

# The power supply design software model for mine based on VBA technology

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## Abstract

Coal mine power supply system is increasingly complex, resulting in difficulties for power computing and tuning. A software design program is proposed by using VBA development tools embedded in AutoCAD secondary development, adopt object-oriented program, ActiveX automation technology and visual programming techniques to achieve human-computer interface and database interaction, design one of the mine power supply design software with function mapping, statistical calculations, protection setting, design reports automatically output, data maintenance. The study shows that the software can greatly simplify the power supply design process, improve efficiency, and can effectively improve the coal mine management level.

*Keywords:* VBA, secondary development, ActiveX automation technology, visual programming

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## 1 Introduction

With the improvement of the level of electrification and automation of coal mining enterprises, the coal mine power supply system become increasing complexity, the traditional supply drawing and calculation methods cannot meet the needs of the coal mine power supply design. Computer-aided design (CAD) has been widely applied in the field of construction, electrical, shipbuilding, mining and other industries. The use of computer-aided design, you can overcome the deficiencies of the traditional methods of power supply design, shorten the development cycle, improve the efficiency and quality of power supply design.

There are a lot of achievements in research for the secondary development of CAD, such, The research studies the object-oriented method and technology of the further development, expecting offer direction of further development methods. An example is illustrated the application of object-oriented technique to the further development of parametric design by means of Pro/Toolkit [1]. ObjectARX files stored in database are shared by users to carry out the parameter-driven design CAD process, Multi-users can run it at multi-points in real time for collaborative design [2]. The parameter design for parts of 3D modelling is mainly introduced, on the basis of CAD (SolidWorks) of second exploitation, illustrates parameter design with correlative characteristics of 3D modelling for vane pump and depicts the correlative requests of parameter design [3]. Along with the extensive use of CAD in the fields of water conservancy and hydropower engineering, secondary exploration of CAD become more and more important. In this paper, combining part drawing of water and electricity station, primary attempt to CAD

secondary exploration of hydraulic engineering is made, including development of special line-type and filling and visual lisp language, etc. [4]. This research introduces a visible theoretic line loss calculation system of distribution network based on two times development of the AutoCAD. This system can draw equipment circuit diagram fast and conveniently based on the geography information. The alternant interface of person and machine raises the accuracy and the efficiency on the equipment and circuit data information to record. At the same time that system according to the network characteristics, with the data of the equipment, circuit and so on, provided two kinds of theoretic line loss calculation methods, really carried out the sketch, data with unify of calculate [5]. This research propose a design scheme of power supply design system of mining area based on AutoCAD. The system uses embedded VBA of AutoCAD plat form to make secondary development, and compiles program to extend functions of AutoCAD to realize integration of drawing, calculation and file management of power supply design by one software. The actual application showed that the system has characteristics of good interaction, convenient operation and high reliability [6]. The research introduces the drawing system of mining equipment power supply system. The drawing system is developed by VBA on the autocad2006 platform, draws quickly and accurately the figure of the power supply system, marks and modifies automatically the attribute of equipment through the menu mode of operation [7]. The process of developing drawing system is introduced in the paper. The developed drawing system has the professional feature on the drawing of mining power supply. It is based on ActiveX technology and developed by using the VBA language embedded the AutoCAD 2004 platform [8].

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## 2 Design program

Mine power supply design software is a database at the core, relying embedded in AutoCAD VBA language development, which can run under Windows2000 or later, Office2003 environment. The system is on the basis of CAD drawing function, with the help of CAD blocks technology and data dictionary technology, establish contacts in the CAD graphic device parameters stored in access, run interactively between the statistics of the load in the power supply design, automated operation of the short-circuit current, and check the tuning. After the design is completed, the system uses the word automation technology, automatic output calculation report based on the design of the access process data records. Through the application of the system eliminates the tedious process for power supply design, the original load statistics, short-circuit current calculated and report writing and save a lot of energy for designers , so that designers can put more effort into rational planning. The design technology program is shown in Figure 1.

