AN INFORMATION SYSTEM FOR TECHNOLOGICAL DOCFLOW FOR VENDORS OF TECHNOLOGICAL AND AUTOMATED PRODUCTS

Master Thesis

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Content

Introduction

Effective management is a necessary condition for the successful operation of an enterprise in a market economy. Nowadays, effective management is impossible without the creation of automated management systems that allow to optimally organize internal business processes in the enterprise.

Manage effectively means to make prompt and correct decisions.

Recently, an increasing number of enterprises understand the need for complex automation, which is an indispensable condition for achieving process controllability, increasing labor productivity and the level of profitability in general.

There are three basic approaches to solving the tasks of enterprise automation:

- You can gradually solve the "narrow" problems of the production process, buying ready-made software products for solving individual tasks;
- You can develop an information system with the help of your specialists;
- You can order the development of an integrated information system from a system integrator that has the technology and experience of creating such systems.

Nowadays, Russian enterprises have a number of disparate systems designed to automate specific sectors.

Before the enterprises in general and before its departments, there are a number of serious problems related to centralization, qualitative and timely consideration of various applications, requirements, documents. In addition, the task arises of operative processing and management of data on the state of technological equipment, aggregates, their completeness, and so on.

Currently, there are many systems that solve the tasks of organizing the document flow of the enterprise - the customer. However, the approaches to the solution and the concept of building such systems have some differences. Among the determining factors are:

- The scale of the enterprise;

- The existing document management structure;
- Enterprise requirements for the system.

The purpose of the master's thesis is:

- Survey of enterprise departments related to automation and energy for the purpose of determining internal and external information flows;
- Analysis of document circulation and document forms;
- Forming the structure of the docflow;
- Development of requirements and descriptions for the main business processes;
- Development of the concept of the information model “An information system for technological docflow for vendors of technological and automated products”.

Applicable for the tasks of the vendor, taking into account the specifics of the corresponding departments of the customer enterprises, the docflow information system should perform the following tasks:

- Implementation of production activities;
- Accounting and planning the allocation of resources (materials, equipment, working hours, transportation costs, etc.), taking into account the norms for the consumption of materials and working time;
- Tracking and periodic reporting for supervisory bodies (energy surveillance, fire protection, etc.);
- Personnel management, i.e. Account of admittances, duties, tracking of periodic briefings and inspections;
- Internal docflow and control system for performing discipline.

This task should fit into the overall task of integrated automation of an enterprise built on the basis of both known world systems (for example, SAP R / 3) and domestic (for example, 1C) and corporate document management systems.

1. THEORETICAL PART

1.1 System Analysis

1.1.1 Requirements to the system design

The designed system is used for document automation of the electrical department of the Chief power engineering department of the company.

According to the client requirements the system must provide the information flows management which provides fast work activity of the Chief power engineering department and has got the following characteristics:

- Complex and constant support of the available technology;
- an opportunity for flexible changes of the technology;
- good scalability;
- simple maintenance.

1.1.2 The analysis of the objects of the system

The creation of any rather significant software demands the analysis of its objects to find out their main sides and the links between them [1]. Moreover, it's necessary to know about existing prototypes when creating a new system. Exactly the analysis of such systems which are successfully used helps us greatly shorten the interval between the own system analysis and its design. According to this the section is divided into three subsections:

- Identification of the abstractions of the docflow area
- The analysis of Document Management Systems
- Analysis of the features and a structure of the docflow of the electrical department of the Chief power engineering department of the company.

Identification of the abstractions of the docflow area

Docflow, according to [2], is the process of documents' transfer within the area of the document support of a department. In other words, docflow is the

complex of operations which provides a document transfer from the stage of its creation or incoming to the stage of its execution or sending [3].

The way of a Document transfer is called **Route**.

According to the docflow definition we can identify two entities of the area such as a document and a route. The correlation of these entities is identified because every document has got its route.

They should be examined in detail.

A document is a semi-structured complex of blocks and objects of information which is clear for a person [4]. Life cycle of any document consists of three steps such as creation of a document, its confirmation (signature, agreement and etc.) and execution (closing).

Documents can be:

- ***Incoming documents***. These are documents which come to a company from its partners.
- ***Outgoing documents.*** Mostly these are documents which are replies to particular incoming documents. Some of them are created according to internal documents of companies.
- ***Internal documents.*** They are documents which are used to organize companies' activity.

A route is a path of a document from the step of its creation or incoming to the step of its execution or sending. Every step of this path is a phase of a document confirmation with some of officials according to the rules of the company. For example, official must have some particular rights to sign documents.

Now we can identify some more entities of the docflow system:

- ***an official***
- ***a rule***

To sum everything up, a route which is followed by a document is a list of officials which is set according to some rules of the company.

According to the data of this section we can identify the list of the abstractions of the docflow:

- ***a document***
- ***a route***
- ***an official***
- ***a rule***

Obviously, all the ***Document Management Systems*** are based on the abstractions above. Moreover, it is also necessary to analyze the ways of these abstractions realization to design the own system.

The analysis of Document Management Systems

The definition of 'Document Management System'

There are some parallels between the definition of 'Document Management System' and its definition of west analysis in literature and press. They are based on specific features and usage of the described software[6]:

- ***DMS (Document Management Systems).*** It has got rather full definition for its terminology in Russian literature as 'Documents Archives';
- ***Doc Flow*** systems or Document Routing systems;
- ***WorkFlow*** systems which have got rather exact definition as 'Automated Business Systems'.

Document Management Systems are rather complicated mechanisms and they can be analyzed according to the size of a company and its specific activity. There is no sense to take into account a separated software as a whole Document Management Systems. For example, Document Management Systems of a small trade company, a Legislative assembly or a project company are used for different companies' functions and based on different software. It means that Document Management Systems of these organizations have got only some common features.

Subsystems and their functions

Document Management Systems consists of several subsystems and each system has got specific functions. Some of the subsystems are in the process of close interactivity. However, Document Management Systems separation into subsystems is academic and has got nominal characteristics in practice to identify which class the software within the classification belongs to.

There some of the subsystems of Document Management Systems [6]:

- ***Office administration management systems.*** The functions of the systems are document registration in particular database by filling a specific document card. A document card data has got specific information according to a company needs. A document itself is kept in paper form in a special archive and we can find out its place, its status and information about its execution in ***Office administration management system*** database.
- ***Document Archives.*** Document Archive is exactly the place where all the electronic documents (their images or their contents or both their images and contents) are stored. Also it must provide database navigation within its hierarchy and a document search.
- ***Document entry system and Document images processing system.*** The function of these subsystems is to transfer a paper document into electronic document.
- ***Document Routing Systems.*** Their functions are transmission of documents to the work places of officials, collecting information about current statuses of documents, providing consolidation of documents according to their status of execution at different stages and the information about documents processing.

Every Document Management System is the sum of the subsystems above [6].

A document

Now we are going to analyze the abstraction ‘a document’ mentioned above within different Document Management Systems.

- ***Paper document*** - is an object which is not included into information system itself except the information about it. The types of such documents are a photocopy of a document, an image, a microfiche, a video and etc.
- ***Electronic image of a document*** - is a copy (or scan copy) of a document which is stored in the system database. A document image, except its content in any form, contains a set of ID (identification) characteristics such as its name, category, date of creation and etc. Such information is stored in output database not in the document image.
- ***Electronic document*** – differs from an electronic image of a document and contains the information which is useful for its search or its classification. For example, it can be a text or a Microsoft Word document, an Excel spreadsheet or an e-mail. Some of them have got no structural elements (e.g. text documents). The others are structured and have got information about their elements (e.g. Word files, spreadsheet, XML files) which is can be accessible for external applications.
- ***Database records*** of group work specific management systems. Such documents haven't got any file forms and present themselves as completed units of information which have got ID, display tools and modifications. They can be taken out of the system, sent in a form of e-mail to the other department and put into the system back. Moreover, such documents contain internal structures, other documents and their references.
- ***Reports created as a result of WKS applications work***. They are a specific type of documents which are formed from different records of different databases. After such document printing it doesn't exist in the database as the completed object, because it can exist only within the application area. For example, it must be exported into a document type mentioned above. The type choice depends on the company docflow structure and its system tasks.

Identification of the abstractions of Document Management Systems

No doubt, this area includes the abstractions of the docflow area. However, the definition of the terminology 'automated' involves computing means in the

docflow process. Completed or partial transfer of paper documents into electronic documents causes a user interface creation which can help to cooperate with the existing system. It leads to the idea that there are abstractions which help to organize user interface to work with documents (abstractions of documents and their entry, document archives and automated docflow) and routes (the abstractions of a route, an official, rules and routing systems). They can be found among the objects of docflow area and the objects of the subsystems mentioned above. The first group of abstractions includes an interface of a document entry, its search and editing. The other group provides administration of users, editing and creating of document routes. It is worth to understand that all of the objects can work together or separately according to the process of workflow realization. However, in any case the system must follow all the rules which are included in the abstractions. Moreover, it's possible if the new abstractions appear within the particular system.

The results of the analysis of Document Management Systems

This section contains the idea that the definition of 'Document Management Systems' can be identified completely within the context of an executed task. A document can have different forms according to the executed tasks. Moreover, it's been found out that Document Management Systems can perform a lot of functions to provide the docflow process. Also two abstractions have been added to the list of docflow system abstractions. They are responsible for organization of user interface within the area of a document, a route, an official and a rule abstraction.

The analysis of the department docflow

On the one hand we have found out about the opportunities and functions of Document Management Systems. However, the information is not enough for the chosen company department because we need to take into account the specific of its docflow structure.

It means that we need to analyze the structure of the department docflow. To do this we need to identify the list of documents, structure them and identify their routes.

According to these tasks, the presented section is divided into the next stages:

- Identification and analysis of the whole list of the documents of the department;
- Identification of the department structure;
- Identification and analysis of the routes of the department documents according to the research data of the two previous sections;
- Analysis of the document structure.

Identification and analysis of the whole list of the documents of the department

The Identification of the list of the document (par. 1.2.2) and its analysis help us divide the list into two independent subsets: 'Documents which provide fast department work' and 'Documents which provide the department organization activity.' (Appendix 2)

Within the number of the subsets some lists of types of documents were identified. Each of the documents is a document of one type only when all the types of documents organize a hierarchy. At the top of the hierarchy is the abstraction 'document'. The second level is the main types of documents which include different protocols and acts. Next levels include documents which clarify the documents of the higher levels for each particular situation. Moreover, they inherit the attributes of the documents of the higher levels. It refers to object – oriented design and programming terminology. According to the analysis above the result of this section is identification of the abstraction 'Types of documents'.

Identification of department structure

This stage of analysis is a process of cooperation of a designer of the system and a specialist of the particular sphere who presents the department. According to their cooperative work we can identify the organization structures of the Chief power engineering department (CPED) and the electrical department which is

included in the Chief power engineering department (CPED). It's important to note that this stage is not independent and interacts with both the previous and the next stages. The data of the department structure is necessary to make the stage of the document routes analysis easier. Moreover, the reason for the analysis of the CPED structure is the great number of documents which belong to the electrical department Also they have got the areas in their routes which are not within the department area. The results of the analysis are in the par. 1.2.

Identification and analysis of the routes of the department documents

This stage includes a rather deep analysis of the abstractions 'an official' and 'a rule'. According to the received data of electrical department and CPED the analysis of these terminologies shows the following:

- Each document goes through the stages of approval. The number of the stages is strictly limited;
- The document can be approved by the official of each stage only;
- Each official holds a position;
- Not any person who holds a position is an official;
- There is a list of certain positions who could approve documents of each type.

It helps to identify such abstractions as 'responsible person' and 'a position' which clarifies the abstraction 'an official' and 'a stage of a document approval' which clarifies the abstraction 'a rule'.

Analysis of the document structure

This stage is necessary for the abstraction 'a document' analysis. According to the data above each document of a department belongs to particular document type. The research of the structure of all the types of documents shows that documents connect with:

- ***an equipment unit***
- ***a part of the department***

Moreover, a document can be created after the previous document as ‘a child-document’ of a ‘parent – document’.

Also it’s necessary to explain the definition ‘an equipment unit’. The electrical department is included into the Chief power engineering department and is responsible for the maintenance of electrical equipment of the company. An equipment unit is a minimal functional completed module which is a part of an installation as a rule. For example, such modules can be an electric engine or an electric pump. The maintenance of such equipment is provided with the frequency according to the schedule of the department activities. Each part of the department is responsible for the particular type of the activity. In such a way two parts of the department provide different types of activities. The further analysis of the terminology ‘an equipment unit’ leads to the necessity to analyze the company electrical equipment structure.

During the analysis of the data of this stage the abstractions below were identified:

- ***an equipment unit***
- ***types of activities***
- ***frequency***

Analysis of the electrical equipment structure of the company

The analysis of the electrical equipment structure of the enterprise was provided in a form of conversation with the representatives of the enterprise. During the interview some of the relevant documents of the department activity were examined. It helped to find out that a part of the department maintains only some of the units of the equipment. A unit is the part of the installation and it means that each unit belongs to the particular installation only. However, there are several units of the installation of a particular type and the types of installations form the hierarchy. Such hierarchy, according to its structure, is close to the hierarchy of types of documents analyzed before. Each of the elements of the

lower levels has got its own attributes and inherits the attributes of the elements of the upper levels. Both installations and equipment units are plugged to the substations. Each substation has got several sections of tires, in other words, grouped phases' outputs. The section of tiers consists of a set of cells which present a separated ou

tputs. Each equipment unit is powered by a separate cell.

As a result of the stage data analysis the following abstractions were identified:

- ***Installation***
- ***Type of equipment***
- ***Substation***
- ***Section of tiers***
- ***Cell***

The analysis of the system is finished at this stage. The process of analysis and the results of the stages are presented in the Figure 1.

