

## **OPPORTUNITIES FOR IMPLEMENTATION OF WEB INTERFACE IN DATA BASE WORKS IN THE MINING INDUSTRY**

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### **ABSTRACT**

The necessity for the creation of software working in the mining is increasing along with the implementation of market principles in the ore output. The complexity of the issues and tasks needed to be solved requires highly specialized software. Due to the specifics of the mining enterprises, the usage of Internet is the best solution for ensuring of access for random clients to the information data basis of the enterprise. The present article regards the characteristics of a Web interface and its application in the mining for the extraction of operative information from the data base, related to the carrying-out of the production indicators, as well as daily the indicators for a past production period. For this purpose, an existing DB on FoxPro has been used and has been transformed in MySQL to meet the requirement for a Web-SQL based interface. The relation between the web-pages and the DBs is carried out by the use of cgi-php scripts in compliance with the requirements of the client/server technology for processing of information. The concrete usage of this technology in the mining is a contribution to the automation of the mining production. The regarded realization has been done on a freeware software – MySQL as a server for DB and PHP as a language for relation to the DB. Another of its advantages are: scalability, portability, usage of customized queries and etc. interment to the Web-SQL based interface. The developers efforts are aimed at the implementation of this software the mining enterprises.

### **INTRODUCTION**

At the end of the XX century, the use of information technologies and the stored in the WWW multimedia data has increased tremendously. This is due to the fact there is a constantly increasing need for information and for an interactive access to this information. Internet has turned into a mechanism for a global spread of information and into a mean for cooperation between the people and their computers not accounting for their location. Its influence affects not only the field of computer communications, but society as a whole, taking into consideration the ever more greater development in the means for e-trade, the acquiring of information, as well as the social processes. Its significant advantage in the case appears in the fact that the information process is a dynamic and two-sided one, so that the acquired by one side information is consequently returned into the net, enriched with new elements.

Internet has changed the flow of the business transactions both between the computers and the companies and the final consumer, offering the following key advantages:

- A fast market cycle;
- Increased turnovers and reduced costs.

The necessity for the creation of software working in the mining is increasing along with the implementation of market principles in the ore output. The complexity of the issues and tasks needed to be solved requires a highly specialized software. The mining companies are situated on large areas, sometimes on the territories of separate states and the sole solution for the DB to be accessible from every point of the enterprise and to clients from all over the world is the usage of intranet or Internet.

### **DIVIDED INFORMATION SYSTEM – WWW**

After its publishing in 1992, WWW (World Wide Web) is presently the most used application of Internet. WWW is universal mean for accessing to different in structure and character data divided between a large number of computer system in a TCP/IP based network, which by the help of hypertext provide access to different type of Internet protocols through a common interface. The selection of documents requires searching finding of the machine (*the Web server*), which contains the desired information establishing of connection to it, transfer of information to a local machine through a client program (*browser*), which interprets and visualizes the documents[12].

The WWW information system is based on a hypertext technology. A word in a hypertext document can serve as a hyperlink.

The basic principle in the work of the WWW information system is that the client send query in a particularly specified format to the server, which processes it and the result from it is send back to the client. The exchange of data between the server is usually realized according to the HTTP protocol (a standardized protocol allowing work with structural divided data, described by the HTML language).

Here are some of the advantages of the client/server technology:

- Decreased service costs;
- The net load is reduced;
- An improved integration of the data due to their centralized storing;
- A big number of operation system can work together on condition that a common net protocol is used.

On Fig.1 are given the functions of the WWW client and WWW server programs:

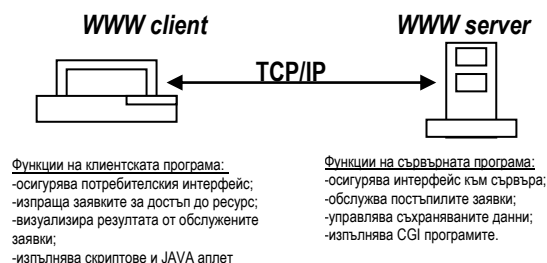


Figure 1. Functions of the WWW client and WWW server programs

An important advantage of the Web technology is the possible that large data volumes to be divided to smaller in volume documents, called Web pages. They incorporate different elements, the more important of which are:

- Formatted and non-formatted text;
- Graphics, sound, animations;
- Hyperlinks – references to other information resources;
- Execute programs;
- JAVA scripts or JAVA applets.

