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## СИНТЕЗ СОСТОЯНИЙ ЛОГИЧЕСКИХ СХЕМ АЛГОРИТМОВ ТЕХНИЧЕСКОЙ ДОКУМЕНТАЦИИ

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### **Аннотация**

В статье рассмотрена методология создания системы электронного документооборота технической документации (ЭДТД), описана ее обобщенная формализованная схема и представлена формальная модель ЭДТД. Аналитическая степень формальной модели ЭДТД реализуется с помощью аппарата теории графов. Рассмотрены сведения о централизованной системе управления сигнализаторами и их контроле. Приведен алгоритм замены всех устройств автоматики и последовательно описан процесс. Эти этапы процесса генерируются путем создания алгоритма графической модели.

**Ключевые слова:** железнодорожная автоматика и телемеханика, техническое оборудование, устройства сигнализации, алгоритм, графовая модель.

## SYNTHESIS OF STATES OF LOGICAL SCHEMES OF ALGORITHMS OF TECHNICAL DOCUMENTATION

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**ABSTRACT**

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The article discusses the methodology for creating an electronic document management system for technical documentation (EDTD), describes its generalized formalized scheme and presents a formal model of EDTD. The analytical degree of the formal model of EDTD is implemented using the apparatus of graph theory. Information on the centralized control system of signaling devices and their control is considered. An algorithm for replacing all automation devices is given, and the process is described sequentially. These process steps are generated by creating a graphical model algorithm.

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**Keywords:** railway automation and telemechanics, technical equipment, signaling devices, algorithm, graph model.

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“Uzbekistan railways” consists of many divisions, which carry out their activities in various directions.

- The most important system of the company are:
- freight dispatching and delivery of goods by rail;
- reconstruction and preservation of railway wagons;
- commuter, traveler transportation;
- maintenance, renovation of the locomotive and wagon fleet.

The priority area for the company is the application of the subsequent contribution programs:

- strengthening of transmission channels using fiber-optic lines;
- acquisition of new rolling stock (electric locomotives and wagons), as well as innovation of the existing one;
- formation of new railway lines;
- railway electrification;
- application of track overhaul schemes, establishment of production at the company’s factories of track superstructure elements, spare parts, etc.

The project of the signaling and communication management is to maintain the uninterrupted operation of the centralization and blocking signaling devices, the good condition of the formations, which in turn guarantees the uninterrupted movement of trains [1].

The production process carried out by signaling and communication distances (SHCH) is the technical maintenance of automation and communication devices. During the production process, terms are often used such as technical equipment, length of service area, number of employees, etc. The production volume of communication signaling distance can be characterized by three main primary indicators:

- technical equipment  $B_i$ , measured in technical units;
- the distance of the serviced section of the railway  $L_i$ ;
- the number of employees of the distance  $N_i$ .

Turn on the mechanical equipment the distances are divided into four groups. The first group includes distances with scientific elements exceeding 400 scientific elements, the second group of distances includes distances with mechanical tool of 300-201 and the fourth group includes distances with mechanical tool of less than 200 elements.

The main product of the generated distance is the reliable operation of technical means. These products have a direct impact on the provision of the transportation plan. The distance carries out technical maintenance of various automation and communication equipment. In order to measure the technical equipment and give a comparable estimate of the number of various devices, a special indicator, a technical unit, has been introduced [2].

One technical unit is the amount of any equipment that needs to be serviced 170 hours per month.  $B_i = K_{kkt} \times L_i$

$B_i$  – technical equipment;

$L_i$  – the distance of the serviced road section;

$K_{kkt}$  is the concentration factor of equipment;

Distance ShCh-1 is equipped with signaling, centralization and blocking devices (SCB), with a total number of: electric interlocking points - 962, hill interlocking points - 36, single-track automatic blocking - 127.095 km, double-track - 137.855 km, two-way automatic blocking on a double-track section - 126.1 km, dispatch centralization and dispatch control devices - 715.14 km.

The provision and adjustment of the safe motion of transport and a definite through put of roads is carried out by means, procedure of telemechanical and automatic influence, directly dependent on the systems and devices of railway automation and telemechanics. To maintain the bandwidth and uninterrupted action of the tools, it is necessary to periodically service the signaling devices. The frequency of maintenance of signaling devices is carried out on the basis of technical operation and normative documents of the senior electromechanical. Replacement of devices in signaling devices should be carried out in the interval between trains, without termination of the automatic blocking or semi-automatic blocking. After replacing a device or a group of plug-type prior, the signaling system electromechanical must check the attraction and release of each armature of each replaced device. If the replacement of devices is carried out under the supervision of a senior electromechanical of the signaling center, then he is allowed to produce a general record for the replacement of a group of devices. At the same time, the replacement of each tool must be agreed with the station attendant, notifying him by means of a record in the journal of examination of ways, turnouts, indication tools, connections and contact network DU-46, about the procedure for using the signaling devices for the period of replacement and checking the operation after replacing the device [3].

If the replacement of devices was registered in the Inspection Log, then after the end of the work, the electromechanical of the signaling center (senior electromechanical) must make a note: "The work on replacing the relay is completed, the correctness of their operation has been checked".