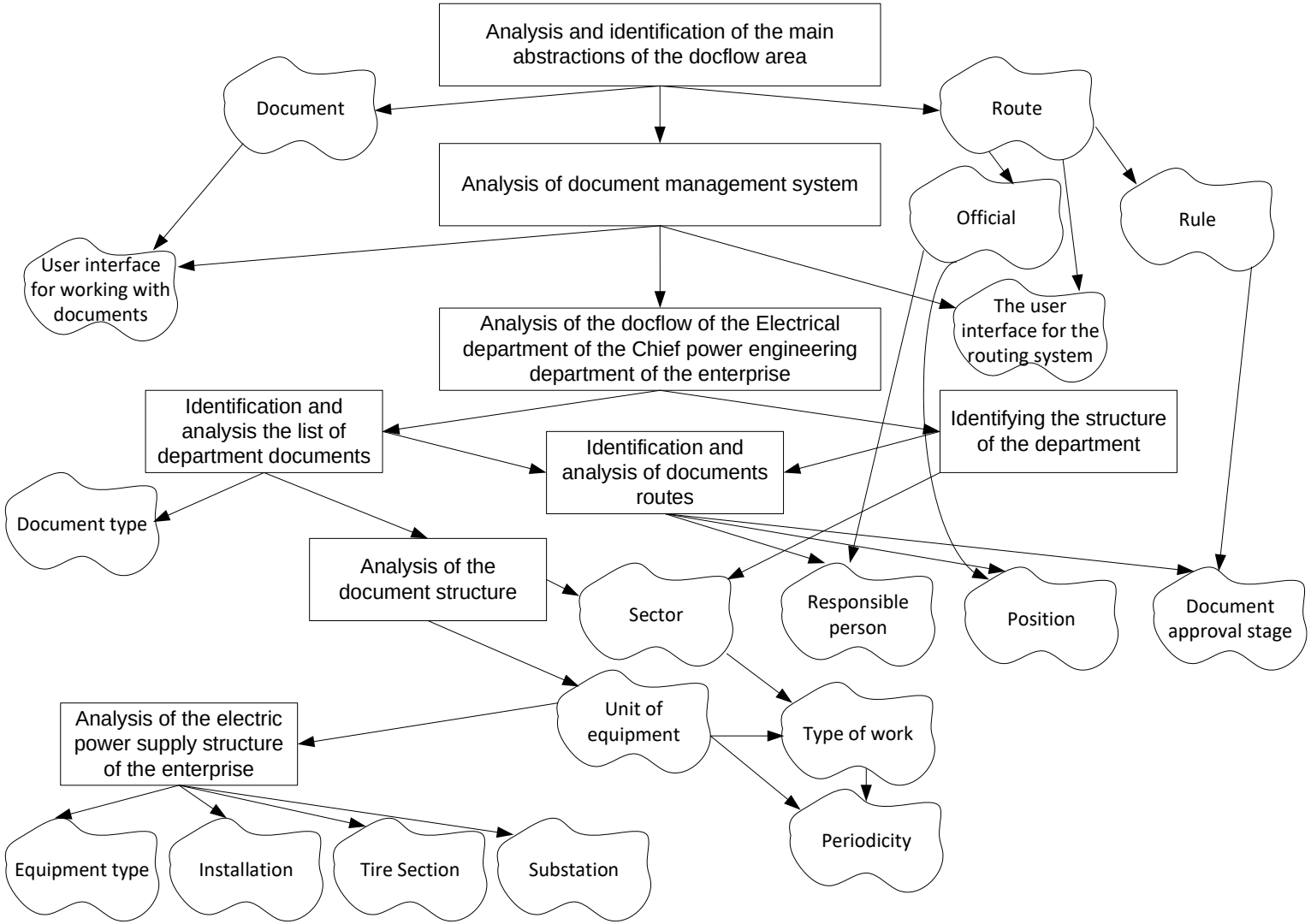

Figure 1. The process of analysis and the results of the stages.

1.2 Department structure

1.2.1 Structure of the Chief power engineering department

Let's consider the organizational structure of the Chief power engineering department.

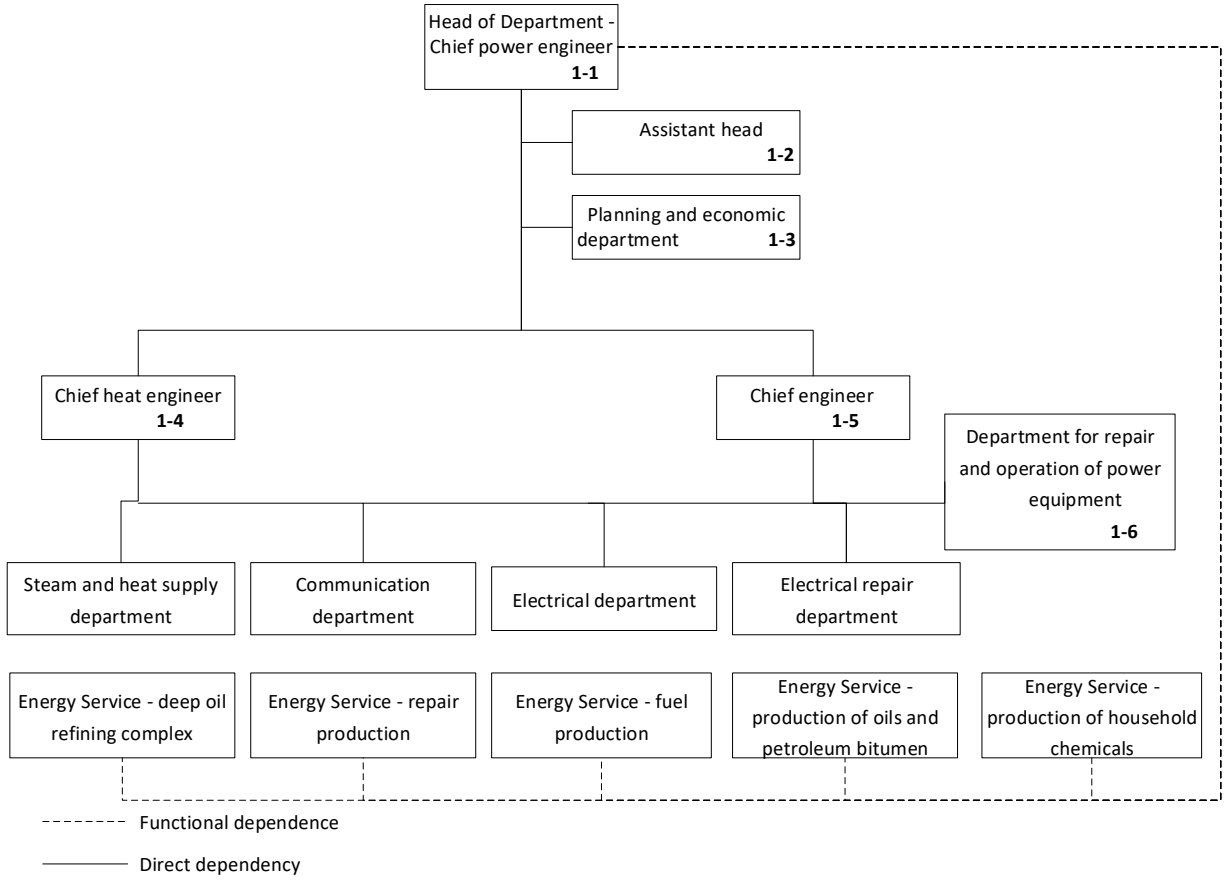

Fig.2 - organizational structure of Chief power engineering department

The Chief power engineer

Manages the maintenance and repair of power equipment of the enterprise, and resolves organizational issues.

Planning and economic department

Preparation of production plans and purchase requisitions, maintenance of reporting on planned preventive service of the main power equipment.

Chief Engineer

Supervise questions of operation, carrying out planned preventive service; Is engaged in solving technical problems facing the Chief power engineering department.

Chief heat engineer

He carries out an organization of operation, supervision of heat and power equipment and heat systems.

Department for repair and operation of power equipment

Carries out the repair of power equipment:

- Planning, organization of repairs;
- Planning the necessary resources for repairs;
- Power Supervision.

Steam and heat supply department

Operation and repair of heat and technical equipment and heating networks of the enterprise.

Communication department

Operation of telephone lines and PBX equipment.

Electrical department

Designed to:

- electric power supply of installation and facilities of the enterprise;
- operation of electrical equipment in a fixed service area according to the Rules for the operation of consumer electrical installations and Safety rules;
- carrying out installation and commissioning that are performed by own forces.

Electrical repair department

Repair of engines, transformers, production of installation works for the enterprise.

Energy Service - deep oil refining complex

Operation of power equipment, electric and heat networks of deep oil refining complex.

Energy Service - repair production

Operation of power equipment, electric and heat networks of repair production.

Energy Service - fuel production

Operation of power equipment, electric and heat networks of fuel production.

Energy Service - production of oils and petroleum bitumen

Operation of power equipment, electric and heat networks of oils and petroleum bitumen production.

Energy Service - production of household chemicals

Operation of power equipment, electrical and heat networks of household chemicals production. Now it is a part of fuel production.

Electrical department

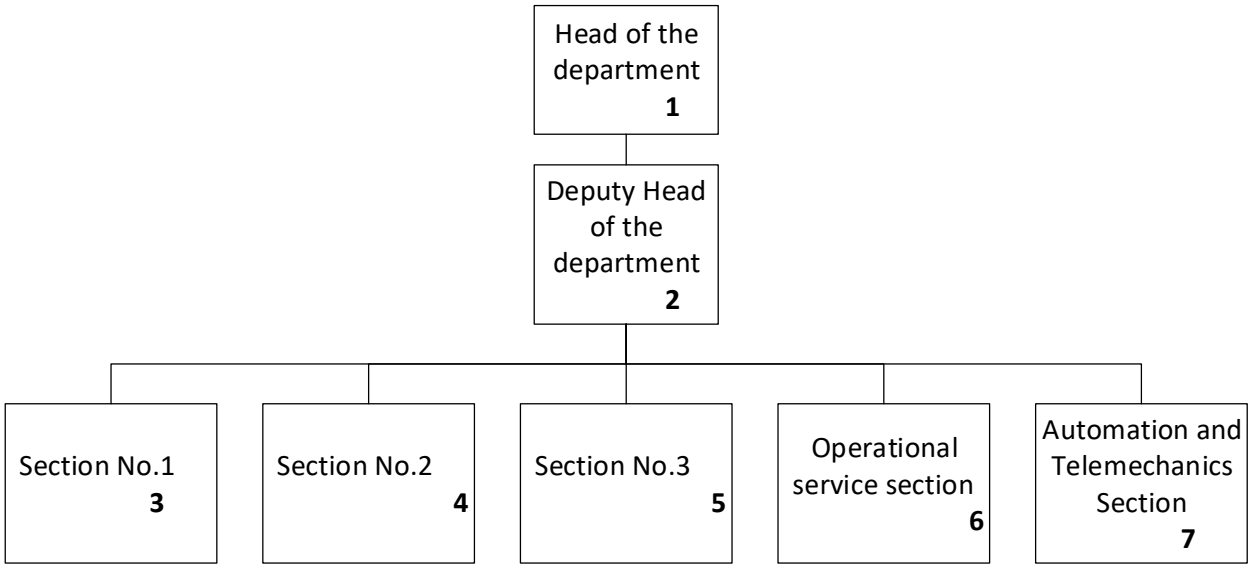

Fig. 3 - organizational structure of the electrical department

It's designed to electric power supply of installation and facilities of the enterprise

Organization of electrical department

1. Section No. 1
2. Section No. 2
3. Section No. 3
4. Operational service section
5. Automation and Telemechanic section

Section No. 1 (Electrotechnical laboratory).

Performs:

1. Operation of relay protection devices, automatics at all power supply facilities above 1000 V of general plant.

2. Preventive tests of electrical equipment, the location of damage to cable lines, testing of protective equipment.

3. Grounding measurement, loop phase-zero on all objects of the enterprise.

4. Testing of electrical appliances, repair of electrical measuring instruments.

5. Operation of electrical devices for commercial and technical metering of electricity.

Consist of 24 people.

Section No. 2

Performs:

1. Operation and repair of electrical equipment for the general production facilities

2. Operation and repair of outdoor lighting

3. Maintenance of the plant area.

Consist of 24 people.

Section No. 3

Performs:

1. Operation of high-voltage equipment of substations on the objects of the enterprise.

2. Operation of cable networks.

3. Performance of works on replacement of obsolete high-voltage equipment, reconstruction of equipment.

4. Repair of high voltage cable networks.

5. Organization of excavation work near the existing electrical equipment.

Consist of 24 people.

Operational service section

Tasks:

2. Operational maintenance of power supply facilities in a fixed area.

3. Operational guidance of the entire power supply system of the enterprise, organization and practical access to repair work in electrical installations.

Consist of 23 people.

Automation and Telemechanic section

Tasks:

1. Operation of the dispatching system for electrical facilities;

2. Operation of the electricity accounting system (commercial and technological);

3. Vibrodiagnostics of power electrical equipment of substations;

4. Installation and adjustment of the system of dispatching and metering of electric power.

Consist of 7 people.

1.2.2 List of documents

In the "Document Route" column the path of the document formation, its route is shown.

For example, document number 6: it is "1-5" - the chief engineer (see Fig. 2), then the document goes to "1" - chief of the electrical department and to "2" - his deputy (see Fig. 3), and finally the document goes to "3..7" - Section No. 1 ... Automation and Telemechanic section (see Fig. 3).

I - Chief Engineer of the enterprise.

Table 1. List of documents on the requirements of safety rules.

No.	Title of the document	Document route
1.	List of activities that increase the safety of work.	1-1 to all
2.	Assigning electrical installations to the personnel.	1-5 to 3,4,5,6,7
3.	Number of persons from operational personnel per shift or per electrical installation.	1 to 4,6
4.	Local instructions.	2 to 1-5 to 3,4,5,6,7
5.	Personnel training and knowledge testing.	2 to 3,4,5,6,7 to 2
6.	Individuals from operational personnel who serve electrical installations alone.	1-5 to 1 to 2 to 3..7
7.	Schedule of operational personnel.	1 to 4,6
8.	List of persons authorized to carry out operational warks with the power system.	1 to 1-5 to 6
9.	List of persons from the administrative and technical personnel who are allowed single inspection.	1-5 to 1..7
10.	The list of chambers of closed switchgears with voltages above 1000 V with the entrance behind the fence for single	1-5 to 1..7

No.	Title of the document	Document route
	inspection.	
11.	Periodicity of inspections to identify and eliminate malfunctions in electrical installations without permanent duty personnel.	1-5 to 1..6
12.	Instructions and technological maps that provide for work when isolating a person from the ground.	1-5 to 1..6
13.	List of works performed in the order of current operation.	**I** to 4,6
14.	List of operating personnel who have the right to give orders for the execution of works.	1-5 to 6
15.	List of electro technical personnel who have the right to give orders.	1-5 to 1,2,6
16.	List of works in electrical installations performed under particularly dangerous conditions.	1-5 to 1..7
17.	List of persons who can be appointed as managers and manufacturers of work	1-5 to 1..7
18.	List of electrical installations whose construction makes grounding impossible or dangerous.	1-5 to 1,2,6
19.	Permission for excavation work.	1 to 2 to 5 to 2
20.	Instructions for cleaning insulators.	2 to 5
21.	Business trip documents.	1-5 to 1,2 to 6
22.	Granting the right to traveler to work in the existing electrical installations as outstanding outfits, responsible managers and producers of work, supervisors and brigade members with a business trip time of more than 5 working days.	1-5 to 1,2 to 1-5

Table 2. List of documents on the requirements of the rules for the operation of consumer electrical installations

No.	Title of the document	Document route
23.	Order on the appointment of the person in charge of the electric power, also the substitute.	1-1 to 1,2 to 1-1
24.	Job descriptions of employees.	1,2 to 1-5 to 1,2 to 3..7
25.	Acts of acceptance in operation of electrical installations. Project documentation. Technical documentation.	1,2 to 1-6 to 1-5 to 1,2 to 6
26.	List of positions of engineers and electrical personnel, who need to have an appropriate qualification group in electrical safety.	1-1 to 1-5 to 1,2
27.	Journal of testing knowledge of industrial non-electrical personnel with the group I in electrical safety.	1,2
28.	List of professions and jobs that require the assignment of the I-st group on electrical safety.	1-1 to 1-6 to 1,2
29.	The order on exemption from medical examination of administrative and technical personnel, not directly involved with operation, repair, installation and commissioning	**I** to 1-1 to 1,2