Web pages can be:

- Static – they are only extracted by the browser and are stored in a ready form in the Web site
- Dynamic – they are generated as a result of query by the client.

A great part of the pages in WWW are written in a program language, called HTML(HyperText Markup Language). The code, written on HTML, is interpreted by the WWW browser and is viewed on the screen of the computer. The HTML language has been developed on the basis of SGML – a language for presentation and exchange of data between different companies. Today, the HTML contains more that 100 commands (tags), which makes it a comparatively complex one [3].

XML (eXtensible Markup Language) has been developed to refer to this disadvantages. This is a simple standard, which is almost as powerful as SGML and in the same time is easy for

usage just as HTML. XML makes two main changes in HTML[6]:

- It close not define preliminary any tags;
- He is more strict.

The stored in the WWW multimedia data increase quite rapidly. This has lead to the appearance of programs designated to serve users queries, related to the searching of particular data in the file structure of the Web server, as well as for the providing of access through Internet to the DB and for processing and systematizing, of the information send by the server to the client. To solve all these problems the CGI (Common Gateway Interface) was adopted, which allowed programs, created on high-level programming language (C, C++ and etc.), to be executed under the management of the Web server. The most popular language for writing on CGI is Perl[4].

One of the most important application of CGI is the processing of HTML forms. The forms are used mainly for two things: first, to collect information for the user and second – to ensure interactive connection between the server and the user.

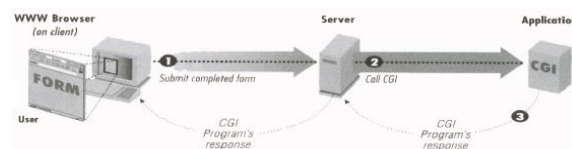


Figure 2. CGI interface

Describing the above figure, one can explain visually the principle of work of the CGI interface. The Web-pages which is seen on the browser, contains blank form with fields which need to be filled in and send back to the server after pressing the "Submit" button. The filled-in information send to the server, which has to process it. The server calls the CGI-script, which in fact is a program, installed on the Web server for processing of the sent information. It resends this information to the computer of the client, who watches it through her/his Web browser.

A considerable disadvantage of CGI is that here to independent applications are considered – every time when a user refer to the script, a new place is separated within the memory and a new copy of the program is executed. This becomes a problem for example when in one and the same moment several hundred people refer to the script – the server separates too much memory and processor time and its work may considerably be delayed. Nevertheless CGI is very suitable for sites, which do not envisage the above – mentioned extreme number of visits.

The above – shown problems of CGI are being solved by the use of applications, which utilize server API (applicable program interface). The idea of these applications is that they are in bodied in the server itself and this means that they use one and same place within the memory and the most important in each new users turning to the script connected with the given application, a new niche is created in the server process.

The most popular API are PHP, ASP, Java Server Pages (JSP) and Server-Side JavaScript (SSJS). Among them the leading is the role of PHP. The major advantages of PHP are[7]:

- PHP can be executed as a separate CGI script or can be incorporated in the HTML page itself, which brings an opportunity to the server itself to generate a part of the html code;
- PHP support the greatest quantity of DBs;
- PHP is extremely suitable for web. For example Php has a built-in support of sessions, automatically processes the input information from the forms and etc.

### SERVER FOR DATABASE

The necessity for generating of dynamic pages on the basis of some information, for storing of orders for buying of goods and so on requires within the most of Web sites to have DBs created as well as the respective data basis management system (DBMS).

The most often used model of DB is the relational one. The relational model offer a high degree data independence. An advantage of the relational model is the one and same representing of classes of objects and the relations between them[8].

In a relational DB the data are stored in two – dimension tables – each table contains non-ordered rows and named columns and each column has a unique name attribute – the type of data contained in it. A DB usually includes more that one table with mutually related information. In this way, it becomes possible the carrying – out of more complex and effective operations with the data.

