assures a higher redundancy connectivity between work stations
- pre-writing operations, maintenance, calibrating
- archive, memory and presentation of the measurements that are processed in an established period of time, operative reports and statistics situations
- communications through data flows between the resident processes in different knots of the system and between different levels of the architectural system including production, finance-accounting, economic data base administration
- assures technological data base communication support for firm managing structure in industrial networks RS485 and LAN/WAN-Intranet
- assures the decision decentralization and a higher tolerance to defects
- data transmission in pyramidal system to the highest hierarchical level integrated in CNLO
- monitoring the energetic consumption and correlation with the equipment's function/stationary data's in different levels of defects including production and technique-economic, finance-accounting indicators

### 2.1.TECHNICAL, OPERATIVE SITUATIONS: (CHARTS, NUMBERS, AND GRAPHICS)

- energetic consumption per hour, day, period, maximum flow
- specific consumption, electrical energy expenses
- energetic consumption/user, electric stations
- situation of the electric defect on technologic lines and electric houses
- daily situation of the electric defect ; periods; what causes them
- graphic chart of the voltage and current on the motors
- product evaluation, operative capacity prognosis, economic, finance-accounting development

integration in the CNLO informatic system, technical data base administration, production, finance-accounting, supply

From the constructive point of view the dispatcher is working as an unit; from the functions point of view the structure is as following:

-career dispatcher: supervises the technological and energetically activity in the career (excavation line, expedition of the coals in the storage)

-coal dispatcher: supervise the technological and energetically activity at the intermediary storage's and at the central coal storage, expedition of the coal

-exploiting dispatcher: supervises the exploiting activity

-energetic dispatcher: administrate electric stations that supplies career equipment

-high rank dispatcher: supervises the activity at the CNLO level

Dispatching installations have:

-specific transducers

-protection and supervision equipment's

-technological and electric data acquisition equipment's

-equipment's for measuring the flow coal quantities and at deliverance

-informatic communication system on hierarchical

levels: career, mining exploitation, CNLO, every

level with his managing factors.

### 3.THE STRUCTURE OF THE COMMUNICATION SYSTEM

Equipment's for technological data's acquisition (ECDT) which are set on the career equipment's are connected between them and also to the career dispatcher through a serial link according with RS 485/ RS 422/ Profibus DP standard being also adapted to larger distances 10-14 km. The communication cable network links between them all the data acquisition equipment's that are set on stationary equipment's. For equipment's in movement (excavators, abzeters) links were established through radio modems. This solution offers an advantage because there is no condition about the length of the cable and the movement equipment's thus the working area will be restricted to a smaller dimension. At the career dispatcher level, network structure, the Ethernet network links the equipment in the dispatching room (communication and network servers, working stations, technological flow monitoring) with the equipment that informs the decision factors. The accosted data's from the process by the communication server through wire network RS 485 and through radio will be transferred in LAN network. The communication server is equipped with a inteligent serial multiplexer, the number of ways is coordinated with the number of technological lines. Through this network a various number of data's will circulate at a high speed between components of the system respecting a special conduct, thus every one of the "customers" connected at this network will have the opportunity to have immediately access at the available data's in no time. Data's will be transmitted to every career and exploiting mining decision factor in an established format that is correlated with the packet program for exploiting data bases (can be different from one to another); there are also priority orders in specific levels for access. At this level a complete visualization of required data's can be done but access to the main database is prohibited. The packet programs implemented at the dispatcher level must allow:

-an operative leading of the production activity and also the supervising of this activity

-collecting the information's regarding: function timing, production achievement, stationary times, what causes them, electric energy consumption etc

-statistic analysis of the data's to elaborate prognosis and long terms strategies

-supervision work protection in the career activity

The system is easy to distribute, adaptable to the career configuration and function changes.

#### *Data acquisition subsystem*

Contents: signal transducers, local acquisition and processed data's equipment, serial communication networks RS 485, radio channels. In this conditions, special requires for serial channels program administration are mandatory. For this reason a maintenance packet program is created. Special requires involves also the dispatcher system. This operates a program through PLC type equipment's with multi-controler will be accessed. This program is mandatory a multi-client type one. He will accept an established number of TCP/IP connections, and a priority system will allow access for the customers. The administration program will permanently display in a window information's regarding data channel flow, events, news. At this level function related to the following aspects will be integrated:

-to supervise, to pursue the technological process indicators (technical + economic), function times, debits, quantities, specific consumption's

-visualizing the technological flow

-supervising the career electric energy supply process (function conditions, consumption)

Data basis contents: technological process indicators, equipment stationary, archives, degree of equipment function, use, etc. Access to server's resources will be under strict control. Server will also process a program that allows access from any distance to the network resources. Through communication server data's will be processed. To protect the system from passive or active interference, that may occur during the operations involving information transfer, a various packet of security systems were conceived.