Before installing the relay or when replacing it, the electromechanical of the signaling system should:

- inspect whether there are any foreign objects and dropped parts inside the device, paying special attention to the free movement of the armature (sector) of the relay;
- must make sure that it is sealed and has a plate inside with the date of the check and the signature of the person who performed the check.

After replacing the relay devices, the old relay devices are re-debugged and the cycle is repeated [4].

An analysis of the process of replacing signaling devices in the form of a block diagram is shown in Fig.1.

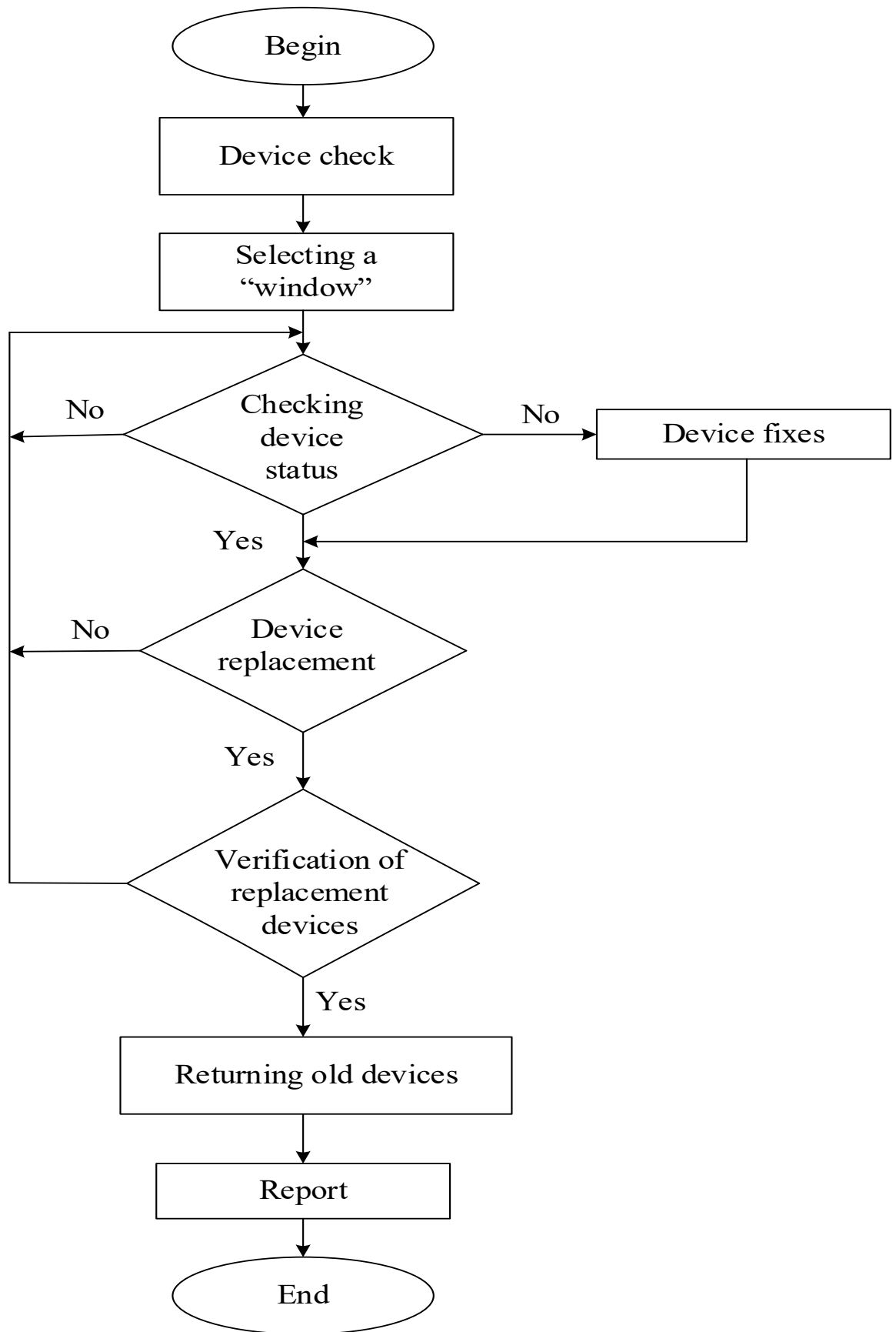


Fig.1. Analysis of the process of replacing signaling devices

The sequence of actions of the process of replacing signaling devices consists of:

1. The choice of "window" - agreement with the station attendant, the choice of the time interval from the passage of trains.
2. Transportation of signaling devices.
3. Checking the status of signaling devices.
  - a. checking the integrity of the case;
  - b. the presence of a seal and a stamp;
  - c. checking the closure of the relay contacts.
4. Replacement of signaling devices.
5. Checking the functionality of all replaced devices.
6. Returning old (removed) devices for debugging in the instrumentation.
7. Reporting on the replacement to the technical department of SHCH-1.

