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CREATING A SOFTWARE SYSTEM FOR CONSTRUCTION OF THE DAILY SCHEDULE FOR RAILWAY INDUSTRIAL ENTERPRISE

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Summary. This article contains the description of the structure of software which is now under development and will be used for planning cargo operations and maneuvering on the industrial rail transport. Data representation in the program considered. The functional features of the program units are described.

Keywords: automation, daily schedule, locomotive, cargo fronts.

INTRODUCTION

One of the main country transport system's elements is industrial enterprises' transport where the bulk of traffic volume is born and redeemed. On the enterprise wagons undergo significant transport and technological processing consisting of cargo, maneuverable and technological operations. Therefore the question of optimal planning of railway traffic complex stays actual for a long time. The important topic for operational planning automation is the creation of program product (traffic controller's automated working station (WKS) which will allow to reduce operating costs and increase the effectiveness of traffic controller's work, as well as to fulfill rating, planning and control over the executing of technological operations functions on the enterprise[3,4,10].

Traditionally the daily schedule is used to solve the present day planning problems. But building a daily schedule is a quite labor intensive process which requires considerable efforts from the scheduler. It is possible to solve this problem with the help of computerization, particularly by automation of building daily schedule. That's why it was decided to create programming tool set which will allow to fulfill building at a high rate and to avoid mistakes during this process[1,2].

OBJECTS AND PROBLEMS

The analysis of scientific achievements on this topic indicates, first of all, big actuality of the considered task. Projects of traffic controller's automated working station (WKS) can be seen among foreign and Ukrainian specialists' publications but this research is notable for searching for methods of problem solving support for development system[6,7,8,9,11,12].

Let us look at the development system's structure. It consists of several separate units that interact with each other, thus making the system work. Each unit is separated from others thus change of separate system part do not affect its integrity and other units work[14].

The program consists of separate units each of which carries out its part of work. We allocated following units: *database information processing unit; wagons and trains revision unit; stations and cargo fronts' revision unit; locomotive revision unit; logic of program work unit; graphic display unit; program interface.* On the fig. 1 we depicted interaction between mentioned units, user and database.

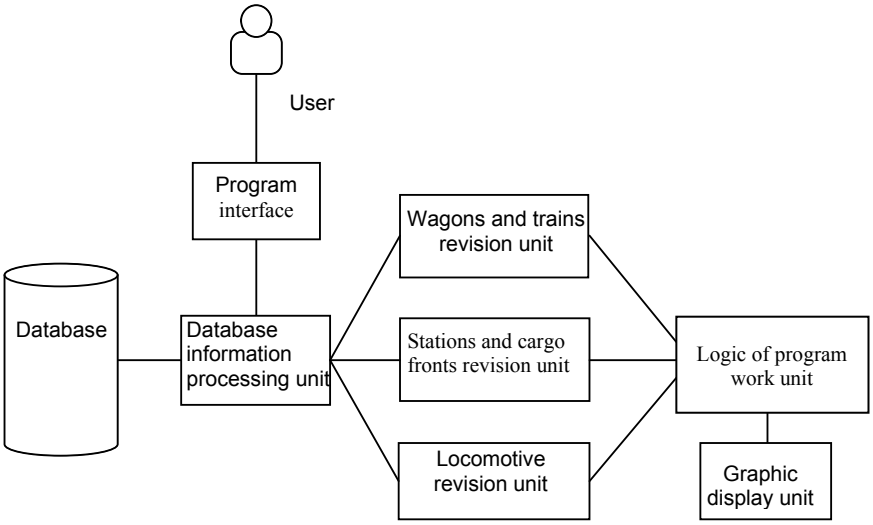

Fig. 1. Scheme of program units interaction

Database information processing unit (DB) is responsible for downloading and presentation of the information from the database in the program. The database is a link that connects components of the future WKS one element of which is developing in this research system for building daily schedule. Database information processing unit must maintain constant connection with a database and to control input and output information in the real-time mode. It also has to provide updated information for operative reflection of changes in the database in the system graphic interface. Any changes in the logical structure of the daily schedule should also be stored immediately

in the database with the purpose to use them with other elements of railway company WKS. This approach will make it easy to combine daily schedule editor with any WKS systems and will provide overall system stability.