No.	Title of the document	Document route
	electrical installations.	
30.	The program of personnel training.	1,2 to 1-5 to 1,2 to 3..7
31.	Knowledge testing and assigning the appropriate group in electrical safety.	3..7 to 1,2 to 1-5 to 3..7
32.	Ordinance (on the enterprise) on the admission of engineers for internships and independent work. Ordinance (on the workship) on the admission of engineers for internships and independent work.	1,2 to 3..7
33.	The commission that conducts the knowledge testing from managers and specialists.	1-1 to 1-6 to 1,2
34.	Journal of knowledge testing of electrical personnel.	1,2 to 1-6
35.	Certificate of successful passing the knowledge test.	1,2 to 1-5 to 1,2 to 3..7
36.	List of measures to improve reliability, economy and safety of power supply of the enterprise.	1,2 to 1-5 to 1-6
37.	Provisions and instructions on the relationship of personnel at different levels of dispatching management.	1-1 to 1,2 to 6
38.	List of approved schemes.	1,2 to 1-5 to 1,2 to 6
39.	Instruction for the prevention and elimination of accidents.	2 to 1-5 to 2 to 6
40.	List of persons entitled to perform operational switching.	1,2 to 1-5 to 6
41.	List of persons authorized to conduct operational negotiations.	1,2 to 1-5 to 6
42.	The order of registration of applications for the disconnection of electrical equipment.	1,2 to 1-5 to 6
43.	The procedure for acceptance of equipment after repair or testing in electrical installations without constant watch (local instructions).	1,2 to 1-5 to 1,2 to 6
44.	The list of complex switching.	6 to 2 to 1-5 to 2 to 6
45.	Allowable values of the currents commutated by fuses.	6 to 2 to 1-5 to 2 to 6
46.	The act of the acceptance commission on putting the ACS into operation.	7 to 1,2 to 1-6 to 1-5 to 1,2
47.	Responsibilities of structural units for maintenance of a complex of technical facilities, software.	7 ->1,2 ->1-6 ->1-5 ->1,2
48.	List of technical and operational documentation for each ACS.	7 to 1,2 to 1-6 to 1-5 to 1,2
49.	Schedule of repair and maintenance works on the technical means of automated control systems.	7 to 1,2 to 1-6 to 1-5 to 1,2
50.	Annual schedule of planning and economic department.	1-6 to 1,2 to 1-6 to 1-5 to 1,2 to 3..7
51.	Technical justification for changing the frequency of repair of equipment.	3..7 to 1,2 to 1-6 to 1-5 to 1,2
52.	Approved technical documentation for the modification of the design, electrical circuits.	2 to 1-5 to 2
53.	Accounting for spare parts.	1,2 to 3..7 to 1,2 to 1-6

No.	Title of the document	Document route
54.	Schemes and programs of special tests for the equipment in operation.	1,2 to 1-5 to 1,2 to 1..7
55.	Acts about major repairs of the main equipment.	3..7 to 1,2 to 1-6
56.	Repair journal.	3..7 to 2 to 3..7
57.	Investigation of accidents.	
58.	List of measures for the prevention of accidents.	1,2 to 1-5 to 1,2

1.2.3 Docflow of the Chief power engineering department

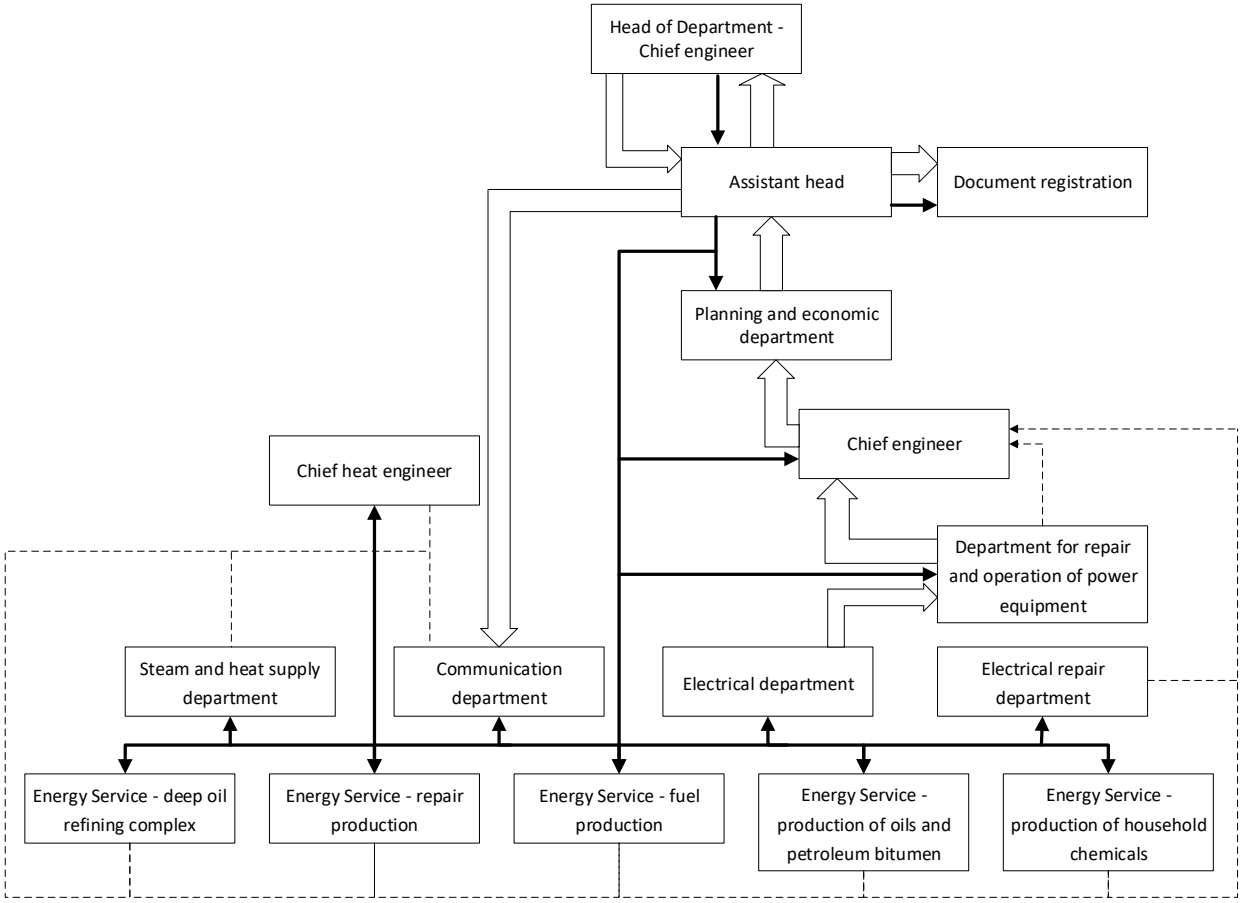

Fig. 4 Information flows of the Chief power engineering department

Let's consider two cases.

1. Electrical department should sent a document to the Communication department. Directly this cannot be done. First the document is sent to the higher departments, it is registered and only then it reaches the destination. (see ⇨).

2. The chief power engineer issues a prescriptive document. Firstly, the document is also registered, and then sent to all units to which it is intended

(see ⟶).

The units that receive the order form an individual report on the implementation and forward it to the responsible person (it is indicated in the instruction, in this case it is the chief engineer of the Chief power engineering department) (see ----►).

Copies of instructions remain in the archives of the departments; a control copy in the archives of the chief power engineer.

Let's consider in more detail the ways of forming documents No. 9, No. 13, No. 25, No. 30, No. 46 and No. 56.

Document No. 9. List of persons from the administrative and technical personnel who are allowed single inspection.

The document is prepared by the leading engineer for energy supervision, industrial health and safety ("1-6": see Fig. 5). The list of persons is requested from the departments, and the department chiefs provide all the necessary data.

Further, the document is approved by the chief power engineer and sent to the departments. Copies remain with the chiefs of departments and all persons on the list. In addition, copies remain with persons deprived of the right to sole inspection, whose names are not included in the list.

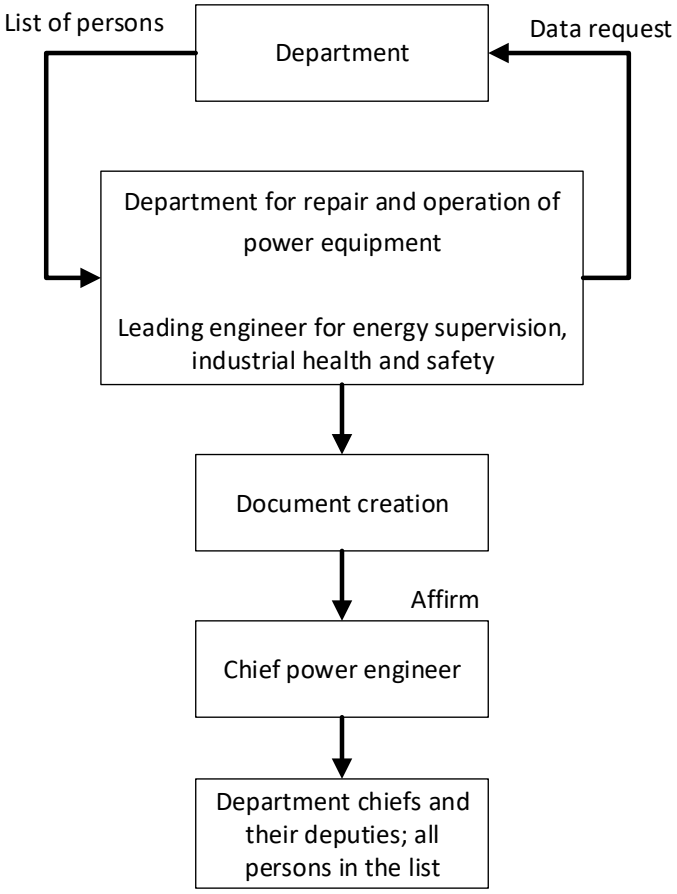

Fig. 5. Creation and route of document No. 9

Document No. 13. List of works performed in the order of current operation.

It is made by the chief power engineer then approved by the chief engineer of the enterprise.

The document is sent to the energy services of the enterprise, to the electric department of the department managers, to the power engineers of the production units.

Inside the departments and units, the document gets to the operative repair and operational personnel, which could to work in the order of current operation.

The scope of work is determined by the main power engineer together with the power engineers of the production and the heads of the Electrical department and the electrical repair department.

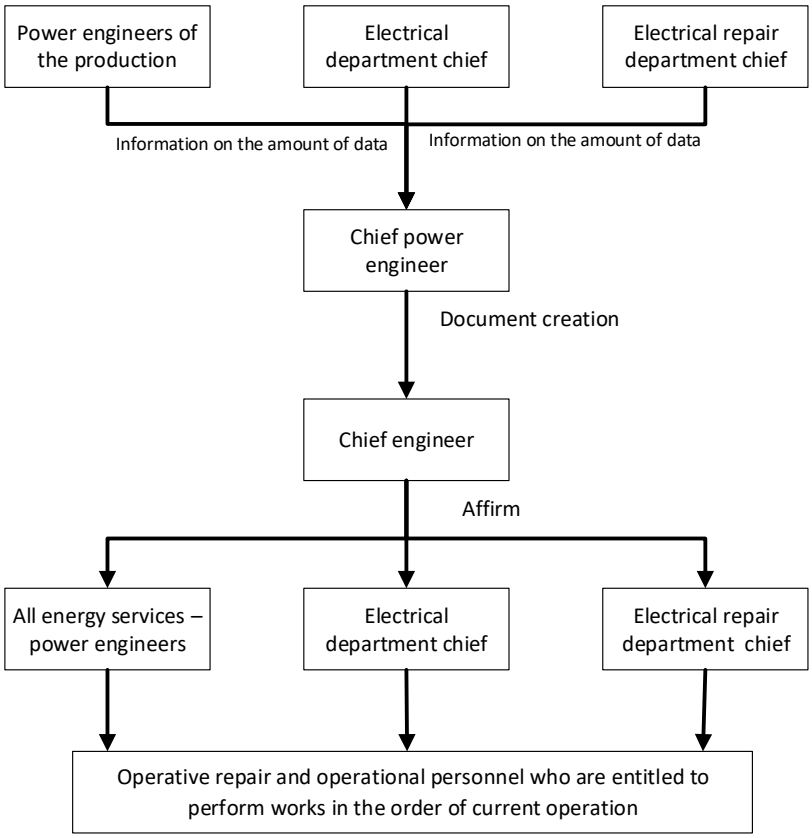

Fig. 6. Creation and route of document No. 13

Document No. 25. Acts of acceptance in operation of electrical installations. Project documentation. Technical documentation.

The power engineers and the heads of the departments carry out technical supervision during assembly, construction and commissioning works by contractors.

Upon completion of work, acceptance tests are carried out, the corresponding documentation is made out. When all requirements, rules and regulations are fulfilled and all documents specified in the special list are available, a bilateral signing of the acceptance certificate is made.

After registration of the certificate on acceptance tests the chief power engineer issues the order on acceptance in operation of the given object.

Storage of design and technical documentation is organized by the operational services. Responsibility for compliance with the projects and the composition of the technical and design documentation of the equipment in operation is also carried by the operational services.

The order on acceptance in operation of this object.

Issued by the chief power engineer. The order goes to the energy services and departments, regardless of who the equipment belongs to. Then it gets to the repair department "1-6", the chief engineer and the one who is ordered.

On the example of Electrical department.

The order gets to the department chief and all chiefs of the area inside the department. In addition, the department chief issues an order on the appointment of responsible persons for the operation of equipment of newly adopted facilities.

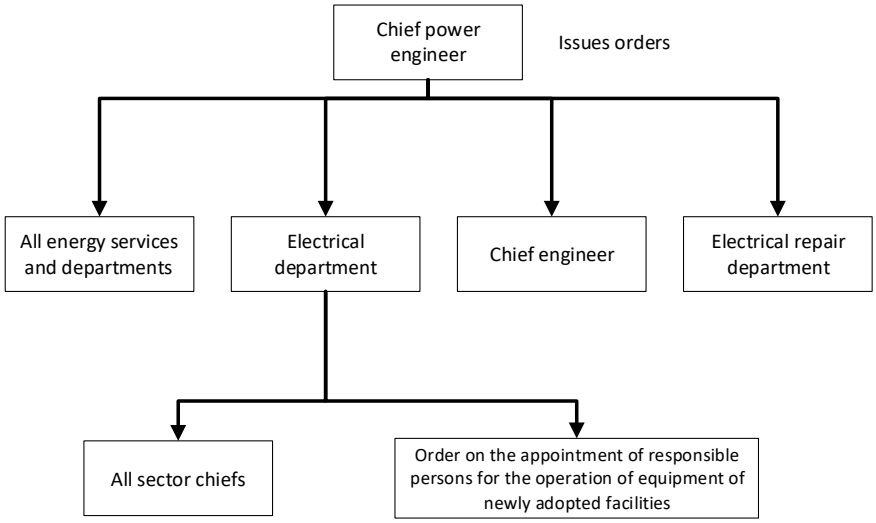

Fig. 7. Creation and route of the order on acceptance in operation of the electrical installation
(document No. 25)

Document No. 30. The program of personnel training.

More detailed structure of the sector No. 1 (Electrical department).

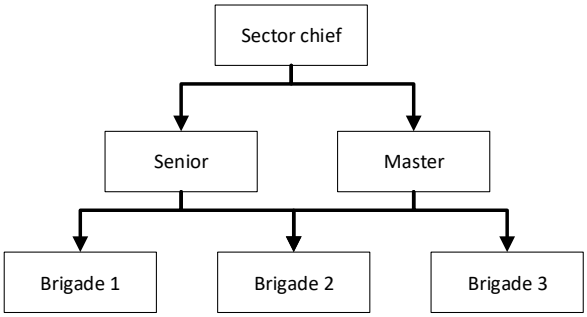

Fig. 8. Organizational structure of the sector No. 1

The program of personnel training is received by all, and for specialists of various qualifications the programs will be different.