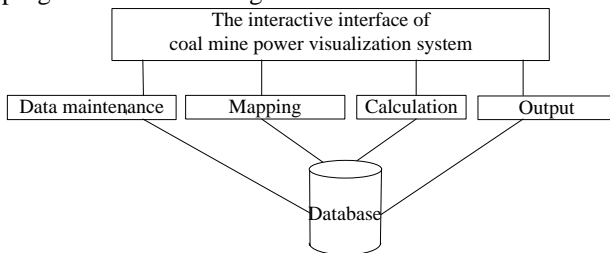


FIGURE 1 The design technology program

From the visualization software design structure, the R&D system is divided into three levels, four functional modules. Upper layer is Coal Mine Power visualization system interactive interface, the middle layer is four functional modules, the bottom layer is the software system's database. The upper man-machine interface are the software system bracket and the main operation of the user interface, it is able to achieve middle-level module functions in the interface layout interface. The underlying database is the foundation of the entire software system. With the support of the database, the function modules can collaborate and work together to achieve the entire functionality of the software system.

The middle layer of the four function module is the core of the development of software systems, including data maintenance module, power supply system mapping module, calculation and statistics module and calculation report output module. Data maintenance module is the auxiliary module system, the use of the module can put the electrical equipment parameters into the database. The mapping module of the power supply system is the basis of the system. Only use function of the module for power graphics in coal mine, which can fulfil power supply computing and power supply design report output. Calculation statistical module's function is to realize the power calculation, the module enables automatic statistics required coefficients, the average power factor calculation, transformer selection and validation, the load center

selection calibration and tuning, the mobile substation selection and validation, high voltage distribution box selection and tuning, high-voltage and low-voltage cables selection and validation, the various protective devices check and tuning. The calculation report output module is to achieve the output of the power supply design report. The power supply design report output with word form, including load tables, electrical equipment selection table, the short-circuit point tables as well as power calculation process.

## 3 Data information and database design

Access database table object contains seven database objects, Table object, query object, form object, report object, page object, macro objects and module objects. Database table objects and query objects are the basic objects, used to store data and query data, form objects, the report object and page objects is directly user-oriented object for input and output data and control system, the macro object and module code type object, to be completed the complexity of the database management, used to organize the macro operation or programming.

Graphics project file is a system diagram of coal mine power supply calculations. Contains file information, block diagram and calculations information. File information including file name, face type, create and creation time. Cell block information includes basic information and attribute labelling. The cell block basic information represent the device information, electrical node information. The calculation result information including the short-circuit current value and the setting calculation result, the short-circuit current values obtained in the power supply system requires information support, the shorting point located in a loop or branch information as well as the loop involving electrical equipment operation parameters need to know. Tuning calculations need to know the value of the short-circuit current, electrical equipment parameters. Calculating the short-circuit current value and the process of tuning results are very important, linked to a variety of information in the diagram of the power supply system of the underground mine. The data is shown in Figure 2.

The final result of the database structure design is to get a reasonable data model, the model is accurate, that generates the application system will be able to meet the needs of users. When designing the database structure the data need to meet the basic needs of the user, the data have a minimum degree of redundancy, data ensure consistency and completeness, and the data must be very strong independence. According to data information needs of the software system, the coal mine power visualization software system can be divided into five categories: file information class, system class, primitive class of electrical equipment, equipment operator parameters and power supply calculation results class.