Wagons and trains revision unit allows to edit, add and look through existing trains and wagons. All the necessary information for the unit work about available wagons and trains can be either downloaded from the database (with the help of appropriate unit) or entered directly by the user. This unit interacts closely with the database information processing unit as the data entered by the user must be operatively saved to the database and be downloaded from it in the future. Information about the train is given in such way:

$$T_i = \{N, C_a, t_a, t_w, L\}, L = \{L_1, L_2, ..., L_{Ca}\}, \quad (1)$$

where: N – train number; C_a – the wagons quantity; t_a – time of the train arrival at the connecting station; t_w – time of the train technological processing beginning; L – the list of wagons in the train[10].

Stations and cargo fronts' revision unit is responsible for presenting stations and cargo fronts, downloaded from the database, in the program as well as for possibility to edit and add new ones. Information about the cargo front is given in such way:

$$F_i = \{N, T_c, C\}, \quad (2)$$

where: N – cargo front number; T_c – cargo front at the given front; C – maximal cargo quantity at the given cargo front[6,15].

Locomotive revision unit is responsible for editing the information about available locomotives. Information on the locomotives is also stored in the database, and can be downloaded and stored there at any time of the program work. Information about locomotives may be presented in such way:

$$L_i = \{N, C, n_c\}, \quad (3)$$

where: N – locomotive number, C – the cost of one hour of locomotive work, n_c – locomotive power measured in the quantity of wagons it can move simultaneously[5,13].

Logic of program work unit performs checks on the possibility of existence of data entered to the program, protection against user's errors and determines the sequence of the program execution. Logic unit provides the control over the sequence of user's actions and performs checks on the validity of entered data which is related to the technological operations. Operation concerning work logic unit has the following look:

$$O_i = \{N_f, T, C_a, t_b, D, C_l, L\}, C_l = \{C_1, C_2, ..., C_{Ca}\}, \quad (4)$$

where: N_f – number of the cargo front where the operation is executed; T – cargo operation type; C_a – the quantity of wagons which take part in the operation; t_b – the time of the operation start; D – the operation duration; C_l – the list of wagons which take part in the operation; L – locomotive which maintains the given operation.

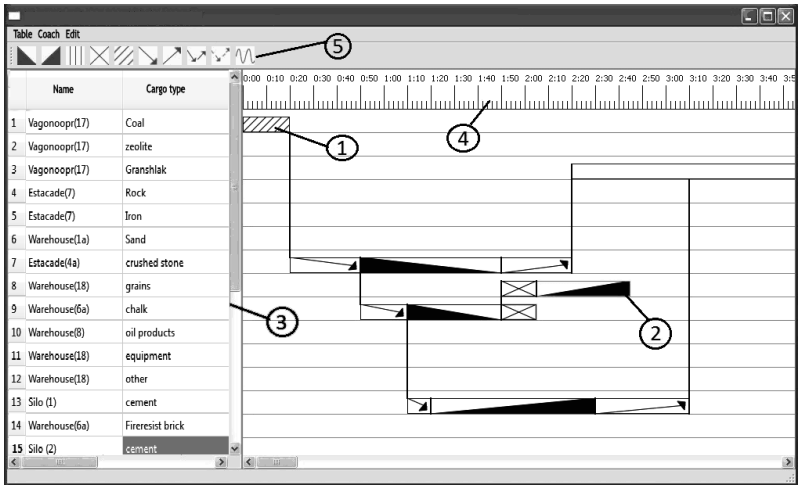

Fig. 2. The main window of the program with the part of ready-built daily schedule
1 – graphical display of the individual transaction (display unit); 2 –visual message about disarranged wagons (work logic unit); 3 – the list of enterprise cargo fronts (station revision unit); 4 – the bar which transfers date and time into screen coordinates (work logic unit); 5 – types of transactions, acceptable for the station (database information processing unit)

Also internal logic of program unit checks locomotive occupancy and cargo front employment at the moment of some transaction; allows the user to receive the information about any wagon state at any moment of time; and also it displays transactions after which there are crude wagons or a free locomotive.

Graphic display unit is responsible for displaying the results of interaction between the user and the program, particularly in the form of daily schedule. It is used for visualization of the work of all previous units and also it implements user's graphic interface (fig. 2).

Thus not only the effective program work is achieved but also, what is more important, the possibility to expand the program for new needs which may appear during the practical use arises.