For brigades, the training program is developed by the sector chief and affirmed by the department chief. The general part of the program concerns all members of the brigade, but depending on the qualification, each member of the team will have its own specificity.

For masters the program is developed by the department chief deputy and affirmed by the chief engineer.

For the chief deputy and department chief the program is developed by the chief engineer and affirmed by the chief power engineer. In fact, this document is being prepared with the participation of the department chief and his deputy.

Document No. 46. Allowable values of the currents commutated by fuses.

The chief engineer takes the values of the currents from reference and regulatory literature, adapting them for a specific case. If it is necessary to correct the values of currents switched by decoupling units, a document is issued. Adjustment is only possible in the direction of stricter requirements.

One copy of the document remains with the chief engineer; the second one goes to the repair department "1-6" (see Fig. 5) and is put in the requirements collection folder.

Copies of the document are sent to the chief of Electrical department and his deputy, then go to the operational service section ("6": see Fig. 6) and to the operational personnel of the sector No. 2 ("4": see Fig. 6).

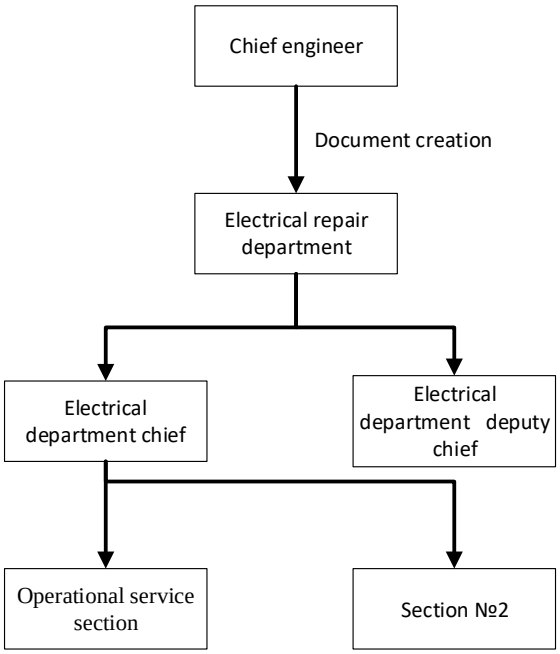

Fig. 9. Creation and route of document No. 46

Document No. 56. Acts about major repairs of the main equipment.

In the production of repair work, a report is prepared on the work done.

Acts on major repairs of equipment contain a reportable part on the technical requirements and parameters determined in the manufacture of repair work.

One copy of the certificate is sent to the archive of the repair department "1-6" (see Fig. 6), and the other copy is kept for further use (maintenance of the technical equipment history) on the sectors - in the archives of the sector chiefs.

The act is created by the sector chief, then signed by the department chief, and then affirmed by the repair department chief "1-6". Data on labor costs are sent to the planning and economic department.

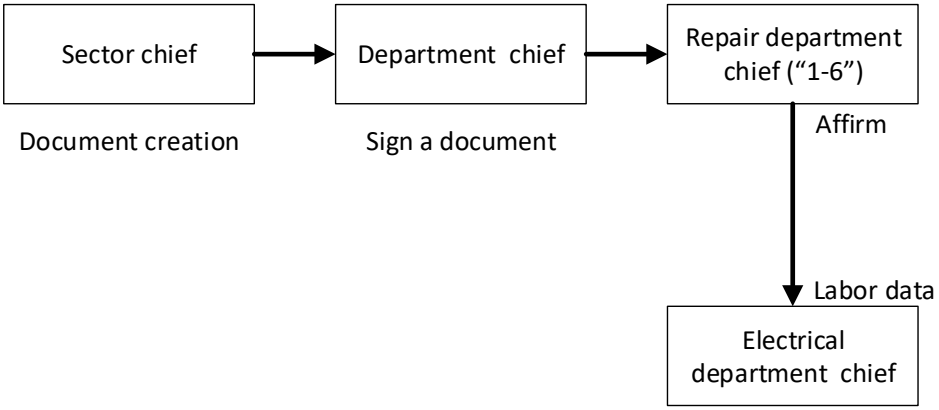

Fig. 10. Creation and route of document No. 56

2. System design

2.1 The selection of the system architecture

The selection of the system architecture (file-server, client-server, multi-unit architecture) is provided by both a client's requirement (scalability, flexibility) and functional features (capacity, the volume of internal network traffic) of the existing technologies.

Every information system must have three main functional parts such as the modules of data storage, data processing and user interface. Each part of the system is independent and can be realized separately. For example, it's possible to change the user interface not changing the programmes which are used for the data processing and storage. The same data can be presented in different forms of tables, charts and bar charts [7].

Speaking about the file architecture it's important to note that the server is suitable only for small applications. Moreover, scalability is not a strong feature of the architecture and its usage within the network application can lead to traffic volume reduction and, as a result, productivity reduction.

Multi-unit architecture gives an opportunity to use these three modules separately (the main feature of the system). However, this architecture is rather expensive and it is not appropriate to realize it for a small department or its parts. Such architecture is useful for big companies.

The client-server architecture has got a feature of strict separation of the module of data storage and the module of user interface. According to the place of data processing module usage there are two types of architecture such as **thick client** (the data processing is provided independently on the client) and **thin client** (the data processing is dependent on the server).

This architecture provides:

- Security of data storage
- Data integrity – internal mechanisms which reduce an opportunity of possible collisions with data input and their editing.
- Regulated data access – users can work with the data if they have got an access and the access mode which is appropriate to their rights
- Multi-user access mode to the data
- Rich functionality and reduction of the load on the server at the expense of spreading the process between the servers and the stations.
- Minimization of network traffic.
- Scalability – increase of the system capacity proportionally to the number of processors and random memory of servers.
- Optimization of the distribution of computational loads between the server and the client.

The advantage of this system is its low price of integrity. The architecture client-server can be used both for companies and for applications of medium size. According to the advantages of the architecture client-server it was chosen as the architecture of the system.

The architecture client-server provides tasks and computational load distribution among several computers of one network. The data system software which is realized within this architecture can be divided logically into server software, medium level software and client jobs software. Client software is responsible for presentation functions and interacts with the user. Medium level software performs logical rules and data processing which goes from or to the client. Server software provides safe data storage and data search according to the requirements [8].

This architecture provides a **Database Management System** (**DBMS**) existence in the server. DBSM functions will be data storage and means of data

access storage such as business- logic elements which provide and realized by triggers and procedures.

The client part is user interface to the server part which is used for documents data output (document view, reporting, search and etc.) and business process management by the means of the business-logic level.

2.2 Design of the system structure

According to the previous section the system structure can be divided in to two parts:

- Server
- Client

Speaking about the selected architecture for our system it's necessary to refine subsystems of document management system described earlier in the section 'Analysis of document management systems'.

According to the stage of analysis the archive subsystem is divided into tree subsystems such as data (data storage), metadata (types of documents, hierarchy of types of documents, the structure of documents) and data directory (data storage of the company power supply structure).

Further analysis and separation of two subsystems into client part and server part lead to the list of subsystems below:

- ***Data directory*** – an element of relational database which stores common data and reference data of the system, the hierarchy of the department, topology and elements of the power supply system, technological installations and etc.
- ***Data (document archive)*** – an element of database which contains the information about the documents movement within the system.
- ***Metadata (documents description)*** – contains the structure, rules of processing and hierarchy of all types of documents of the system. Moreover, it has got the information which is necessary for documents visualization.
- ***Work with database directory*** – a module of the (client) application which provides the interface to the suitable layer.

- ***Setting of document description*** – a client module which suitable for the setting of all parameters, operating within the document system. The module helps to realize the interface to the suitable server layer.

Routing subsystem is divided into the following subsystems:

- ***Business logic layer (rules of work with data)*** – is the set of stored procedures and triggers encapsulating the logic of work with documents and reference data. Any client activity with database relates to this layer.
- ***Work with data*** – the central module of the client application which provides the main functionality of the system.
- ***The layer of user data and their access rights*** – is used to identify the user's permissions and to store different register information.
- ***Administration*** – is performing of the setting of users' rights for different activities with documents and referring data. This module can be included into the main client application or to be an independent application.

The functions of a document input are performed within the subsystem 'Work with documents'. Any document activity is performed within the Business logic layer, using saved procedures and data update.

Moreover, the system must have the modules to connect with other systems which are used by the company.

- ***The modules of connection*** – can be used for connection (data export) of the designed system with the other systems (internal to the designed system) which are used by the company. The functionality and specification must be approved separately.

The result of the stage analysis is presented in the Figure 11.

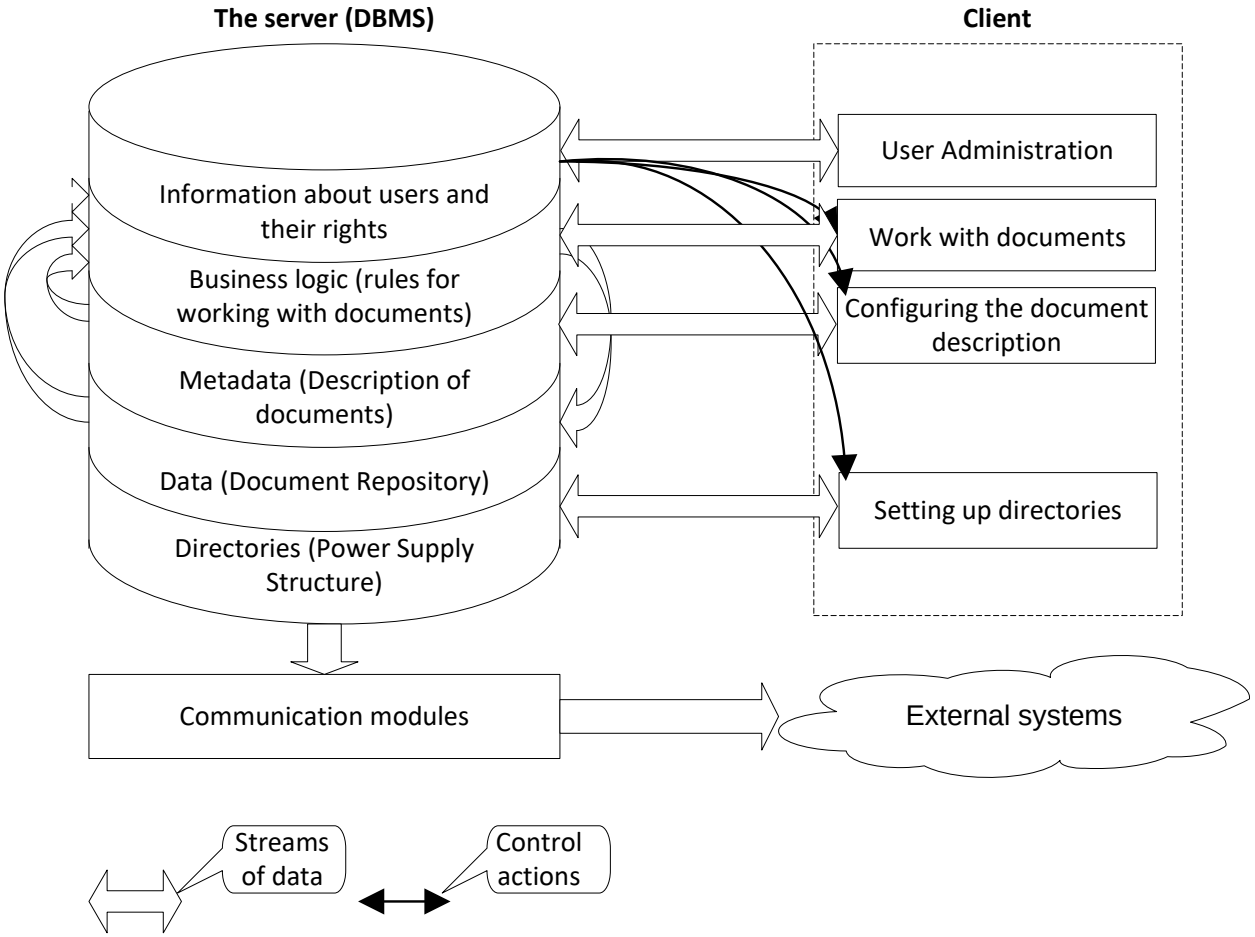

Fig. 11. The general system structure.

2.3 Design of the information model of the system

DBMS usage means that it's also important to design the structure of database, in other words, **the information model of the system**. Such model must include objects which are identified at the analysis stage and it must be suitable to the designed common structure of the system elements interactivity above.

Data model, being the basic part of the offering system, must take into account the whole amount of the really existing objects of the automation (documents, departments, executives, elements of the schemes of power supply, etc.) and their relations. The selected model will specify the functionality and the interface of designed system.

One of the main features of the designed model must be its high flexibility and adjusting of the system to the specific conditions of activity. A great amount of

types of documents were identified at the stage of analysis. Moreover, it can be possible to identify the other types of documents or some changes of the old documents structure further. It means that it's impossible to plan ahead the tables with the particular set of boxes for either each type of documents or each type of equipment. It's necessary to have an opportunity to enter new types of equipment or new types of document and edit the sets or characteristics of boxes exactly during the system usage. It's absolutely evident that the interface must support such setup.

There is an information model below which is based on the analysis data of the previous sections of the report.

The model is divided into two loosely cooperating areas. The first area describes the structure of docflow (Fig.12), directly connecting with the productive activity (creation and flow of types of documents such as an order, a protocol and the other documents of such type). The second area is a model of the scheme of the company power supply (Fig.13). The areas' link is single and performs that each document can be referred with only one equipment unit (Document ID_unit_equpment). The basic feature is the types of documents which identify all the possible documents, functioning within the system. The types of documents can the hierarchy. It means that it's possible to identify the type of a document, e.g. 'protocol' ant then create the type of document 'a protocol of tire insulation test' based on the. It leads to that the 'document-offspring' inherit all the boxes of the 'document-parent', described only first appeared boxes

The attributes of a document (boxes description) with the types of documents form together the relation 'many-to-many' which means each document is characterized by the set of the number of boxes and some of the boxes can belong to several types of documents at the same time.

Particular characteristics of the boxes of each document are stored in the table 'Boxes of a document'.

The table 'A document' is the main object of the whole model and contains the headings of every functioning (or functioning earlier) documents.

The second area describes all the objects and relations between them which are important for creating and reflecting the schemes of power supply. It contains all the objects, referring to power supply area and admit the structures of relations between them.

According to this the main idea of the system function is that there are different ways of navigation within the model and their aim is searching of the particular document. For example, the navigation within the single-line scheme of power supply, installation and its equipment, the hierarchy of documents or the hierarchy of the departments. As a result, the user gets an access to the particular document to provide some activities with it (earlier discussed and included to their rights – 'The rights to be confirmed 'section) such as the document editing or changes of its status (agreement, making some notes, etc.) all the possible changes of the status are described in the table 'Regulated stages of document agreement'.

Moreover, there is an opportunity to create one document from another as a protocol can be created, based on an order. The characteristics for each document can de set.

The result of this stage is two information models of the system. They are the model scheme of the department docflow and the model scheme of company power supply. They are introduced in the Figures 12 and 13 .

