THE SYSTEM OF PHOTO, VIDEO RECORDING OF THE RAILWAY WAGON WEIGHING PROCESS

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Abstract. *The problem of wagon weighing process is considered in the paper. Are analyzed the process of railway wagons weighing, the problems of the functioning of the automated system, and a description of the functions of the software. When implementing the weighing procedure, it is important to save the photo/video of the weighing process. Are presented the characteristics and differences of the existing systems. Principles of good weighing-machine are examined. The work describes the types of static and dynamic weights. The main part of the work is devoted to consideration, the system structure, and its structural scheme. The composition of the system and technical characteristics are described.*

Keywords: *scales, weighing process, video recording, automated system.*

I. INTRODUCTION

For proper operation of the rolling stock, traffic organization, and commercial calculations, it is of great importance to take account of the goods carried by rail. It is also important in the transport of hydrocarbons, liquefied automotive and household gases, and plays a significant role in determining their prices.

To ensure such an account, we need a railway weighing-machine with an automated system and the corresponding software. An electromechanical weighing-machine that converts the effect of gravity into an electrical signal is called a tensometric weighing-machine [1].

When implementing the weighing procedure, it is important to fix (photo- or video-) the weighing process with the help of the special equipment. In this precis, the organization of such a system is presented.

II. LITERATURE ANALYSIS

2.1. Overview of the existing systems

The electronic wagon scales are divided into two types: for static weighing and for weighing in motion. When choosing weights, it is important to determine which of the weighing methods is most convenient and optimal for the enterprise.

Wagon scales for static weighing are the most accurate and are the most massive. Static railway scales are intended for weighing in a static position of cars. Scales for dynamic weighing are designed for weighing in the movement of wagons and cisterns.

If there is a need for two scales: dynamic, for weighing and static, to save space and facilities, it is possible to produce two scales in one installation frame. These combined scales have the advantages of both types: they allow you to quickly

weigh the train in motion in the dynamic mode, and if necessary, more accurate results, in static mode.

According to the method of installation, rail scales are divided into two types: foundation and foundationless. Foundation wagon scales are installed on a concrete foundation. The non-foundation scales are installed on the prism of the railway track, then they are filled with crushed stone. Preparatory works are not required, they are installed within one to two working days. The warranty period for the rail scales is 2 years [5].

2.2. Principles of good weighing-machine

Scales wagon must have a certificate of entry in the register of measuring instruments. Having a certificate means a serious approach to production. It gives a guarantee of compliance with the declared technical characteristics.

Weighing wagons should be easy to assemble, installation should not take more than 3 days. The total cost of work with all materials and the performance of the technical conditions can reach the value of the scales themselves and even exceed their cost.

Digital transmission of data. Scales with digital data transmission eliminate interference from some operating equipment and can transmit the signal over long distances.

Scales should be unpretentious in service.

Scales wagons should be able not only to measure the weight but also to determine the longitudinal and transverse displacement of the center of gravity of the wagon, to avoid uneven loading and as a consequence of tipping the car while driving.

Each sensor must have a separate channel. That allows you to diagnose the balance. On low-cost devices, this can not be done, as a rule, unscrupulous manufacturers use the cheapest equipment, where the sensors are combined into a single channel.

III. OBJECT, SUBJECT, AND METHODS OF RESEARCH

3.1 Structure of the system and the structural scheme

For the organization of weighing of wagons with photo and video recording the following equipment is necessary:

- IP video cameras (Cam 1 and Cam 2);
- Information (LED) board;
- Ethernet Switch;
- weight measuring indicator (weighing device);
- personal computer.

The structural diagram of the system illustrating the interaction of these components is shown in Figure 1.

All components of the system are connected to a personal computer through standard system interfaces and protocols. The names and devices are displayed in Table 1.

