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Formalization Of Electronic Technical Document Management Of Railway Automatics And Telemechanics

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Abstract— *The article examines the features of electronic document management of technical documentation of railway automation and telemechanics. The article deals with the problems of synthesis of mathematical description of electronic document flow of technical documentation of railway automation and telemechanics. For this purpose, a survey of the actual processes of creating, checking and using technical documentation was performed on the example of maintaining custom specifications for automation and telemechanics systems, which allowed us to identify document flow scenarios, as well as protocols for the properties of technical documents. The use of the proposed method for constructing a mathematical model based on graph theory allows us to develop reliable application software for solving problems of operational document management of technical documentation.*

Keywords— Electronic document flow of technical documentation, graph theory, model of electronic document flow of technical documentation, formal presentation of technical documentation, technological process of maintaining custom specifications of railway automation and telemechanics, matrix of incidents of electronic document flow of technical documentation

1. INTRODUCTION

Currently, the most complex tasks are being solved in railway transport using modern information technologies. Microprocessor systems are used to manage and centralize stations and stages. Intensive work is continuing on the transfer to electronic document management in parallel with the traditional paper document management. In Uzbekistan, there is currently a definition of this term at the legislative level [1].

The issues of formalization of electronic document flow of technical documentation (TD) of railway automation are considered in works, however, the task of clearly formalizing the concept of "electronic document flow of technical documentation" and creating a model of technological processes of railway automation and telemechanics, as well as using existing information technology achievements to solve management problems remains urgent.

2. MAIN PART

To create a model of electronic document flow of technical documentation (EDTD) for signaling, centralization and blocking devices, a survey of the actual processes of creating, checking and using technical documentation in automation and telemechanics systems was performed. This allowed us to identify document flow scenarios and property protocols for technical documents.

This article discusses a new approach to creating models of technical documentation workflow based on the graph theory apparatus. Methods for defining sets for the developed model are described, and a document flow algebra using graphs is proposed.

To build a graph model, need to defined a certain set of data that will be accepted by the basis. For a graph model, the data must be discrete and assume varying degrees of connectivity. The notation introduced in the paper is used as the basis for the graph model under consideration [2-3].

Formally, the EDTD process is represented as three finite sets and links of elements of these sets to each other. The mathematical notation of this process is represented as a triple

$D_T = \{Y,P,F\}$

where D_T – a formal model of electronic document flow of technical documentation; Y - a set of participants; P - a set of processes; F – a set of technical documentation States with acceptable areas of values.

The set Y is defined as a finite set of actual document flow participants, and P is defined as a finite set of processes that are performed within the document flow system under consideration by participants from the set Y. F is a finite set of States that can accept TD after executing processes from the set P by participants from the set Y.

When building a graph model of the TD workflow, it is proposed to use the following method for displaying the TD workflow with graphs. To set the vertex set of a graph use the number of possible States of Edges of F. The edges of the graph will be set by using a variety of processes P and installed this according so as to fulfill the following rules:

– one node of the graph corresponds to one and only one element of the set F;

– one edge of the graph corresponds to one and only one element of the set P;

– one element of the set F corresponds to one and only one vertex of the graph;

– one element of the set P corresponds to one and only one edge of the graph.

Such an identical mapping of the sets of States F to the set of vertices v and the sets of processes P to the set of edges e can be mathematically defined as follows: for any i, the statement is true

$v(i) \leftrightarrow F(i)$ and $e(i) \leftrightarrow P(i)$, where $i=1,2,3\ldots, n$

That is, two paired grammars are defined – the first grammar for establishing the translation of F to v, and the second grammar for establishing the translation of P to e.

Thus, the relationships between vertexes correspond identically to the relationships of States of the modeled workflow. After implementing the sets of processes P, the States F of the technical documentation change. In a workflow graph, the vertices of a graph connect edges if and only if the corresponding state vertices are connected by an action corresponding to the edge, i.e.