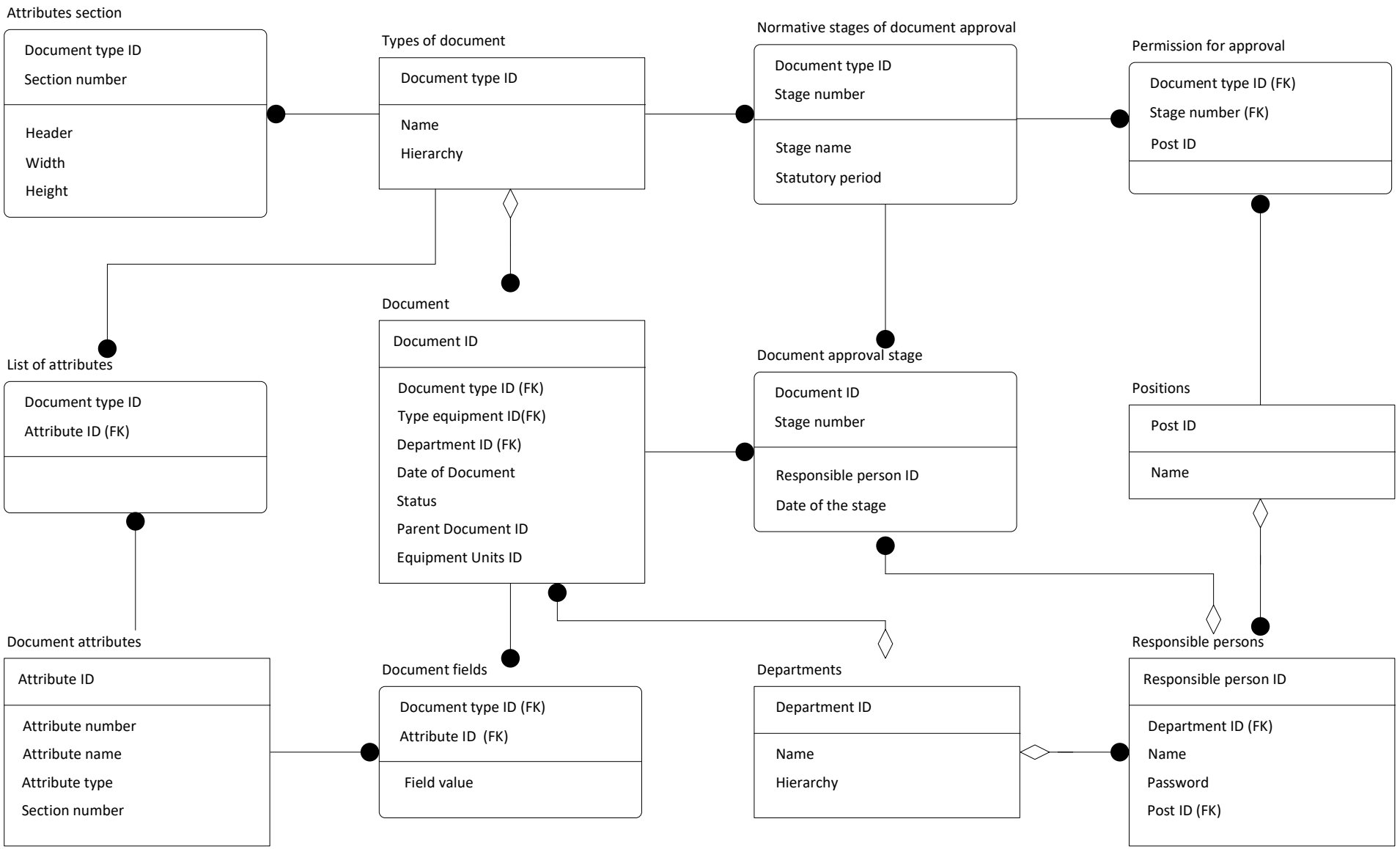

Fig.12 The model of the structure of the depatmenrt docflow.

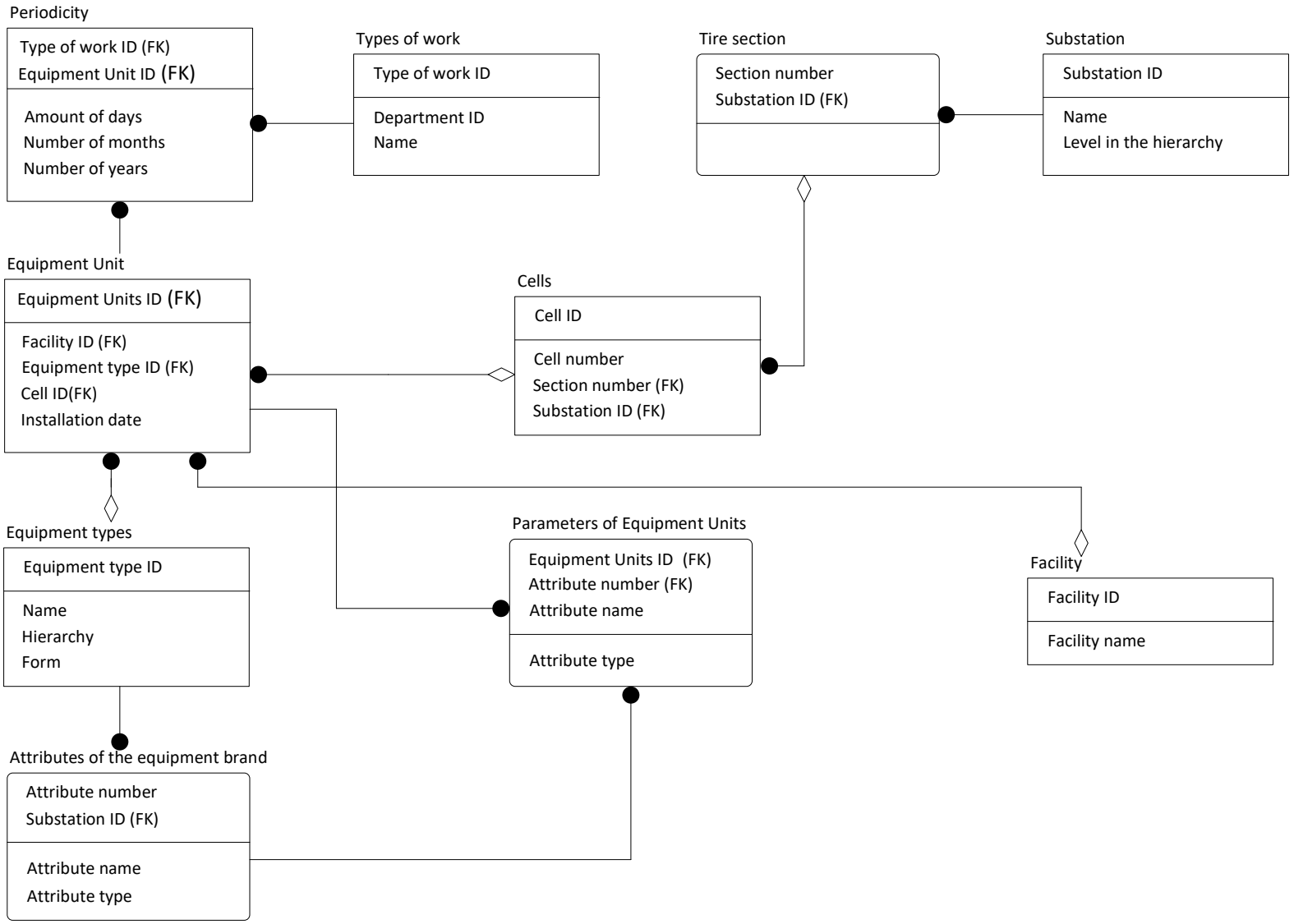

Fig.13 The model of scheme of the company power supply.

3.Realization of the system

3.1 Engineering of the system programme modules

At the moment the system is at its development phase. The system engineering is the work for the team not for a single specialist. The components which are realized within the qualification work and described in this section are the structural elements of the system and will be used for its assembly

These components can be divided into two parts: client and server. The components of the client part of the system are programmes or program modules. The components of the server part are triggers and stored procedures, provided in the trigger and stored procedures languages of the DBMS.

Our task is realization of several sets of stored procedures which present business processes (server part).

Stored procedures

Stored procedures are the elements of a code, provided within server by server processes. They can be run by a triggering client application, other stored procedures or triggers. A call of the procedure by a client is provided with the help of the interface and makes it possible to get the access to the core of the DBMS. Such interface can be API of the database of the server, ODBC, etc. However, more often the calls are made through the interfaces which provide cooperation of the user and DBMS by the means of SQL – requirements. Then the procedure is called by the core of the database. After that the result of its work is returned to the user with the same interface usage. The usage of the stored procedures is the function of the model client-server which concentrates the logic of the work with data within the server and gives the client an opportunity to deal with the issues of the information display.

There are some advantages of the stored procedures below:

- ***Performance.*** Execution of stored procedures reduces the network traffic. The location of the database at the same machine as the stored procedure leads to the

rather fast access to the data of the procedure (in comparisons with its location at the client machine).

- ***Advantages of client-server system engineering.*** Stored procedures usage allows separating of the creating tasks of the client and the server parts of the system. The interface of the stored procedures is unchanged when the structure of the database is changed. Moreover, the stored procedures can be used again to minimize the quantity of the source code.
- ***Security.*** The stored procedures can be used as the tool to provide high-level security. The data access, provided by the procedure, can be opened to the user while the source of the data (tables) is hidden.
- ***The rules of data input.*** Data input with the stored procedure usage is allowed by the complicated rules of data input (verification of the table data in other tables, etc).

SQL is not a procedural programming language, it's allowed to use of the managing key words [13] (e.g. constructions IF…THEN…ELSE, WHILE…DO) with the triggers and stored procedures. It becomes possible to use the stored procedures for database and tables activity instead of the programmes, written in traditional programming language.

The stored procedures are the best tools for business-logic realization within the system. They help to perform different business processes such as document routing, signing of the documents by an official and etc.

The list of the realized stored procedures

The stored procedure is a business process stored in the server. In the section of realization some of the procedures are:

- The procedure of the document confirmation CONFIRM_DOCUMENT
- The procedure of the department activity scheming GetNecessaryDates.
- The procedure of the document fields creating CreateDocFields.
- The procedure of a new document creation NewDocument.

- The procedure of the document field updating UpdateDocField.
- The procedure of the document content extraction GetDocFields.
- The procedure of the document deletion DeleteDocument.
- The procedure of removal of the hierarchy branch of the types of documents GetChildrenTypeDoc.
- The procedure of the path removal within the types of document hierarchy GetPathByID.
- The procedure of the document addition AddTypeDoc.

The source codes of the stored procedures are presented in the appendix 1.

The procedure of a document confirmation Confirm_Document.

Function.

The procedure is used for a document confirmation by the official of the department. It's the analog of a signature of a paper document.

Operation description

The procedure gets input data from the user and according to them it performs operations with the table of the system database. Firstly, the procedure verifies the information about the user such as his/her database number and password. After that the procedure sends some queries to the database which cause if the document can be confirmed by the official at this stage. If the verification of all the characteristics is successful, the next step is making changes in database tables which inform about the document status changes. In this case the procedure returns the code of successful completion of the operation. In the case of the error occurrence at any stage, pre-set earlier the procedure returns the code containing the information about the error type.

Input and return parameters.

Input parameters:

ACB_ID	ID number of the official
PASS	Password of the official
DOC_ID	ID number of the document

Return parameters:

ERR	Completion code of the procedure

Possible values of completion code of the procedure (ERR)

0	The procedure is over correctly
-1	The official of required input characteristics doesn’t exist (an user’s ID error)
-2	The Document number which is equal to the input characteristics is not found.
-3	The document is executed.
-4	The official doesn’t have the rights to confirm the document of this stage.

Algorithm of the procedure process

The algorithm of the procedure process is presented in a form of a flowchart in the Figure 14.

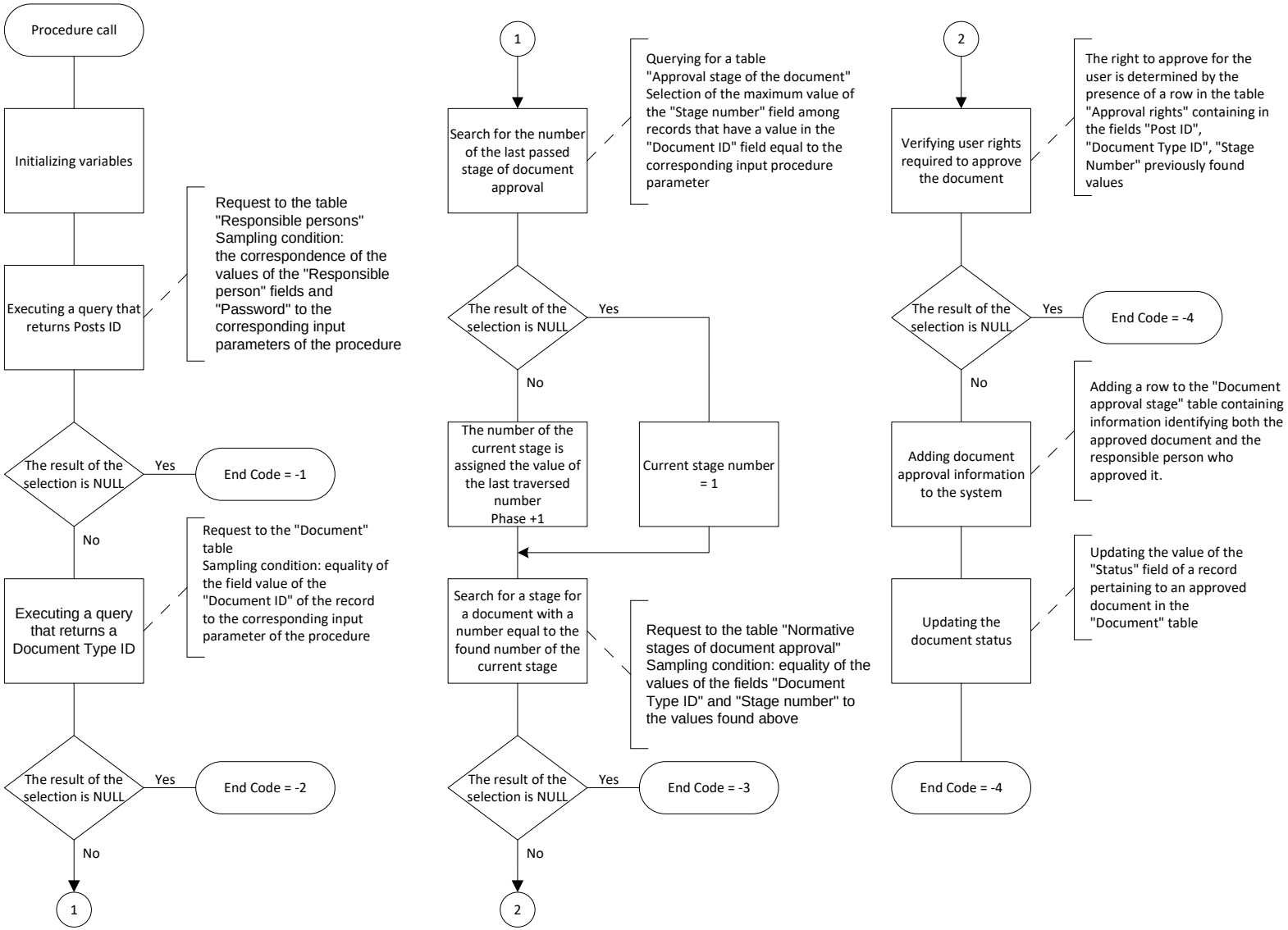

Fig. 14. The flowchart of the procedure processes algorithm - CONFIRM_DOCUMENT

The procedure of the department activity scheming.