Table 1 - Table of interfaces of the system

Device	Communication interface with PC
Video cameras	Ethernet, IP
Informational board	Ethernet, UDP
Weighing device	RS-232

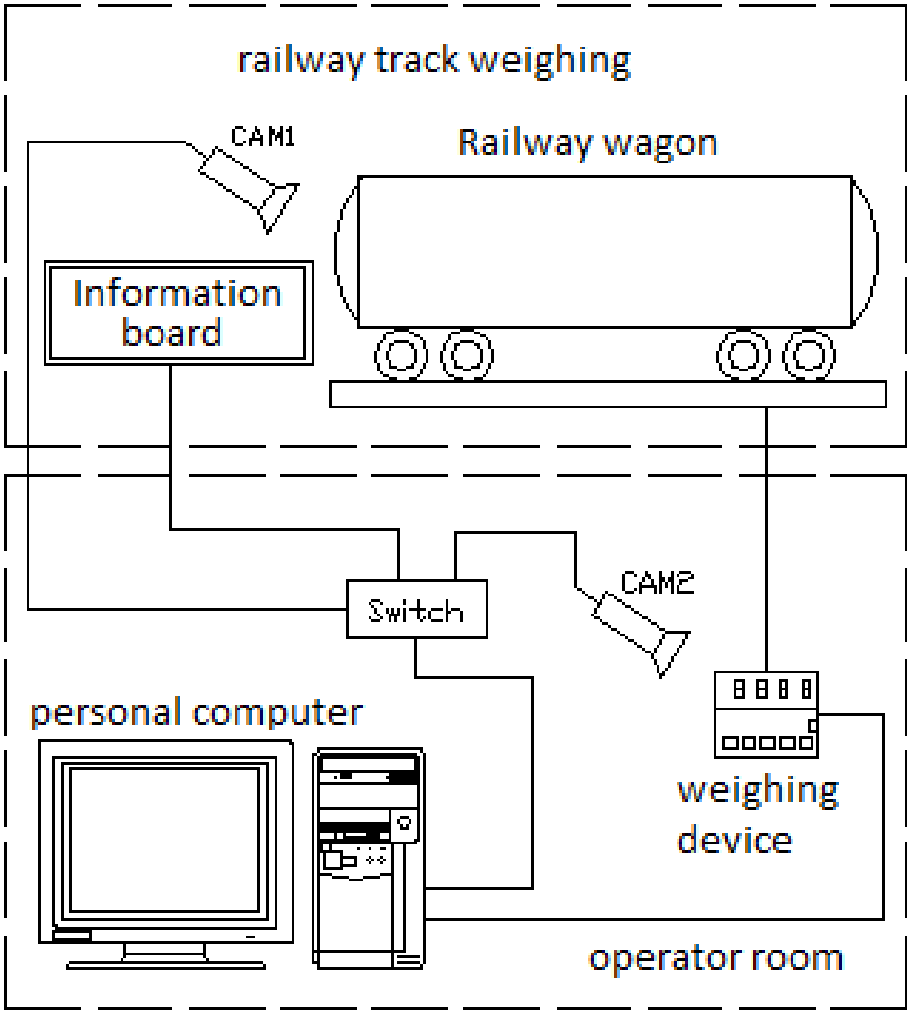

Fig. 1. Block diagram of the system video fixing

The main issues that arise when creating such a system are:

- when installing the car on the measuring platform, the maximum speed limit is not always observed;
- great increase in the time of stabilization of the weight of half-empty wagons with liquid cargo (filling less than 70 percent);

- Impossibility of direct visualization of the process of weighing the car due to significant distance of the operator's room from the weighing platform (more than 400 meters);
- lack of feedback on the information (LED) board, the inability to see what is displayed on it;
- the inability to correctly read the numbers of the wagons, due to the often occurring contamination, different background colors, a large number of other technical records on the wagon, a certain location of the record number of the wagon.

Most of these problems can be solved with the photo and video fixation of not only the weighing process itself but also the entire process of the weighing. For example, recording a video or creating a series of photos.

The problem of determining the number of the wagon can be solved as follows. Since the image of the railway wagon has a known resolution of 1920x1080, it allows us to apply the algorithm of number recognition for certain areas, even when the number field occupies only part of the image.

IV. RESULTS

The developed software not only maintains reports and displays the current weight, but also implements photo and video-recording of the weighing process, allows weighing without the operator's participation.