The systems, which in the greatest extend cover the requirements for the DBMS are the DBMS, which use the relational data model. These systems are called relational data basis management systems.

The access to the relational data is provided with the help of the relational languages. They are divided into two major categories - *languages of the relational algebra* and *languages of the relational calculation*. Beside the two categories of languages there are also the so-called *intermediate relational languages*, which have abilities of the relational calculus and the relational algebra. The most widely spread language of such type is SQL (Structured Query Language)[9].

For the realization of the particular DBMS today are used neither the relational algebra, nor the relational calculations. In the fact the standard access to relational data is provided by the SQL language. The SQL language is a mixture of operators of the relational algebra, expression of relational calculations and expanded additional capacities, not present in the relational algebra and the relational calculations SQL are a non-procedural, platform and product independent language. Actually, this is the standard language used for manipulation and extraction of data from relational DB[10].

The connection between the relational data model, the SQL standard and its different realization can be formally represented by the following pyramid[11]:

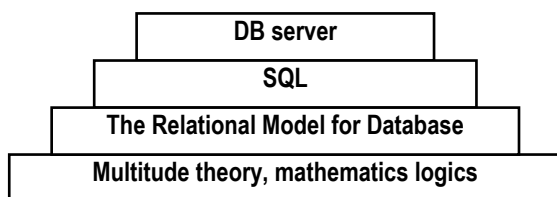


Figure 3. The connection between the relational data model, the SQL standard and its different realization

At the moment the most DBMSs provide opportunities for integration of Web-based applications such as: SQL Server 2000, Oracle, Progress, Informix and etc. From the other hand many program languages allow integration of DBMS, from one side and of Web-based applications from another side.

For the development of such applications a three-layer structure is used:

- First layer – web client (for example web browser);
- Second layer – web server, CGI scripts and APIs for connection with DBs;
- Third layer – database server.

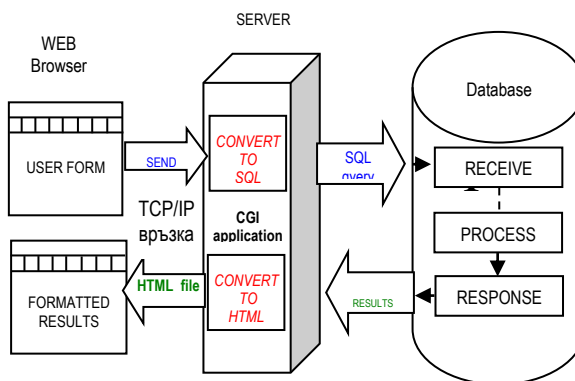


Figure 4. Three-layer structure

MySQL is a small, compact and easy to use server for DB. It is made on the client/server model and is accessible for both UNIX and Window platforms SQL 92 and ODBC 0-2. It is not to disregard the fact that MySQL has an open code and is freeware. Among the other advantages the MySQL are its rapidness, punctuality, as well as its well-developed system of privileges. The system of privileges of MySQL allows every user to make exactly what is permitted for her/him. MySQL is available on the two most popular program languages for server applications – Perl and PHP. And exactly because of such qualities, in the present report, this server for DB has been preferred instead of the commercial DB servers such as DB2, Microsoft SQL Server and Oracle. It is true that they provide greater potentialities that MySQL, but their prices are considerably height (DB2 – 20 000\$, Oracle – 40 000\$, Microsoft SQL Server – 20 000\$), and they, similarly to MySQL, are SQL based, so that the transition from MySQL to a commercial server for DB shall not be a considerable difficulty.

MySQL keep every table as a separate file in the directory for DB. The maximum size of a table can be from 4GB to the maximum size of a file supported by the used operational system. The maintenance of the saved procedures, transactions sub-SELECT and UNION (the fields within which the MySQL has suffered numerous criticism) has been added in the 4.0 version of MySQL of November, 2002. This version is still in a beta type[14].