One of the main directions of the railway development strategy is research and scientific developments to ensure the dynamic development of society, the introduction of innovative technologies and improve its technical level, the expansion of cooperation in this area.

There is a need for effective automation of workflow, which will allow you to get quick and complete access to information and provide control over the status of replacing signaling devices [5,6].

This paper proposes an automation technology, a system of calculating and check of signaling devices in a compact and convenient form - in the form of formalization of the method. Let's say that the entire technological process of calculating and check of replacement of indication tools (SCB) is represented in the form of a designation:

1. Selecting a "window" -  $Da, a = \overline{1, \overline{A}}$
2. Transportation of indication tools -  $Db, b = \overline{1, \overline{B}}$
3. Analysis the status of indication tools -  $\alpha 1, 1 = \overline{0, \overline{1}}$   
Control the integrity of the case -  $\alpha 11$ ,  
The presence of a seal and a stamp -  $\alpha 12$ ,  
Investigation the closure of relay contacts -  $\alpha 13$ ,
4. Replacement of indication devices -  $\alpha 2, 2 = \overline{0, \overline{1}}$   
The condition for replacing plug implement is  $\alpha 21$ ,  
The condition for replacing non-plug devices is  $\alpha 22$ ,
5. Checking all replaced devices -  $\alpha 3$ ,
6. Returning old (removed) devices for debugging in the instrumentation -  $Dc, c = \overline{1, \overline{C}}$
7. Reporting on the replacement to the technical department SHCH-1 -  $Dd, d = \overline{1, \overline{D}}$   
 $a1 = (1- \text{positive position selected}, 0 - \text{position not selected})$   
 $a2 = (1- \text{positive position selected}, 0 - \text{position not selected})$   
 $a3 = (1- \text{positive position selected}, 0 - \text{position not selected})$

After the end of the first scientific operation, the process is repeated with a difference only in time, number and types of devices [7,8].

This algorithm can be clearly represented in the structure of a graph model, which is shown below in Fig. 2.

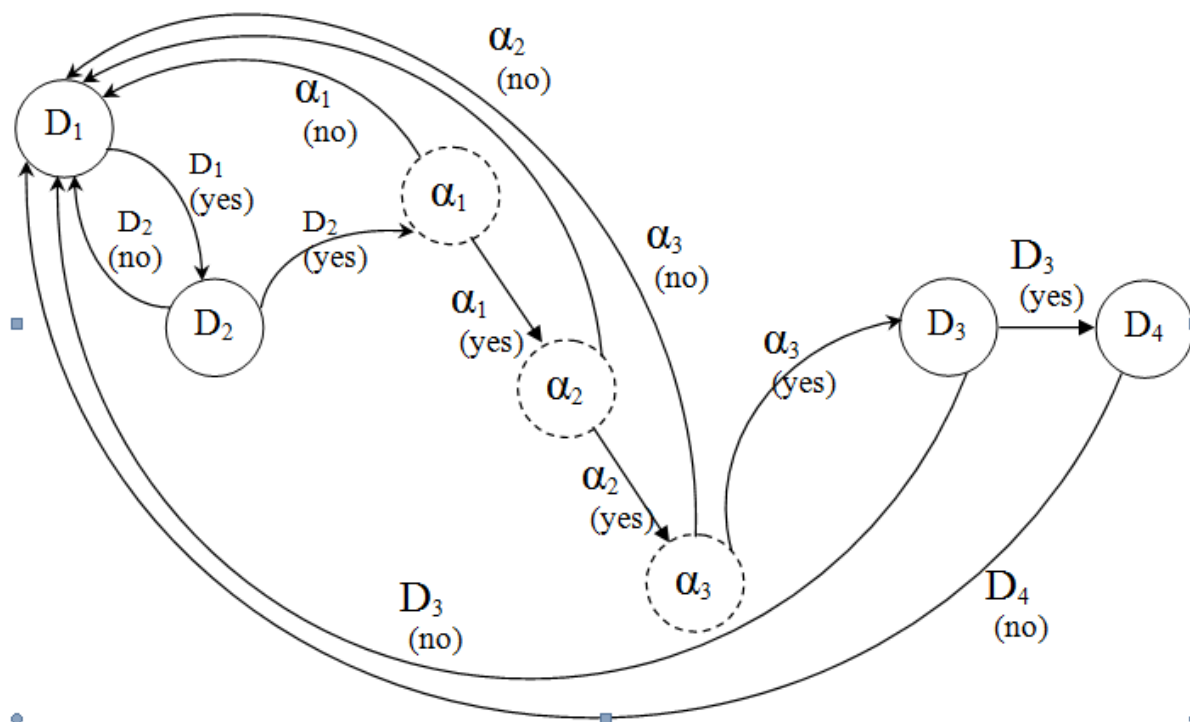


Fig.2. Graph model of algorithms

This graph model is a set of algorithms (actions and conditions) at a definite value of which we go to the next algorithm, or revenue to the original state.

The results of the research can be applied to the electronic document management system of technical documentation in railway automation and telemechanics. The application of the results of the research at all railway stations will significantly increase the cost-effectiveness and regulation of the automation system.

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