The software allows recording the weighing process results both in automatic and manual modes. An example of the type of software is shown in Figure 2.

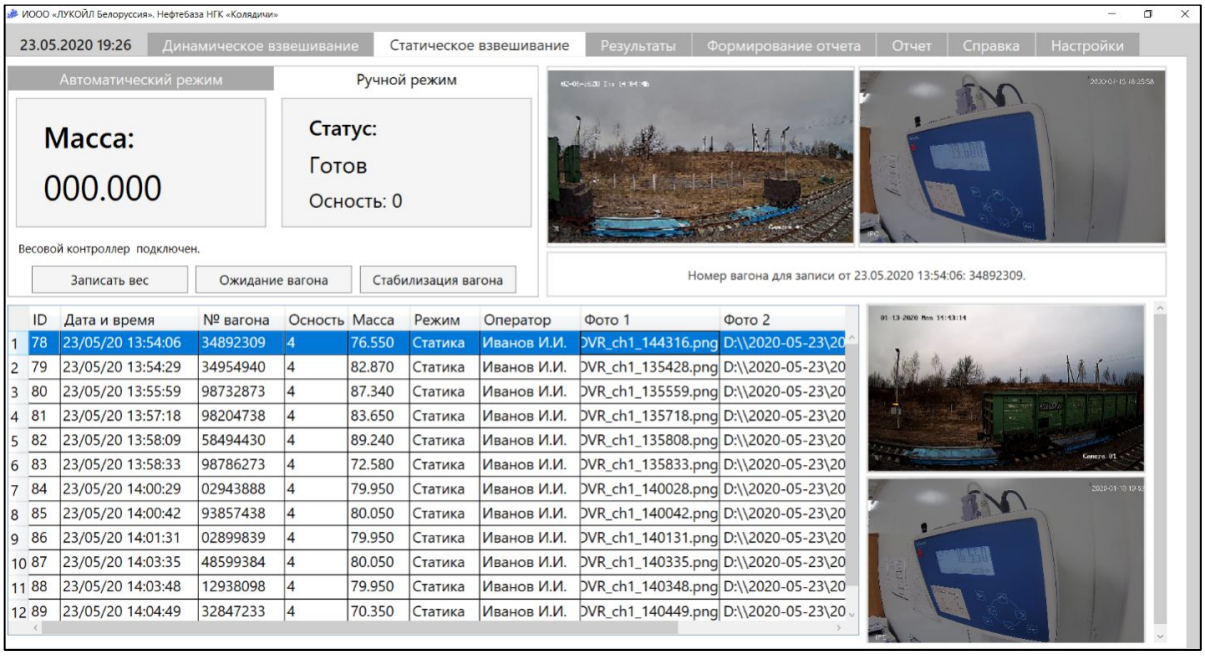

Fig. 2. Software of weighing system

The software has an intuitive interface with a minimum number of control components. It is implemented taking into account the requirements for ease of use [9].

Technical features and capabilities of the software and systems:

- registration of complete information on all weighing of wagons;
- support for work with the data received and stored;
- display and analysis of weighing data in an interactive (real) mode;
- measuring the mass of the empty car (tare) and automatic calculation of the mass of the goods carried;
- creation of an entry (information card) for each weighing with the following information:
- number of weighing, date and time of weighing, number of the car;
- mass of the container, gross, net, type of cargo;
- organization shipper;
- comparison of the photo image of the load measuring indicator and the car with the information card;
- generation of specific reports.

Figures 3-4 shows the general view of the installed scales.

Fig. 3. Calibration of scales of a weight-measuring wagon

Fig. 4. General view of the installed railway scales

V. CONCLUSIONS

These rail scales and software proved to be sufficiently reliable and functional. It not only maintains reports and displays the current weight, but also implements photo and video-recording of the weighing process, allows weighing without the operator's participation since all the necessary information for the wagon compiler is displayed on the LED display board.

The capabilities of the developed system and software are not inferior to the best analogs and models in terms of their characteristics and functionality [2-6].

VI. REFERENCES

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