In MySQL there are missing some of the capacities in comparison to the commercial DB servers[5]:

- **triggers** – they are stored procedures which are executed in the appearance of certain conditions;

- **views** – a view is an ordered by the user presentation of tables (or from other views). A view accept the returned result from a query and treats it as a table;
- **foreign keys** – this is a column or group of columns in table A, which are not a primary key in this table, but are a primary key in table B. They are part of the rules for the completeness of the data;
- **inherent support of XML** – the XML support is present in Perl and PHP;
- **in MySQL the access is limited only to a command row** – there are instruments with open exit code offering a graphic design of administration – MySQL Manager 1.0 and WinMySQLadmin 1.3

Despite of all these disadvantages MySQL remains the most widely spread server for small and medium sized DBs in Internet.

#### REALIZATION OF WEB INTERFACE FOR EXTRACTION OF OPERATIVE INFORMATION

This article aims to represents the realization of a DB with Web interface in the mining and in automation of the mining production. For that purpose a relation DB was create, which can be filled through Internet by the use of a Web-SQL based interface. The choice for SQL has been made due to the fact, that it is the standard that has been proved itself over for the past several years. SQL is used in all products for creation and processing of DB. It has been created and developed also an appropriate interface for searching and visualization in the data basis. The connection between the web-pages and the data basis is carried out by the use of cgi-perl/php scripts.

The “Operational Extraction” data basis will be daily used for putting, in of data as per working places, blasting fields, excavators, shifts or as per other production units regarding the way of reporting and recording. There will be sustained models entitling numbers or names of excavators, which will represent dumpers with different volumes of their baskets, as well as tables with volume weight, which can be updated on any time. The daily quantity of oar and metal as per working places excavators, blasting fields and etc. will be automatically calculated and be visualized. The software will provide a potentiality for an automatic operative tracking of the ready oar balance, as per blasting fields for example.

After the initial input of the quantities and the qualities of the mined mass as per blasting fields, an every day recording and reporting of the extraction as operational data will start. In every moment it will be possible an inquire to be made for the current situation of the ready oar of quantity and quality as per fields sections, horizons and for the whole mine..

The “dobiv” data basis contains the tables **main**, **bager**, **samosval** and **indicators**.

Table 1. Description table **main**:

Field	Type	Attribute	Null	Default
IDnum	Tinyint(3)	Primary Key, UNSIGNED	No	
name	Varchar(10)			

It contains information about the section, in which works are done.

Table 2. The contents of table **main** is:

№	Name
1	Кет
2	Насипище
3	План-шихта

The tables **bager** and **samosval** contain information about the excavators and draggers, which are being used.

Table 3. Description table **bager**:

Field	Type	Attribute	Null	Default
Number_b	Tinyint(3)	Primary Key, UNSIGNED	No	
name_b	Varchar(10)			

Table 4. Description table **samosval**:

Field	Type	Attribute	Null	Default
Number_s	Tinyint(3)	Primary Key, UNSIGNED	No	
name_s	Varchar(10)		No	
obem_s	int(10)	UNSIGNED	No	
Kursove	Tinyint(3)	UNSIGNED		

Table 5. Description table **indicators**:

Field	Type	Attribute	Null	Default
Idnum	Tinyint(3)	UNSIGNED	No	
Za	Enum('за','до')		No	3a
day	Tinyint(3)	UNSIGNED	No	0
Number_b	Tinyint(3)	UNSIGNED	No	0
Z	Smallint(5)	UNSIGNED	No	0
Cu	float(5,3)		No	0.000
Obem	int(10)	UNSIGNED	No	0
obt	float(4,2)		No	0.00
Ruda	float(9,1)		No	0.0
Cut	float(9,1)		No	0.0

It contains 10 fields:

**IDnum** – this field is an foreign key from table **main** it shows for which section belong the entered parameters;

**za** – this field has two possible values “за” or “до” and shows whether the inquiry is being made for a particular day or for a group of days;

**day** – number of the day the inquiry is being made;

**bager** – the number of the excavator. The field is an foreign key from table **bager**;

**z** – horizon;

**Cu** – Copper contains;

**obem** – the volume of the excavate mass, it is calculated on the basis of the indicators “kursove” and “obem\_s” from table **samosval**;