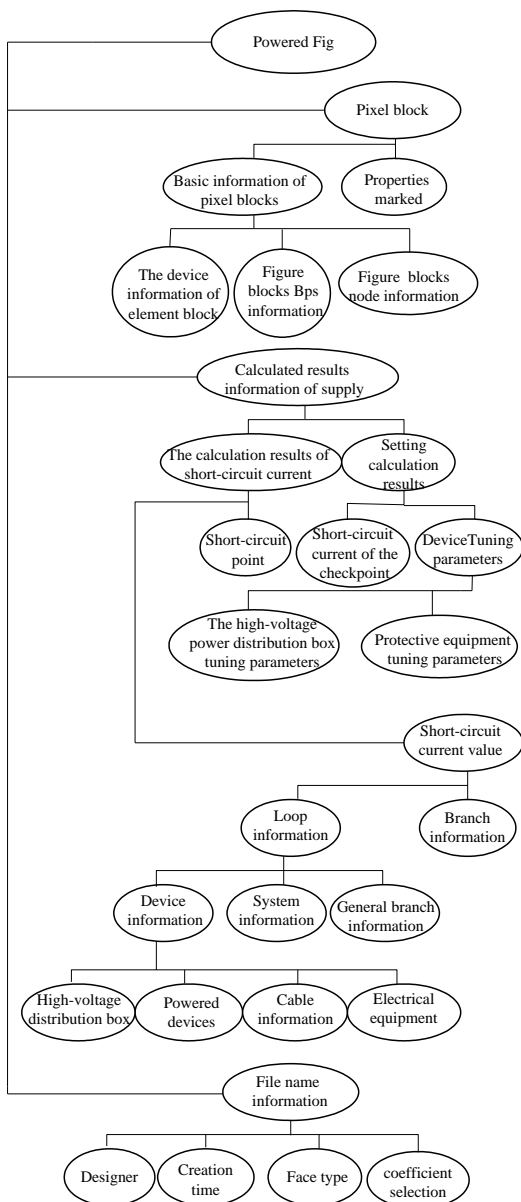


FIGURE 2 Data information

File information class: that reflect the data information what is recorded the information that needed by a power supply system drawing. This information includes: program number, name, the face, power calculation, creator, create time, and required coefficient.

System information class: the system classes data information is recorded information of the logical relationship between the electrical equipment and electrical equipment, cables and electrical equipment, the short-circuit point and the electrical equipment. The information includes: the element number, uniquely identifies of protection device, subsection transformer logo, subsection the high-voltage power distribution box logo, the number of branches, branch Number, uniquely identifies of starting point, the starting point component name, uniquely identifies of the endpoint, the endpoint device name.

Electrical equipment figure element class information: such data is a basic information for device diagram element. The information include: identifies of electrical equipment primitives, basis points, nodes, equipment figure element name, scaling factor, and twiddle factor.

Operation parameter information class information: the data information is a parameter of the equipment needed in the power calculation. the main parameters include the value of the rated voltage, the value of rated current, the value of rated power, the value of starting power factor , the value of start current multiple .

The calculation results class information: such data are the results of the short-circuit current calculation and setting calculation. Short circuit current calculation requires power supply circuit information and loop calculated. Setting calculation reflects the sensitivity of check results, select protection as well as protection setting results.

#### 4 Design of graphics sub-module

The system mapping module use object-oriented technology and with auto cad ActiveX automation technology, the coal mine power supply system equipment components is to be created as device diagram elements. Take advantage of the man-machine interface system's drawing module, the interface device component primitive button is inserted in equipment components primitive macro. The system equipment components diagram element commonly used in the coal mine power supply is placed in the drawing area, and then take advantage of the system mapping module device component layout button primitive for editing macros, such as moving the macro, delete macros, edit equipment components primitive that placed in the drawing area. Finally, the component parameters are transferred out by auto cad internal events ADO database access technology and human-computer interaction interface database, attribute labeling of equipment components in the drawing area. The design scheme of the system diagram for rendering module shown in Figure 3:

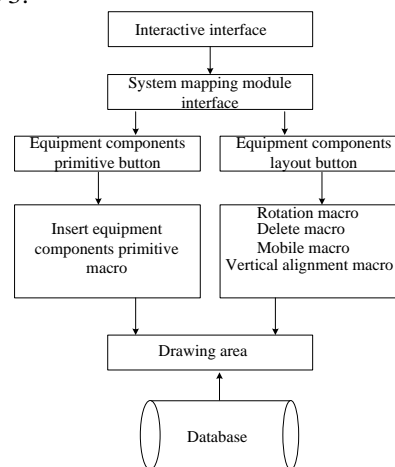


FIGURE 3 The design scheme of the system diagram for rendering module

## 5 The design for calculation statics and output

Design steps include: database setup and initial configuration, pixel graphics, load parameters configuration (load statistics), mobile substation select, dry-type transformers select, load centers select, high voltage cable and low voltage selection and calibration, short-circuit current calculation, high voltage distribution electrical device selection and calibration, mobile substation and load center tuning, combination switch ,feed switch and starter selection and calibration, calculation report automatically output.

VBA on ActiveX automation technology has the windows interoperability. The technology enables the common use between AutoCAD and other windows applications, and provides a way for the exchange of information between the each other application and control. AutoCAD use ActiveX automation technologies to interact between VBA language and word applications, and its essence is AutoCAD application program quote the word application's object library, then use VBA program to call word application object library.

AutoCAD and word application interact has four step:

1. Complete word application object library reference.
2. Create a word application instance to achieve access.

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