Function

The procedure GetNecessaryDates is used for scheming of schedule of both completed (and recorded) work and expected work (according to its frequency) for adjusted areas (of the part of the Electrical department) and temporarily periods (adjusted by the opening date and the final date).

Operation description

The procedure returns the dates of repair (inspection) works (both expected and completed (recorded)) for all units (elements) of the equipment which demand the execution of particular and necessary works performed by the particular department. Moreover, the equipment is set and returned for its each element. Also each element has got its periods of frequency (for the particular unit of the equipment within all types of work of the particular department) which are the starting point for further performance of inspections and repair. Besides, the procedure returns the type of the date which is properly described below.

Input and returned parameters.

The procedure selects the data from the table: the department, type of work, frequency, equipment unit, document, type of document, installation.

Input parameters:

WG_ID	ID of the department
BEGIN_DATE	The lowest boarder of the time interval
END_DATE	The top boarder of the time interval

Return parameters:

DEVICE	Name of the department
WORKTYPE	Type of work
UNIT	Name of the installation unit
RECORD_DATE	Date (e.g., the date of the protocol or the date calculated according its frequency)
RECORD_TYPE	Type of the date (see below)

P_D	Days periods
P_M	Months periods
P_Y	Years periods

It's necessary to give some explanations before the description of the type of the note. They should be divided into three main types of date:

1. The date of the equipment unit installation (is presented in the appropriate table)

2. The date of the protocol of work execution (inspection and repair)

3. Calculated date – the date of providing of the next inspection or repair according to its frequency.

Supposedly, the user wants to view the data of the previous period and there are new protocols, situated beyond the upper boundary of the time interval, among the selected protocols. Moreover, the time interval for an element between the latest protocol (included according to the input parameters) and the following protocol (situated beyond the time interval) is wider that the interval (according the frequency) for the given element. For example, inspection and repair works were not possible to provide on time because of there was not opportunity to stop the working process. In addition, the date (as the result of summing with the latest date of the protocol) for the given element is included into both the interval of frequency and the given interval. As a result, if we don't check availability of th protocols beyond the upper boundary of the time interval, the user will get the set of protocols with the correct date which has lost its relevance.

In conclusion it was identified the further amount of values for the type variable of record date Record_Type:

If there is a protocol beyond the interval	*Date of element installation*	*Date of a protocol*	*Calculated date*
No	0	1	2
Yes	3	4	not exist

Algorithm of the procedure process

Algorithm of the procedure process GetNecessaryDates is presented in the form of a flowchart in the Figure 15.

The procedure of the document fields creating CreateDocFields.

Function.

The procedure CreateDocFields is used to create an empty list of document fields. It provides the creation of a new document with the usage of a document editing interface.

Operation description

The procedure gets the data from the input parameters identifying a creating document.

According to the data it's possible to identify the type of the document. The final step is creating of the list of notes with the empty information fields based on the list of attributes of the detected type of the document.

Input and returned parameters.

Input parameters

DOC_NO	Document ID

Returned parameters are absent.

Algorithm of the procedure process

The algorithm is presented in the form of a flowchart in the Figure 16.

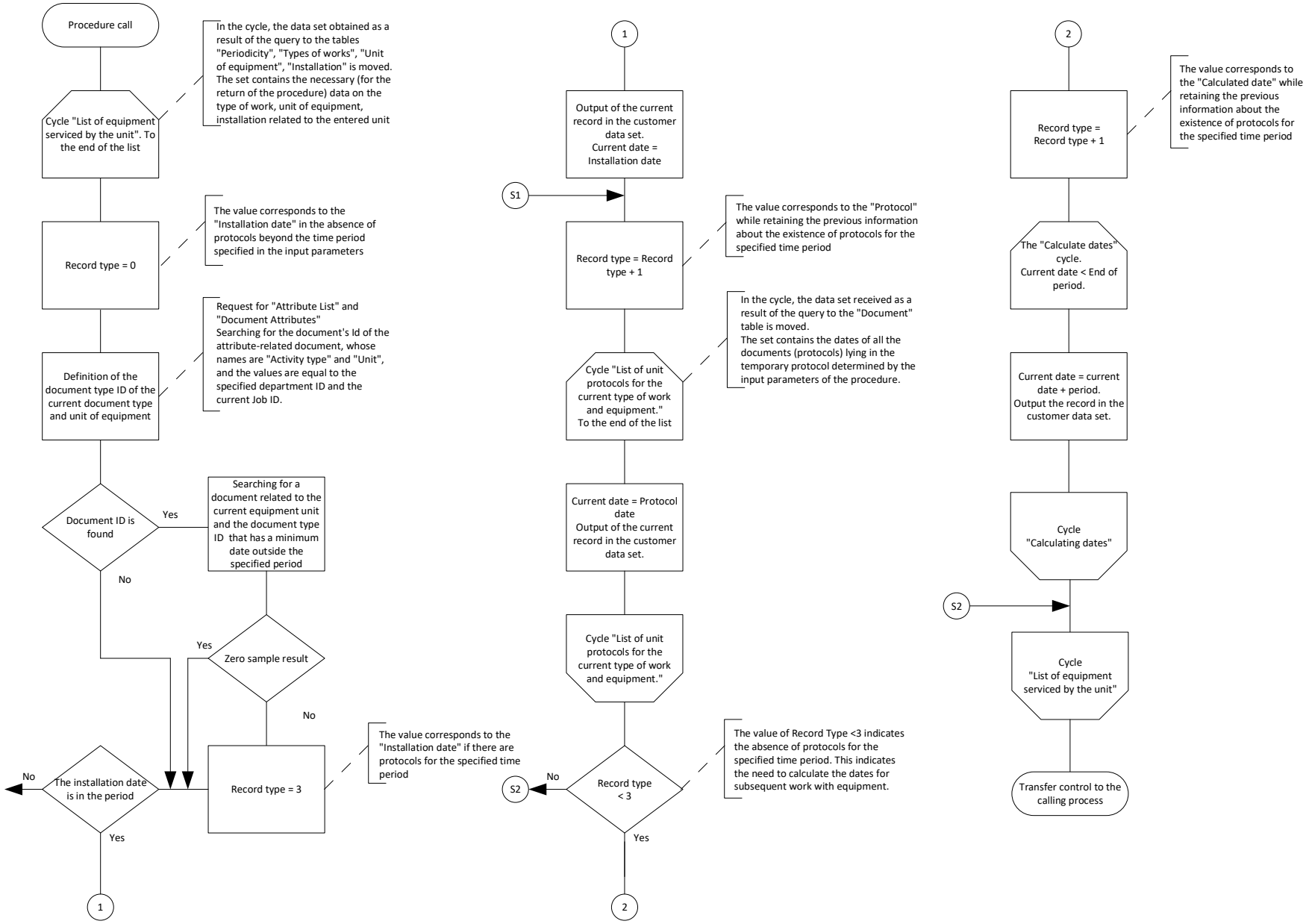

Fig. 15. The flowchart of the procedure processes algorithm - “CreateDocFields”.

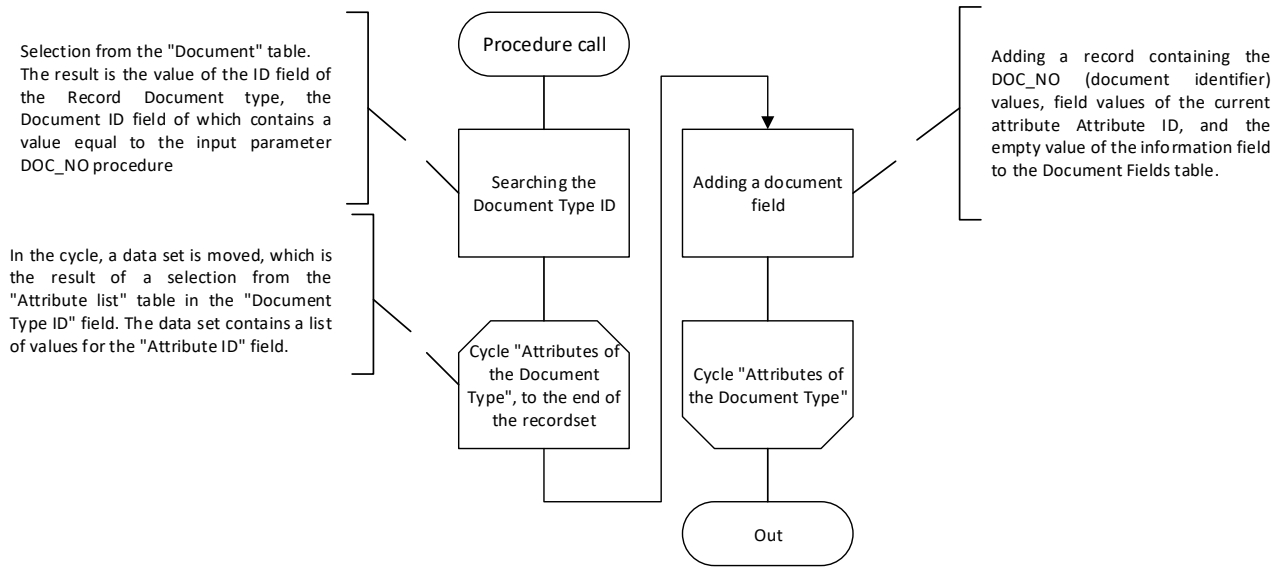

Fig. 16. The flowchart of the procedure processes algorithm - “CreateDocFields”.

The procedure of a new document creation NewDocument.

Function.

The procedure NewDocument is used to add a new document to the system.

Operation description

The procedure gets the data from the input parameters which are necessary to add a ‘blank’ document to the system. It leads to the contribution of necessary information to the system.

Input and returned parameters.

Input parameters

NEW_TD_ID	Type of document ID
NEW_DATE	Date of a document creation
NEW_STATUS	Document status
NEW_SUBD_ID	Department ID
NEW_PARENT_ID	Document-parent ID

Returned parameters

NEW_ID	A created document ID

Algorithm of the procedure process

The algorithm is presented in a form of a flowchart in the Figure 17.

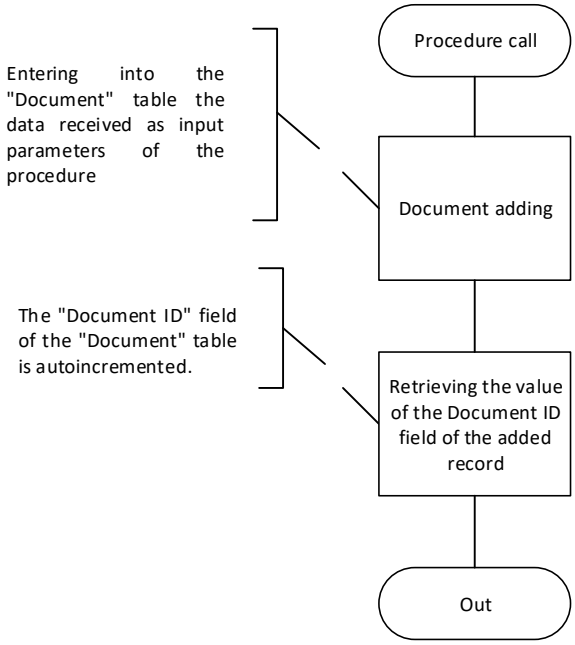

Fig. 17. The flowchart of the procedure processes algorithm - “NewDocument”.

The procedure of the document field updating UpdateDocField.

Function.

The procedure UpdateDocField is used to edit document content.

Operation description.

The procedure gets the data from the input parameters which identify the editing document and its field. The value of the old data filed is replaced with the new value which is got form the input data.

Input and returned parameters.

Input parameters

DOC_NO	Document ID
ATTRNO	Document attributes number
ATTRVAL	New attribute value

Returned parameters are absent

Algorithm of the procedure process

The algorithm is presented in the form of a flowchart in the Figure 16.

The procedure is performed by only one language operator SQL – “Update”. The operate change the value of the field ‘The value of the field’ of the table ‘The

fields of the document' which has got the equal value to DOC_NO in the field 'Document ID' and the equal value to ATTRNO in the field 'Attributes ID' .

The performance of this operation as a stored procedure is provided according to the security policy of data access based on the stored procedures, logic data management transfer to the server area and independence client part from database system.

The procedure of the document content extraction GetDocFields

Function.

The procedure GetDocFields is used to extract the content of the necessary document from the system.

Operation description.

The procedure gets the data from the input parameters which identify the necessary document. The next step is selection of the document content from the system database. The data of document attributes and their value is shown in returned parameters.

Input and returned parameters.

Input parameters

DOCUMENT	Document ID

Returned parameters

ATTR_ID	Document attributes ID
ATTR_NUM	Document attributes No.
ATTR_NAME	Attribute's name
ATTR_TYPE	Attribute's type
ATTR_VALUE	Attribute's value
DOC_TYPE	Type of the document ID

Algorithm of the procedure process

Only one language construction SQL – ‘FOR SELECT … INTO ….DO’ is performed within the procedure. The construction helps to provide the selection and organize the cycle of data set navigation from the first to the final note.

The construction makes it possible to provide the selection from the tables ‘Document’, ‘Document fields’, ‘Document attributes’.

The conditions of the selection are the next:

- The only note with the value of the field ‘Document ID’ which is equal to input parameter DOCUMENT is selected from the table ‘Document’.
- The only note with the value of the field ‘Document ID’ which is equal to input parameter DOCUMENT is selected from the table ‘Document field’.
- The notes with the value of the field ‘Attribute ID’ which are equal to the value of the fields with the same name of the table ‘Document fields’ are selected from the table ‘Document attributes’.

The results of the selection are the set of data with the fields which are equal to the appropriate list of returned parameters.

All the selected values are returned back to the client set of data within the cycle.

The procedure of the document deletion DeleteDocument.

Function.

The procedure DeleteDocument is used to delete a document from the system.

Operation description.

The procedure gets the data from the input parameters which identify the document. Then the information of the document is deleted and after that the document itself.

Input and returned parameters.

Input parameters

DOC_NO	Document ID

Returned parameters are absent.

Algorithm of the procedure process

Two operators SQL – ‘DELETE’ perform within the procedure.

1. All the notes of the table ‘Document fields’, having the value in the field ‘Document ID’ which is equal to DOC_NO are deleted.

2. The note of the table ‘Document’, having the value in the field ‘Document ID’ which is equal to DOC_NO is deleted.

The procedure of removal of the hierarchy branch of the types of documents GetChildrenTypeDoc.

Function.

The procedure GetChildrenTypeDoc is used to extract the set of data, containing the list of values of ‘Type of document ID’ from the database. The values are the direct child-documents of the top of the hierarchy of types of documents which are featured in the input parameters and exist in the system. The procedure is used to navigate within the system tree of the types of documents in the appropriate module of the client application.

Operation description.

The procedure gets the data from input parameters which indentify a type of a document. This type of a document is the top of the hierarchy and the child-documents of this top are necessary to be identified. Next step is identification of the rout to the top. Then the path to the final types of documents is structured according to the top ID and the route to it. The final stage is the search and output of the client data set of the list of all types of documents which have got the identified route.

Input and returned parameters.