It is believed that at the time of submission occurred updating the sets, i.e. all the States are represented by many forms, all actions leading to state changes lots of action, and the manufacturing steps in the form of roles in many of the participants. A matrix model is a model of the current state of the technical documentation workflow that operates with a finite number of technical documents.

To solve the above problem, it is proposed to use a set of flat rectangular document flow matrices, each of which represents the state of the system in a discrete unit of time. Columns in the workflow matrix are set to match the document States that are possible within the workflow lifecycle [4].

That is, the first column corresponds to the first element of set F, the second column the second element and so on, until the last element of the set F. The matrix Rows of the document are associated with the process, the product of which leads to a change of state of at least one document. The first row corresponds to the first element of the set P, the second row to the second, and so on, for the entire set P.

Thus, it is got a rectangular matrix with columns, the number of which is equal to the dimension of the set F and rows in the dimension of the matrix P. this matrix is Filled with elements of the set of role participants in the modeled document flow Y. An element is filled into a matrix cell if and only if the corresponding participant performs an action corresponding to a row element, which results in a change in the state corresponding to the column element.

If the row action does not change the column state at this workflow step, the matrix element is filled with empty or null values. The criterion for the success of creating a matrix is its non-degeneracy in columns and rows. In other words, there is at least one column in the matrix that contains a non-empty element, and at least one row that contains a non-empty element. However, it is assumed that not all elements of the set of role participants in Y will be used for filling in [5].

The process consists of the following steps:

1) the Project organization makes custom specifications (CS) based on the completed project for the objects under construction or reconstruction.

2) The compiled CS is approved by the automation and telemechanics service.

3) after that, the CS is sent to the capital construction Department (CCD). This data is used to determine which equipment manufacturers need to order. Since there are several hundred items of equipment and devices in the CS, the probability that only one factory produces them is very small. CCD divides the equipment specified in the CS between suppliers.

4) Suppliers, in turn, give an order to the factory to complete the order.

5) at the end of the work, the plant sends the equipment to the warehouse signaling distance.

3. CONCLUSION

Obtained result:

- survey of real processes of creation, verification and use of technical documentation of automation and telemechanics systems;
- document flow scenarios and protocols of technical document properties are identified;
- developed a method for creating a model of electronic document flow of technical documentation based on the graph theory apparatus;
- it is proposed to use a set of flat straight-angle matrices to set the matrix form for the representation of technical documentation workflow;
- methods for defining sets for the proposed model are described, and an algebra of technical documentation workflow with the use of graphs is proposed.

Prospects:

- further improvement of the theoretical base of technical documentation workflow
- the ability to effectively identify all possible scenarios of document movement in the process, describe all possible document States, and identify possible participants
- development of computer application software based on the graph theory apparatus for solving problems of document management of technical documentation of railway automation and telemechanics systems.

4. REFERENCES

[1] Bulavsky P.E. Conceptual model of electronic document management of technical documentation // Transport of the Russian Federation (Транспорт Российской Федерации). – 2011. – №1(32). – Pp. 60-63.

[2] Vasilenko M. N. Electronic document management in railway signalling / M. N. Vasilenko, V. G. Trohov, Zuev D. V. // Automation, communication, Informatics. – 2014. – №8. – Pp. 2-3.

[3] Vasilenko M. N. The development of electronic document management in railway automation and telemechamics / M. N. Vasilenko, V. G. Trohov, D. V. Zuev, V. D. Sedykh // Automation, communication, Informatics. – 2015. – № 1. – Pp.14-16.

[4] Bulavsky P.E. Synthesis of a formalized schema of electronic document management systems of railway automatics and telemechanics / Bulavsky P. E., Markov D.S. // proc. of Petersburg transport University (Известия ПГУПС). – 2010. – Vol. № 4. – Pp. 63–74.

[5] Aripov N. M. About document management in the Department of automation and telemechanics and the introduction of paperless technology technical documentation management / Aripov N.M. Baratov D. H. // Bulletin Of The Tashkent Railway Transport Engineering Institute (Вестник ТашИИТ). – 2015. – №2. – 2015. – Pp.77-81.