#### *Technological flow visualization programs*

This program can be used in any CNLO careers if there is a proper configuration; the program dispatcher subsystem will be adaptable to career configuration changes. On LAN server will be a database that describes the whole monitoring system. There you will find information's regarding:

-career structure, existing equipment's and their place in the system

-necessarily information's for monitoring problems (priority to read an equipment, rates frequency)

-specific information's for each equipment (measure acquisition and their meaning)

The system allows that many sequences of each program to be processed simultaneously. The only restrictions are regarding to the right of changing database; only the administrator from the dispatch room can do that changes while the personnel from the exploiting career can only supervise the production process. All programs available in the dispatcher room can be accessed also from the distance due to the present communication system. Any station could take over the duties from another thus a great level of defect proof tolerance can be obtain.

The system conducts a multi user operating system, multi tasking with real time facilities. Also the system must provide support for network communication, security services and information protection. The system will have a higher upgrade degree-new equipment's for data acquisition, work station and application programs can be added.

4.PACKET PROGRAMS UTILISED IN THE SYSTEM:

*Communication RS 485 /radio type server program*

Through this, the monitoring programs can collect data's from micro controllers ECDT type which are located in the electric houses or are set on the equipment's. The collected data's from the process will be manipulated through RS 485 main line or modem radio (serial channels) and then, through communication server will be transferred in LAN network. The analysis of the conditions asks for a protocol in communication (interrogative type) in which an established computer (communication server) is the referee for all communication channels. All other equipment's works on their own without the possibility of communicating one to another.

The program behaves as a master on the serial line. He accepts a number of clients TCP/IP whom interrogative requests will rule them after a necessarily processing to the serial line.

Configuration refers to the necessity of fill the databases that describe the monitoring of the career.

The structure of the database is set and supplied in Microsoft database format. Appalling the database is run through special programs ODBC, which allows independence to Database Administrator System, SGDB. Even if initial database is a Visual Fox database, the company can use its own Database system administrator only under condition that it could be accessed by special programs ODBC and its structure to respect the initial configuration. Through communication servers the program can aquisit data's from all ECDT equipment's.

*Technological flow visualization and automatic events recording programs.* Along with the monitoring function, the program also makes records in one of the database table ("brute journal"). This journal contains a history of the equipment evolution in use by monitoring the event, time and code of the equipment. The journal can be filled by an operator with data's that can't be deduces automatic by the dispatch system. In time journal is completing cu data's by the operator, it also can be transferred to a database servers if reports are in order to be asked.

*Journal dispatcher program.* With this program the dispatcher (operator) can process "the brute journal" from the automatic events recording program and then transfer them to the central database server. This program use specific programs not only to work with the "brute journal" but also to transfer data to central database server.

*Automatic "brute journal" transfer to central server.* This program can be used for the "brute journal" automatic transfer (without operator interference) to the central database server, It could be accessed by the operating system at established hours for data's "forced" transfer in case when dispatcher does not fill/transfer this data or when he is not available during this time.

*Reports /equipment, reports/ technological line programs.* This program allows us to gather reports regarding equipment's in use (individual or through telephonic lines), cumulated or journal type by accessing the central database server.

*Central database (structure and programs).* The database located on the central server must fulfill all the company requests. Database administrator system (SGDB) is Microsoft SQL Server 6.5 or ORACLE. Journal table format is indicated as unique by CNLO. Also a minimum format for "equipment" and "equipment maintenance" must be respected. Besides this tables indicated by the company, the database also contains a

various number of programs as stored procedures by the SQL server/ORACLE. The other modules use these programs so they are mandatory for the system to work. By using the integrated package programs for all mining exploitation from CNLO and specific functions import in these package database administrator system programs, specific technical functions and economic indicators administration is completed.

*Data analysis and system maintenance program.* Through this program, the data acquisition is realized so we can make a specific analyze: tables, graphics, charts regarding their progress in time etc

System maintenance and the connection to the database are made through this program.

## 5.DATA SECURITY TECHNICAL CONDITIONS AND THEIR SAFE FUNCTIONING

Considering the importance of the inter connection system and data transfer is mandatory to assure their safety use. Communication subsystem must transmit fast, efficient without mistakes of losing information's. For reference model ISO/OSI regarding inter connection of the open systems request the following security measures:

- participant identification – through this service you have the opportunity to check if the participant is the requested one
- access control – that mean restrictions in using the network for all unauthorized participants
- data confidentiality – so that no unauthorized participant can have access to database
- data flow secret – main goal is to prevent data flow observation by unauthorized persons
- data integrity – permits the system to detect data alteration between the transmitter and the receiver
- data authenticity – you can verify if the transmitter is the right one.

## 6.CONCLUSION

The described system is implemented in Romania EM Husnicioara mining and is proposed for 2 minings in Turkey.

The distributed achievement concept with information processing in real time along with open architectural system allows his use in different local and central monitoring applications of the technological processes (production dispatcher, energetic dispatcher) and also for the integration in the Informatic System of National Lignite Company.

The distributed structure allows the entire process to be divided in many careers that are connected to the Mining Exploitation, meaning that many mining exploitation careers communicate with Oltenia National Lignite Company (CNLO), the higher level dispatcher being integrated in the informatic CNLO system, thus support in taking the optimum managing decisions is being offered. The existing systems must be integrated in a coherent communication system at CNLO level, which can offer the integrated communication support, assumed by Intranet. At CNLO level the subsystem is linked to the industrial unit backbone through a router, which is required to assure the routing base Internet/Intranet.