Input parameters

PARENT	Type of the top parent-document ID

Returned parameters

CHILD_ID	Type of the top child-document ID
CHILD_NAME	Name of the child -document
CHILD_PATH	The path within the hierarchy to the type of the child-document

Algorithm of the procedure process

The procedure has got the following stages:

1. The search of the path to the parent-top. The path is the value of the field 'Hierarchy' of the table 'Type of a document' in recording, the value of the field 'Type of a document ID' is equal to the value of the input parameter PARENT. This stage is performed by the language operator SQL SELECT.
2. If the identified value in par. 1 is empty (is equal to NULL), the empty value field is assigned to this variable.
3. Identification of the child path. It is provided with the help of the procedure NEWCLASSPATH. Its parameters, identified in par.1 and par. 2, are paths and the input parameters of the procedure.
4. Output to the client data set and its structure, identified by the list of the returned parameters. It is provided by the construction of the language SQL «FOR SELECT … INTO … Do». This construction returns the value of the fields of the table 'Types of documents' to the client: 'Type of document ID', 'Name' and 'Hierarchy' in records which have the equal value of the field 'Hierarchy' to the identified the value of the child path in the par.3.

The procedure of the path removal within the types of document hierarchy GetPathByID.

Function.

The procedure GetPathById is used to extract data about the location of the requested type of document within the system hierarchy of types of documents from the database. It is used in the navigation module within the hierarchy tree of the system types of documents in the appropriate module of the client application

Operation description.

The procedure returns the path to the top of the hierarchy of the types of documents, identified by the input parameters.

Input and returned parameters.

Input parameters

NODE_ID	Type of document of the top ID

Returned parameters

NODE_PATH	The path to the required document

Algorithm of the procedure process

The procedure consists of the one stage:

1. The search of the path to the top. The path is the value of the field 'Hierarchy' of the table 'Type of document' in recording, the value of the field 'Type of document ID' is equal to the input parameter NODE_ID. This stage is performed by the language operator SQL SELECT. The identified value is stored in parameters returned to the client. Найденное значение сохраняется в параметре, возвращаемом клиенту.

The procedure of the document addition AddTypeDoc

Function.

The procedure AddTypeDoc is used to add a new type of document into the system.

Operation description.

The procedure adds information about a new type of document into the system. There is information about a type of a parent-document in the input parameters to add a new document. The path for the adding document of the hierarchy is identified according to this information and after that all the necessary data is added to the system.

Input and returned parameters.

Input parameters

PARENT	Type of parent document ID
TYPE_NAME	Name of the adding type of document.

Returned parameters

ID_CHILD	New type of document ID

Algorithm of the procedure process

The procedure consists of the following stage:

1. Verification of the parameter PARENT. It the parameter has got an empty value, adding type of document (root document) and the path to it is an empty field. Go to par. 4 otherwise par. 2.
2. Search of the parent hierarchy. The path is the value of the filed ‘Hierarchy’ of the table ‘Type of document’ in recording, the value of the field ‘Type of document ID’ is equal to the value of the input parameter PARENT. This stage is provided by the language operator SQL SELECT.
3. Identification of the path of a new document. It is performed with the help of the user procedure NEWCLASSPATH. Its parameters are identified in par. 2 the path of the input parameters of PARENT procedure.
4. Adding of the type of the document. The record, containing the input parameters in the fields ‘Name’ and “Hierarchy’ and the path to the new type of document is added to the table ‘Type of document’.
5. Search of the type of document ID for a new document and storing of the obtained value within the returned parameter by the ID_CHILD procedure.

3.2 System assembly

The system realization consists of several stages, each of them is completed with the next version of the system. The capability of the next versions comes closer to the client requirements. So the last version finishes the system assembly.

At the present moment the first version of the system testing is being prepared. The system performs the process of document ant types of document creation and provides the navigation within the set of types of documents of the department.

The system is the set of components which are realized both within the present qualification work and beyond it by the other members of the creators' team. The interactivity of the components is presented in the Figure 18.

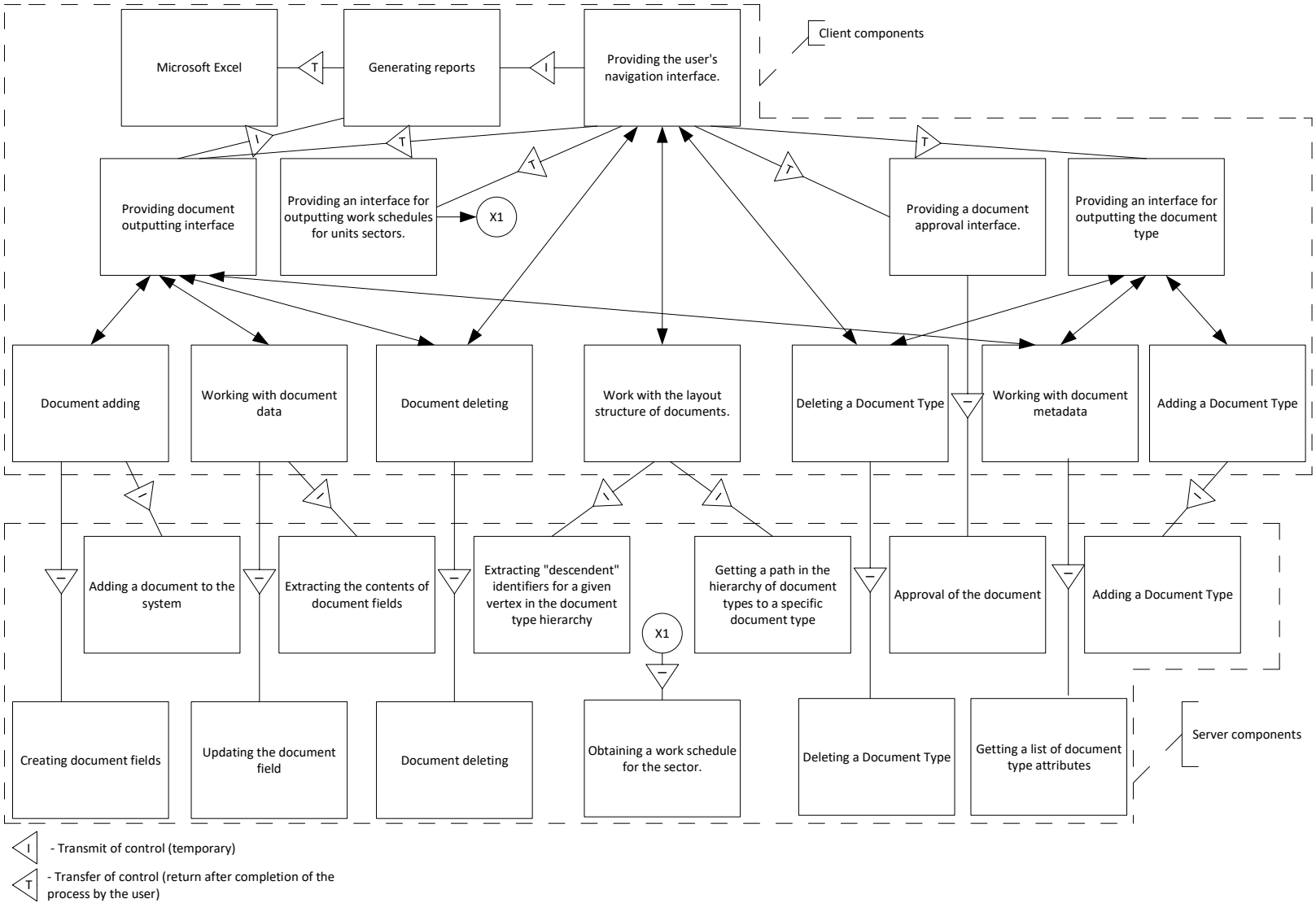

Fig. 18. The flowchart of the system components interactivity.

3.3 The testing of the procedure of the document confirmation.

The stored procedure creation as in some other programme modules can cause a danger of errors appearance inside the source code. The test of the procedure working capacity is provided to identify and fix such errors. Moreover, it is the final stage of the whole process of the system creation. This section contains the description of the steps, taken to analyze the stored procedure of the document confirmation (Confirm_Document) after checking by the official its correct performance.

According to the source code and the algorithm of the procedure, described in the design part, it has become clear that Confirm_Document performs the selection from different database tables to verify if input parameters perform the system present state and its settings. That's why it's very important to enter particular information in the system database tables in advance to verify the procedure. This information helps to analyze if the results, returned by the testing programme element, are either correct or incorrect.

Following the algorithm of the procedure we can identify that it applies to the tables below:

- ***The officials.***
- ***Document.***
- ***The stage of document confirmation.***
- ***The regulative stage of the document confirmation.***
- ***Access to the confirmation rights.***

The tables below are the source of data for the procedure. So it's necessary to enter the following testing data to the tables. The tables present the exact fields which are important within the context of the analyzed procedure.

The officials:

Official Id	*Department Id*	*Name*	*Password*	*Position Id*
1	1	1 person	pass1	2
2	2	2 persons	pass2	3

Official Id	*Department Id*	*Name*	*Password*	*Position Id*
3	3	3 persons	pass3	1
4	1	4 persons	pass4	4
5	2	5 persons	pass5	2
6	3	6 persons	pass6	2

Document:

Document Id	*Type of document Id*
25	1
30	32
31	32

The data is not required to be entered into the table 'The stage of the document confirmation'.

The regulative stage of the document confirmation.

Type of document Id	*Stage N*
1	1
1	2
1	3
32	1
32	2

Confirmation rights:

Type of document Id	*Stage N*	*Position Id*
1	1	2
1	2	1
1	3	4
32	1	1
32	2	3

According to the information above there are 6 officials, 4 positions, 3 documents and 2 types of document.

The procedure must return completed _code. If the completed code 0, the procedure must:

1. Enter the record, containing the data about Document ID, N of the stages, type of document ID and the official ID into the table Вносить в таблицу ‘Stage of document confirmation’.

2. Change the value of the field ‘Status’ of the table ‘Document’ which is recorded and has got *ID_Document* in the field of value which is equal to the input parameter of the procedure.

There are 5 testing calls of the procedure:

1. *Verification of the Client ID error*

Expected result: -1.

The procedure calls performance:

Exec Confirm_Document 1,’wrong_pass’,25

Result: -1

Exec Confirm_Document 2,’pass1’,25

Result: -1

Conclusion: obtained result is equal to the expected result

2. *Verification of the document absent within the system. Expected result*: -2.

The procedure calls performance:

Exec Confirm_Document 1,’pass1’,77

Result: -2

Exec Confirm_Document 2,’pass2’,13

Result: -2

Conclusion: obtained result is equal to the expected result.

3. *Verification of the official’s rights to document confirmation error. Expected result*: -4.

The procedure calls performance:

Exec Confirm_Document 1,’pass1’,30

Result: -4

Exec Confirm_Document 2,’pass2’,25

Result: -4

Conclusion: obtained result is equal to the expected result.

4. *Verification of document confirmation by the user*. *Expected result*:0.

Confirm the document with Id_Document = 25. The document has got Id_Type _Document=1. Such documents can be confirmed by the official of the position No. 2 at the first stage. These positions are occupied with people who has got ID_Official = 1,5,6.

The procedure calls performance:

Exec Confirm_Document 6,’pass6’,25

Result: 0

Verification of the table content ‘**The stage of document confirmation'**:

ID_Document	*N Stage*	*Id_type_document*	*Id_official*
25	1	1	6

Confirm the document with Id_Document = 25. The document has got Id_Type _Document=1. Such documents can be confirmed by the official of the position No. 2 at the first stage. These positions are occupied with people who has got ID_Official = 1,5,6.

The procedure call performance:

Exec Confirm_Document 6,’pass6’,25

Result: 0

Verification of the content **‘The stage of document confirmation'**:

ID_Document	*N Stage*	*Id_type_document*	*Id_official*
25	1	1	6

Confirm the document with Id_Document = 30. The document has got Id_Type _Document= 32. Such documents can be confirmed by the official of the position No. 1 at the first stage. These positions are occupied with people who has got ID_Official = 3.

The procedure call performance:

Exec Confirm_Document 3,'pass3',30

Result: 0

Verification of the content **'The stage of document confirmation'**:

ID_Document	*N Stage*	*Id_type_document*	*Id_official*
25	1	1	6
30	1	32	3

Conclusion: obtained result is equal to the expected result.

5. *Verification of the error absence of the particular stage for the document*.

Expected result: -3. Addition of another signature to the document 30.

Exec Confirm_Document 2,'pass2',30

Result: 0

Trying of document confirmation in three steps:

Exec Confirm_Document 2,'pass2',30

Result: -3

Conclusion: obtained result is equal to the expected result.

The procedure research Confirm_Document proves the accordance of the returned results to the expected results.

Results

To sum all the data of the research section up, all the results of the selected components of the system are expected. The rest archived operations were analyzed in the same way and this analysis is described in the design part of the research work. The analysis of the components does not show any errors.

CONCLUSION

At present, for all the importance of system performance, its quality often depends on how simple and understandable its structure is.

In turn, it is impossible to build a satisfactory structure without knowledge of the subject area of the system being developed. The analysis phase is intended to develop the designers' most complete understanding of the task at hand, to familiarize themselves with the main entities of the problem area of the product being created.

Therefore, the first step in creating a master's thesis was the stage of analysis. In the analysis section, it was shown the need to create a docflow system that takes into account both the specifics of the vendor and the departments of the customer enterprises. The analysis of the subject area in the course of which the functions of the document management systems were established, the list of the main documents and business processes of the automation and energy departments was identified.

At the design stage, the general structure and information model of the system data was constructed. The structure of the system is built on the principle of modularity with the use of client-server technology. The application of the modularity principle gives the system flexibility and scalability. There is the possibility of replacing obsolete modules in the future without changing the others. The use of client-server technology allows you to concentrate data control (security, integrity) in one block (logical and physical) and abstract data management from the user interface. This solution gives the system stability and greatly simplifies data management. The information model of the data (database structure) of the system constructed at the same stage has the necessary flexibility to meet the current needs of the customer (since the initial material for its creation was the results of the departmental docflow analysis stage) and is designed for possible changes in the list of the main types of documents due to the separation of the concepts "document" and "document attribute". In other words, the system is

designed with the expectation of significant changes in the structure of documents and docflow, always reflecting, at the same time, the existing docflow method in the department.

Thus, the main result of the design phase is the structure of the system, fully satisfying the requirements in par. 1.1.1.

The subsequent stage of the system creation is presented in the master's thesis by sections 2 and 3. The result of the implementation section is a set of components that will then be used as building elements in the building of the entire system.

