ABSTRACT

The topic of my dissertation is "Analysis of large sets of operation data in railroad automation systems."

The first chapter presents an introduction to the dissertation in which the author introduces the concept of operation, as well as the current number of railroad crossings by specific categories. The second chapter presents an analysis of the current state of knowledge, which indicates the fact that there is a lack of research related to the analysis of large sets of exploitation data related to railroad automation systems.

Based on the analysis of the literature, the purpose, thesis and scope of the study were formulated. The purpose of the thesis was To conduct analysis of large sets of operational data in order to achieve results to improve the safety of railroad automation systems.

The scientific thesis was formulated as follows:
Improving the safety of railroad automation systems is possible through the analysis of large sets of operational data in Railway Traffic Control systems.

The third chapter of the dissertation describes the purpose of the work, presents the scientific thesis, as well as the assumptions of the dissertation and the tasks involved in carrying out the work. In this chapter, the author also presents publications and scientific achievements related to participation in research projects and scientific conferences.

The fourth chapter of the dissertation presents the types of operational data and their classification. The author of the dissertation presented the current state of safety of SRK systems presenting the most common causes of accidents on the railroad. Then the dissertation outlined the scope of SRK / ETCS and ERTMS systems, indicating the principle of operation of subsystems used in the above railroad automation systems. The fourth chapter also presented the classification of operating data with an analysis of the reliability assessment of technical facilities. Another point of the fourth chapter was to present the scope of operational data collection focusing on station systems and the structure of their operation. The discussed chapter of the work also presents a suggested format for recording operational data for the analyzed SRK systems. The author presented in this chapter the requirements for data analysis software with an indication of the preferred installation environment.

Chapter five visualizes the organization of exploitation databases. In this chapter, the author presented how the database is managed and the software used for this purpose. This part of the work presents the relationships between exploitation data that can be applied to exploitation data analysis systems. In the fifth chapter, the author conducted an analysis of modern cloud systems for aggregation and processing of exploitation data and the possible dangers of handling exploitation data through information systems. During the analyses presented in the fifth chapter, the author presented cryptographic techniques and ways to secure data transmission between the components of the railroad diagnostic system and the database. In the chapter, the author also selects how to secure the transmission of operational data and presents an analysis of data transmission rates using data encryption methods.

The databases storing the operation data were configured in a virtual environment. Cryptographic security was ensured at the stage of communication with the database machine through the use of an intermediary VPN server, which is responsible for user authentication. The use of this technology makes it possible to minimize access to the analyzed data by unauthorized and unauthorized users.

The sixth chapter is devoted to the analysis of the structure of Railway Traffic Control systems. In this part of the work, the author presents the analysis of operational data of railroad automation systems related to station systems. In this chapter, the author presents an analysis of the actual operational data related to the operation of station systems.

Chapter seven presents the functional structure of railroad automation systems. This chapter of the dissertation presents a graph of the system operation model. The dissertation author proposed a solution based on a centralized database and individual SRK systems.

The eighth chapter presents the design of the operation database and the concept of the table structure. This part of the dissertation presents the author's design of the operation database, which can be used to aggregate data from railroad automation systems.

Chapter nine deals with data processing. In it, the author presents the types and types of mathematical model that can be applied during the analysis of operational data in chapter ten of the dissertation.

The tenth chapter deals with the establishment of parameters and verification of hypotheses of consistency of distributions. This chapter presents the process of analyzing actual operating data related to railroad automation systems.
In this chapter, work was done to find relationships between parameters for individual failures of railroad control systems. Chapter ten involved the preparation and development of statistical models to analyze real operating data.
In connection with the above analyses of real operating data, the dissertation author can clearly state that in order to improve the safety of railroad automation systems, it is necessary to eliminate or minimize the faults whose duration was within the ranges indicated in the dissertation. The application of the indicated recommendations will require a detailed analysis of the causes of the faults that occur, and then take steps and make every effort to reduce the possibility of dangerous events related to railroad infrastructure failures in the future.

Chapter eleven presents the conclusions and a summary of the dissertation.

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