CONCLUSIONS

The developed suite of tools is able to facilitate greatly the railway station controller's work by excluding from his work not only the necessity to measure and draw graphic elements (with the risk to make a slight mistake in the detail which will entails entirely wrong daily schedule), and also the need to follow the logical transaction sequence and the order of data constantly. It will allow building a daily schedule quicker, more efficiently and with fewer mistakes. The system will also allow correcting mistakes without rebuilding of the daily schedule from the very beginning.

Structural system of work will allow easily expanding the system if it is required and will supply with compatibility of the tool set with other systems of parallel

allocation, for example, it will allow to combine the program with earlier developed visualizer unit which allow to enhance facilities of the railway enterprise operator's WKS.

Also perspectives of the program enhancement include numerous possibilities to automate the process of the building and clearing transactions of the logical plan such as the priority of removal and feed of wagons to cargo fronts, the calculation unit for maneuver operations etc.

REFERENCES

1. Akulinichev V.M., 1979.: The organization of the car traffic volume on the railway transport. Moscow: Transport.
2. Akulinichev V.M., 1983.: The organization of shipping operations by industrial transport: Student's book. – Moscow: Transport
3. Bobrovs'kij V.I., Kozachenko D.M., Vernigora R.V., 2004.: Basic track development model in simulation models of railway stations. // Edited volume UkrDAZT: Series "Improving cargo and commercial work on Ukrainian railway stations". – # 62. – Harkiv: UkrDAZT. – p. 20-25.
4. Bobrovs'kij V.I., Kozachenko D.M., Vernigora R.V., 2004.: Technical and economic administration of railway stations on the basis of ergative models // Information and control systems on the railway transport. – № 6. – p. 17-21.
5. Goncharov N.E., Kazantsev V.P, 1978.: Maneuvering work on a railroad: the scientific publication. - Moscow: Transport.
6. Kolodiy L.P., Mishchenko N.G., Sidyakov V.A., 1986.: Railway stations and industrial junction of transport: - Moscow: Transport.
7. Korop G.V., 2008.: Logistic approach in the planning of maneuvering work with a sufficient number of paths / The reporter of ENU im.V.Dalya. - Lugansk. - № 7 (125). - p. 164-172.
8. Korop G.V., Ovcharenko A.O., Titakov S.O., 2009.: Improving existing methods of planning maneuvering work / / The reporter of ENU im.V.Dalya. - Lugansk. - № 5 (135).
9. Kozachenko D.M., Vernygora R.V., Korobyova R.G., 2008.: Software system for simulation of railway stations on the basis of daily schedule / D.M. Kozachenko, R.V. Vernygora, R.G. Korobyova / / Rail transport in Ukraine. - № 4. - p. 18-20
10. Kozlov I. T., 1985.: The capacity of transport systems / Kozlov T. - M.: Transport.
11. Levickij I. E., Korob'eva R.G., 2008.: Improving the processing of local car traffic volume in rail junctions // The reporter of Dnipropetrovsk national university of railway transport. – Dnipropetrovsk: Dnipropetrovsk national university of railway transport Press, # 23. – p. 104-107.
12. Nechaev G.I., Korop G.V., Slobodyanyuk M., 2009.: Automation of classification work planning at rail mode // Transport problems 2009. Conference materials. – p. 283-287.
13. Odintsov L.V., 1947.: Reviews of maneuvering work. - Moscow. Transzheldorizdat,.
14. Prata S.,2007.: C++ Primer Plus, 5th Edition. Lectures and exercises. Translated into Russian. – Moscow: I. D. Williams Ltd.
15. Sotnikov I.B., 1976.: Interaction of stations and sections of roads. Moscow: Transport.

СОЗДАНИЕ ПРОГРАММНОГО ПРОДУКТА ДЛЯ ПОСТРОЕНИЯ СУТОЧНОГО ПЛАНА-ГРАФИКА ЖЕЛЕЗНОДОРОЖНОГО ПРОМЫШЛЕННОГО ПРЕДПРИЯТИЯ

Геннадий Короп, Виталий Пархоменко, Станислав Степанченко, Дмитрий Моргачёв, Никита Соснов

Аннотация: В статье представлена структура разрабатываемого программного комплекса для планирования грузовой и маневровой работе на промышленном железнодорожном транспорте. Описаны функциональные особенности блоков программы.

Ключевые слова: суточный план-график, автоматизация, локомотив, грузовые фронты, вагонопоток.

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