Thus, the results obtained correspond to the design assignment for the “An information system for technological docflow for vendors of technological and automated products” direction:

1. The analysis of the organizational structure of the subdivisions of the enterprise-customer is made;

2. The analysis of the route of documents participating in office work, operational, organizational and other activities was carried out and on the basis of analysis a classification of these documents was developed and a list of their main types was developed;

3. The concept of an information model of an automated information system for the activities of departments of vendor and customer enterprises is developed;

4. A variant of technical implementation of the developed system is proposed.

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APPENDIX 1

Source of the stored procedure Confirm_Document.

```
CREATE PROCEDURE Confirm_Document
-- Input parameters
        (acb_id integer, doc_id integer, pass varchar(20))
--Returned parameter
        RETURNS (err integer)
AS
-- Declaring variables
DECLARE VARIABLE job_id integer;
DECLARE VARIABLE new_stat varchar(20);
DECLARE VARIABLE td_id integer;
DECLARE VARIABLE ph_num integer;
DECLARE VARIABLE i integer;
BEGIN
 i = 0;
/* Verifying the input parameters of the identification of the responsible person with the
information in the database */
FOR SELECT acb_job_id
FROM ACCOUNTABLE
WHERE  acb_id = :acb_id and acb_pass = :pass
INTO :job_id
DO
        i=1;
/* Exit with the appropriate exit code if this user does not exist in the system */
IF (job_id IS NULL) then
BEGIN
        err = -1;
        EXIT;
END
 /* Checking the availability of the document corresponding to the input parameter
Doc_id. Also finding out the document type identifier */
FOR SELECT doc_td_id
FROM DOCUMENT
WHERE doc_id = :doc_id
INTO :td_id
DO
/* Exit with exit code -2 if there is no such document in the system */
if (td_id is null) then BEGIN err=-2; exit; END
/* Finding the number of the stage where the document is now located */
FOR SELECT MAX(cf_ph_num)
FROM CONFIRMATION
WHERE cf_doc_id = :doc_id
INTO :ph_num
DO
```

```
/* Calculating the new stage number for the document */
        if (ph_num is null) then
                ph_num = 1;  ELSE    ph_num = ph_num + 1;
/* Checking the availability of a new stage for the document */
FOR SELECT ph_name
FROM phase_confirmation
WHERE ph_td_id = :td_id AND ph_num = :ph_num
INTO :new_stat
DO
/* If there is no such stage, the document is completed. Sigh out with end code -3*
if (new_stat is null) THEN BEGIN err = -3; EXIT; END
/* Determining the rights of the user to approve the document at a new stage. */
FOR SELECT rt_job_id
FROM rights
WHERE rt_td_id = :td_id  AND rt_job_id = :job_id AND rt_ph_num = :ph_num
INTO :job_id
DO
/* If no rights, sigh out with end code -4*/
        IF (job_id IS NULL) THEN BEGIN err=-4; EXIT; END
/* Entering in the table "Approval stage of the document" of an entry on the approval of
the document at a new stage by the responsible person */
INSERT
INTO CONFIRMATION (cf_doc_id,cf_ph_num,cf_td_id,cf_acb_id,cf_date)
VALUES (:doc_id,:ph_num,:td_id,:acb_id,CURRENT_DATE);
/* Change the status of the document */
UPDATE DOCUMENT
SET DOC_STATUS = :ph_num
WHERE doc_id = :doc_id;
/* End code 0 - normal completion of the procedure */
err=0;
END
```

Source of the stored procedure GetNecessaryDates.

```
CREATE PROCEDURE GETNECESSARYDATES
/* Input parameter */
(WG_ID INTEGER,BEGIN_DATE TIMESTAMP,END_DATE TIMESTAMP)
/* Returned parameters*/
RETURNS
(DEVICE varchar(100),WORKTYPE varchar(100), UNIT varchar(100),
RECORD_DATE TIMESTAMP, RECORD_TYPE SMALLINT,P_D INTEGER,P_M
INTEGER, P_Y INTEGER)
/* Variables description */
AS
/* Last processed date */
DECLARE VARIABLE LAST_DATE TIMESTAMP;
/* Equipment item identifier */
DECLARE VARIABLE UNIT_ID INTEGER;
```

```
/* Document type identifier */
DECLARE VARIABLE TD_ID INTEGER;
/* Job type Identifier */
DECLARE VARIABLE WT_ID INTEGER;
BEGIN
/*Selection of data about equipment, the date of installation of which is 'over' the upper limit of the interval. The work item identifier, the type of work, the period (days, months, years), the element identifier, the name of the element, the date of its installation, the name of the installation to which this element belongs are selected. All this is chosen for each piece of equipment and in orderly by settings, types of work and equipment units, respectively*/
FOR SELECT
WT.wt_id,WT.name,P.PERIOD_DAYS, P.PERIOD_MONTHS, P.PERIOD_YEARS,
UN.unit_id, UN.name UN.build_date,DEV.name
FROM
WORKTYPE WT,PERIOD P,UNIT UN,DEVICE DEV
WHERE
WT.sub_id =:WG_ID and
P.wt_id =WT.wt_id and
P.unit_id=UN.unit_id and
UN.dev_id=DEV.dev_id and
UN.build_date<= :END_DATE
ORDER BY
DEV.dev_id,WT.wt_id,UN.unit_id
INTO
:WT_ID, :WORKTYPE, :P_D, :P_M, :P_Y, :UNIT_ID,
:UNIT,:RECORD_DATE,:DEVICE
  DO
  BEGIN
/* Initialize the record type with zero */
        RECORD_TYPE=0;
        /* Defining the type of document - the protocol for the current unit of equipment and type of work */
        FOR SELECT
                TYPE_DOCUMENT.td_id
        FROM
        DOCUMENT, TYPE_DOCUMENT, ATTRIBUTE_LIST,
ATTRIBUTE_DOCUMENT, FIELD_DOCUMENT
        WHERE
                DOCUMENT.unit_id = :UNIT_ID and
                TYPE_DOCUMENT.name LIKE ‘ПРОТОКОЛ%’ and
                ATTRIBUTE_LIST.td_id = TYPE_DOCUMENT.td_id and
                ATTRIBUTE_DOCUMENT.ad_id = ATTRIBUTE_LIST.ad_id and
                ATTRIBUTE_DOCUMENT.ad_name = ‘ВИД РАБОТ’ and
                ATTRIBUTE_DOCUMENT.ad_id=FIELD_DOCUMENT.ad_id and
                FIELD_DOCUMENT.doc_id = DOCUMENT.doc_id and
                FIELD_DOCUMENT.value = :WT_ID
        INTO
```

```
                :TD_ID
        DO
                TD_ID = TD_ID;
/* If the document type is not found, then the relevant protocols do not exist. Otherwise,
we set the protocols for the entered interval. If at least one exists, set the record type to
3*/
IF (TD_ID IS NOT NULL) THEN
BEGIN
        FOR SELECT
                MIN (DOCUMENT.doc_date)
FROM
        DOCUMENT
WHERE
        DOCUMENT.td_id = :TD_ID and
        DOCUMENT.doc_date > :END_DATE
INTO
:LAST_DATE
DO
        IF (LAST_DATE IS NOT NULL) THEN
        RECORD_TYPE = 3;
END
/* The values 0 and 3 of the record date type refer to the type - the date of installation
B RECORD_DATE, According to the last sample the installation date is determined */
/* If the date of installation is in the interval - output the record to the result set of data*/
IF (RECORD_DATE>=BEGIN_DATE) THEN SUSPEND;
/* Since the installation date for each element is always one - go to the protocols. Set the
record type - protocol*/
RECORD_TYPE=RECORD_TYPE+1;
 /* All the protocols falling into the interval are returned to the result set of data*/
        FOR SELECT
DOCUMENT.doc_date
FROM
DOCUMENT
        WHERE
DOCUMENT.td_id=:TD_ID and
DOCUMENT.build_date BETWEEN :BEGIN_DATE and :END_DATE
        INTO
:RECORD_DATE
        DO
IF (RECORD_DATE IS NOT NULL) THEN SUSPEND;
/* If the type of the record date indicates the absence of protocols for a time interval, the
calculated dates are calculated*/
        IF (RECORD_TYPE<3) THEN
        BEGIN
/* Setting the corresponding record type*/
                RECORD_TYPE=RECORD_TYPE+1;
IF (P_D IS NULL) THEN P_D=0;
                IF (P_M IS NULL) THEN P_M=0;
```

```
                IF (P_Y IS NULL) THEN P_Y=0;
WHILE (RECORD_DATE<END_DATE) DO
BEGIN
/*ADDPERIOD  Is a user-defined function. Returns the date obtained by adding to the
date passed by the first parameter of the function, the values passed by the next three
parameters */
        RECORD_DATE = ADDPERIOD( RECORD_DATE ,P_Y ,P_M ,P_D);
                /* If the date is in the interval - return a record */
                        IF (RECORD_DATE<=END_DATE) then SUSPEND;
                END
        END
END
```

Source of the stored procedure CreateDocFields.

```
CREATE PROCEDURE "CREATEDOCFIELDS"
/* Input parameter*/
(  "DOC_NO" INTEGER)
AS
/* Declaring variables */
declare variable TDoc_ID integer;
declare variable TAttr_ID integer;
BEGIN
  /* Search for the document type ID for a document whose document ID is Document*/
  select Doc_TD_ID from Document  where Doc_ID = :Doc_No  into :TDoc_ID;

 /* Selecting ID Attribute of all attributes for the found document type*/
  for    select AL_ATRIB_DOCUMENT_ID from ATTRIBUTE_LIST
         where AL_TYPE_DOCUMENT_ID = :TDoc_ID
         into :TAttr_ID
         do
  /* Add a document field with an empty value in information field*/
    insert into Field_Document  values (:TAttr_ID, :Doc_No, '');
END
```

Source of the stored procedure NewDocument.

```
CREATE PROCEDURE "NEWDOCUMENT"
/* Input parameter */
(  "NEW_TD_ID" INTEGER,
  "NEW_DATE" TIMESTAMP,
  "NEW_STATUS" INTEGER,
  "NEW_SUBD_ID" INTEGER,
  "NEW_PARENT_ID" INTEGER,
  "NEW_UN_ID" INTEGER )
/* Declaring variable*/
RETURNS (  "NEW_ID" INTEGER)
AS
BEGIN
```

```
  /* Adding a document to the system */
  insert into Document
  values (0, :New_TD_ID, :New_Date, :New_Status, :New_Subd_ID, :New_Parent_ID,
:New_UN_ID);
  /* Searching document ID of the entered document */
  SELECT GEN_ID(DOC_GEN, 0) FROM RDB$DATABASE
  into :New_ID;
  suspend;
END
```

Source of the stored procedure UpdateDocField.

```
CREATE PROCEDURE "UPDATEDOCFIELD"
/* Input parameters */
(  "DOCNO" INTEGER,  "ATTRNO" INTEGER,  "ATTRVAL" VARCHAR(18))
AS
BEGIN
  /* Changing the value of the document field */
  update field_document
  set fd_value = :Attrval
  where (fd_ad_id = :AttrNo) and (fd_doc_id = :DocNo);
END
```

Source of the stored procedure GetDocFields.

```
CREATE PROCEDURE "GETDOCFIELDS"
/* Input parameter */
(  "DOCUMENT" INTEGER)
/* Declaring variables */
RETURNS
(  "ATTR_ID" INTEGER,
  "ATTR_NUM" INTEGER,
  "ATTR_NAME" VARCHAR(20),
  "ATTR_TYPE" INTEGER,
  "ATTR_VALUE" VARCHAR(18),
  "DOC_TYPE" INTEGER)
AS
BEGIN
 /* Selection of necessary information */
  for  select
          a.ad_id, a.ad_num, a.ad_name, a.ad_type, f.fd_value, d.doc_td_id
        from
          field_document f, attribute_document a, document d
        where
          (f.fd_doc_id = :document) and (a.ad_id = f.fd_ad_id) and (d.doc_id = :document)
    order by
          a.ad_num
    into
```

```
        :attr_id, :attr_num, :attr_name, :attr_type, :attr_value, :doc_type
  do
/* Returning data to the client */
    SUSPEND;
END
```

Source of the stored procedure DeleteDocument.

```
CREATE PROCEDURE "DELETEDOCUMENT"
/* Input parameters */
( "DOC_NO" INTEGER)
AS
BEGIN
  /* Deleting a document*/
  delete from document
  where Doc_ID = :Doc_No;
END
```

Source of the stored procedure GetChildrenTypeDoc.

```
CREATE PROCEDURE "GETCHILDRENTYPEDOC"
/* Input parameters*)
/* Returned parameters */
RETURNS
(  "CHILD_ID" INTEGER,
  "CHILD_NAME" VARCHAR(20),
  "CHILD_PATH" VARCHAR(256))
AS
declare variable Base_Path varchar(256);
BEGIN
  /* Searching for a path to the parent document type */
  SELECT T.TD_PATH from TYPE_DOCUMENT T
  where (T.TD_ID = :Parent)
  into :Base_Path;
  /* Finding the way */
  IF (Base_Path is NULL) THEN Base_Path = '';
/* Building the path of the desired hereditary document*/
  Base_Path = NEWCLASSPATH(Base_Path, Parent);
/* Finding direct hereditary document */
  for  SELECT T.TD_ID, T.TD_NAME, T.TD_PATH from TYPE_DOCUMENT T
    where (T.TD_PATH = :Base_Path)
    into :Child_ID, :Child_Name, :Child_Path
  do
    suspend;
END
```

Source of the stored procedure GetPathByID.

```
CREATE PROCEDURE "GETPATHBYID"
```

```
/* Input parameter*/
(  "NODE_ID" INTEGER)
/* Returned parameter*/
RETURNS
(  "NODE_PATH" VARCHAR(256))
AS
BEGIN
  /* Finding the path to the requested document type */
  select TD_Path from TYPE_DOCUMENT
  where (TD_ID = :Node_ID)
  into :Node_Path;
END
```

Source of the stored procedure AddTypeDoc.

```
CREATE PROCEDURE "ADDTYPEDOC"
/*Input parameters*/
( "TYPE_NAME" VARCHAR(20), "PARENT" INTEGER)
RETURNS
/* Output parameter */
( "ID_CHILD" INTEGER)
AS
declare variable Doc_Path varchar(256);
BEGIN
  /* Check if the document type added is a root document */
  if (PARENT is NOT NULL) THEN
  BEGIN
   /* Finding the path of the parent */
   FOR SELECT TD_PATH from TYPE_DOCUMENT
   where TD_ID = :Parent
   into :Doc_Path
   DO
   IF (Doc_Path IS NULL) THEN Doc_Path='';
   /* Building a path for a new kind of document */
   Doc_Path = NEWCLASSPATH(Doc_Path, Parent);
  /* Adding a Document Type to the System */
  INSERT INTO TYPE_DOCUMENT VALUES(0, :Type_Name, :Doc_Path);
  END
  ELSE
   /* Adding a Document Root to the System */
   INSERT INTO TYPE_DOCUMENT VALUES(0, :Type_Name,'');
/* Finding the Document Type ID */
SELECT GEN_ID(TYPE_GEN, 0) FROM RDB$DATABASE
  into :ID_CHILD;END
```

Appendix 2

During the research of document flows taking into account their specifics for the Electrical department, the following specification of the main types of documents was developed:

1 Documents ensuring the operative work of the department

1.1Documents providing periodicity of work

1.1.1 Documents establishing time limits, frequency of inspections, modes of operation of elements of the power supply system

1.1.2 Documents regulating work on the schedule of preventive maintenance

1.1.3 Documents regulating planned works

1.1.4 Documents regulating unscheduled work

1.1.5 Documents regulating emergency work

1.2Protocols, acts, logs

1.2.1 Protocols

1.2.2 Acts

1.2.3 Reports

1.2.4 Logs of accounting

1.3Acts of acceptance, technical specifications, technical documentation

1.4Documents providing operational activities related to current operation

1.5Documents of registration of access to electrical installations of consumers

1.6Documents allowing for admission to work performed by other departments (third-party organizations)

1.7Travel Documents

2 ***Documents providing organizational activities of the department***

2.1Documents regulating official duties, regulations and control of the performing discipline

2.2Logs of the account and the control of performance by the personnel of various positions

2.3Documents regulating the organizational activities of the enterprise, organization of events

2.4Instructions for use, lists of means used, documents that establish standard values for equipment

2.5Documents ensuring the implementation of safety, labor protection, fire and gas safety