**obt** – volume weight;

**ruda** – oar quantity;

**Cut** – Copper quantity.

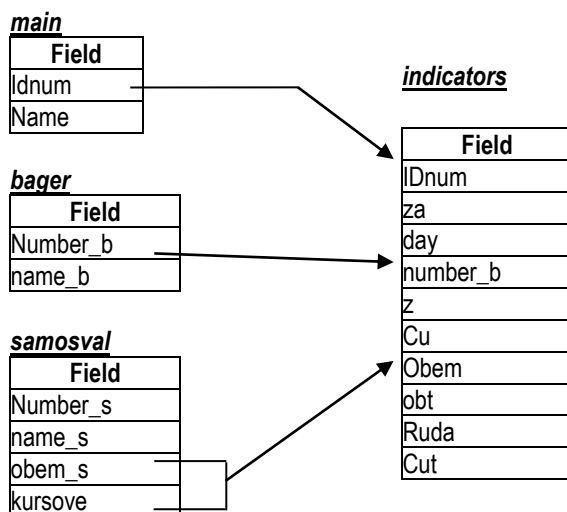


Figure 5 Description of relations between the tables

The Web interface for extraction from the data basis of operative information about the implementation of the production indicators for daily production, as well as for production for a past period, is done through PHP. And as a server for DB is used MySQL. The choice for PHP is provoked by the fact that for the last several year it has become the most widely used language for creation of Internet application and has replaced Perl (as CGI programming language) and ASP (as API). Beside this, PHP can work as CGI or other module to the Web server, avoiding in such a way the disadvantages of CGI. With it fastness, high reliability and open code MySQL has proved itself as a leading server for DB for small and medium sized Internet applications. The mutual work of PHP and MySQL responds to and meets also the requirements of the Internet programming and the client/server processing of information:

- A full Internet support;
- The fastest possible market circle;
- A full scalability both upstreaming and downstreaming;
- Portability.

The application contains three major scripts. The first is **index.php**. This is the initial page of the site.

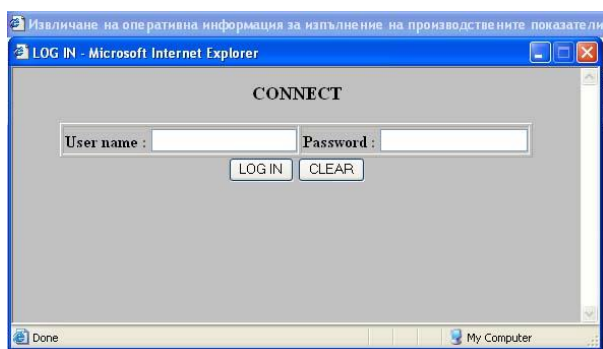


Figure 6. Page index.php

To make a query to the data basis, the system requires the user to identify her/him self. For that purpose she/he, must enter her/his name and a password. By pressing the "LOG IN" button a call is made to the data basis whether such an user exists. If the answer is YES, the script

**create\_cuery\_select.php** is activated. Otherwise, an error message is viewed. Here the user can by the help of application form buttons can compose its query. Although the query is in SQL format, it is not necessary for the user to know the SQL syntax or the DB structure. All these is in concern of the PHP script. The access to this page is allowed only after the identification of the user – by **index.php**. Every other attempt to make a query will be rejected.

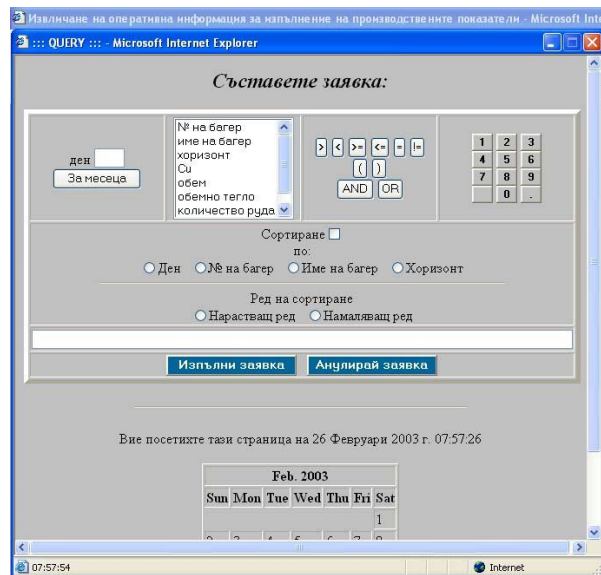


Figure 7 Page create\_cuery\_select.php

For the carrying out of the connection of the Web server to the server for the MySQL data basis, by the use of a PHP script several stages are needed:

1. A connection is created to the MySQL server.
2. A SQL query is sent to the MySQL server and a result is received.
3. The applicable program interfaces are used for extracting of data from the result received from (2).
4. A HTML page is generated to present the contents.

Two often used functions - **DisplayErrMsg** – a function for displaying of a message for error and **authenticateUser** – the function making the connection with MySQL are given in a separate file - **functions.php**

Besides the application form the page shows the hour in which it is activated the current hour (in Status Bar) and a calendar with the current month. For the creation of all these things a JavaScript. For a great view ability and clarity the JavaScript and the cascade styles are moved in separate files - **query\_javascript.js** and **query\_style.css**.

After sending of the query, the third major script - **create\_cuery.php** is activated. Its tasks are to compose and to send query to the server for DB in compliance with the data provided by the user, as well as to visualize the returned by the server answer. For this purpose, two queries are executed - the one created by the user in **create\_cuery\_select.php** and the query requiring a providing of data the relevant day or group of days. The result of these queries is visualized by the PHP command **mysql\_fetch\_object**. It will return the next row



of the given set of results as an object, or as a "false", if there are no more rows.

Оперативна информация за изпълнение на производствените показатели за ден:

za/do	Ден	Номер на багер	Име на багер	Хоризонт	Cu %	Обем	Обемно тегло	Количество руда	Количество Cu
za	1	11	aaaaaaa	1111	0.100	115554	2.00	231108.0	231.1
za	1	22	bbbbbbbbb	1111	0.100	115554	2.00	231108.0	231.1
do	1	11	aaaaaaa	1111	0.100	115554	0.00	231108.0	231.1
do	1	22	bbbbbbbbb	1111	0.100	115554	0.00	231108.0	231.1
do	1	44	ddddddddd	1111	0.165	231108	0.00	462216.0	762.6
za	1	44	ddddddddd	1111	0.110	115554	2.00	231108.0	254.2
za	1	45	eeeeeeeee	1111	0.100	115554	2.00	231108.0	231.1

Обобщена оперативна информация за изпълнение на производствените показатели за дни:

za/do	Ден	Багер	Количество руда	Количество Cu	% Cu
do	1	11	115554	231.100000	5.000000
do	1	22	115554	231.100000	5.000000
do	1	44	115554	254.200000	4.546000
do	1	45	115554	231.100000	5.000000

Fig. 8 Page create\_cquery\_select.php

The access to this page is possible only and only after the identification of the user – by *index.php*. Every other try to take answer from the query will be reject. It is envisaged also an option for printing of the result – by pressing of the Print button. This option is realized by JavaScript.

The filling in of the data basis is not a subject of this development. One of the possible ways is the usage an additional module (provided by the official site of MySQL – [www.mysql.com/contrib](http://www.mysql.com/contrib)) for transforming of a table from dbf format – a format used by FoxPro, into frm – the format used by MySQL. Or in other words, after the updating of the data basis in FoxPro the contents of the table is to be extracted in a text file and then a small script is to be executed, containing the SQL command - LOAD DATA INFILE "file name" ...

## CONCLUSION

The created software for extracting of operative information besides the advantages of the Web-SQL based software – scalability, portability, preparation of queries from the DB by the request of the user and etc., has also another big advantage – it is created by a freeware software - MySQL as a server for data base and by PHP as a language for connection with the data base.

It is expected that the developed project of DB with a Web interface to grow in the future into a complete system, which shall take into accounting the objective and subjective factors in the automation of the mining, as well as shall analyze the data and support the decision – taking in the management of the mining enterprise.

The authors expectations are that it will be implemented in one of the mining enterprises functioning in Bulgaria.

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