NERUBATSKYI V. P., *PhD, Associate Professor*
HORDIIENKO D. A., *Postgraduate*
Ukrainian State University of Railway Transport
Kharkiv, Ukraine

DEVELOPMENT OF UNMANNED TECHNOLOGIES IN RAILWAY TRANSPORT

The high growth of automation leads not only to global changes in the life of society, but also significantly improves the country's economy [1].One of the most urgent areas of technology implementation around the world is the development of unmanned railway transport [2].

Systems of unmanned driving on railways provide for increased safety, efficiency, reduced costs of operation and maintenance both for new lines and for the renewal of existing ones [3].

In order to implement the development of the network and the structure of urban rail transit, it is necessary to improve the operation and level of automation of the internal urban rail transit system.When trains are running, continuously updated information about the entire train and the real-time traffic plan are essential for the driver advisory system and for train traffic control. New design concepts and technologies, including the application of computational network management, the reliability of integrated circuits, electronic and electromechanical components, innovative production and the application of 5G technology significantly increase the reliability and safety of railway transport systems [4].

An increase in the level of automation leads to a decrease in manual intervention and gradually reaches a level where the functions of drivers are completely replaced by automatic systems.

Railway transport provide 4 levels of automation (Fig. 1).Level 1 involves only automatic driver assistance and accident prevention systems. Level 2 involves moving trains from station to station independently, but there

is always a driver in them, who is responsible for closing the doors, detecting obstacles on the road, etc.

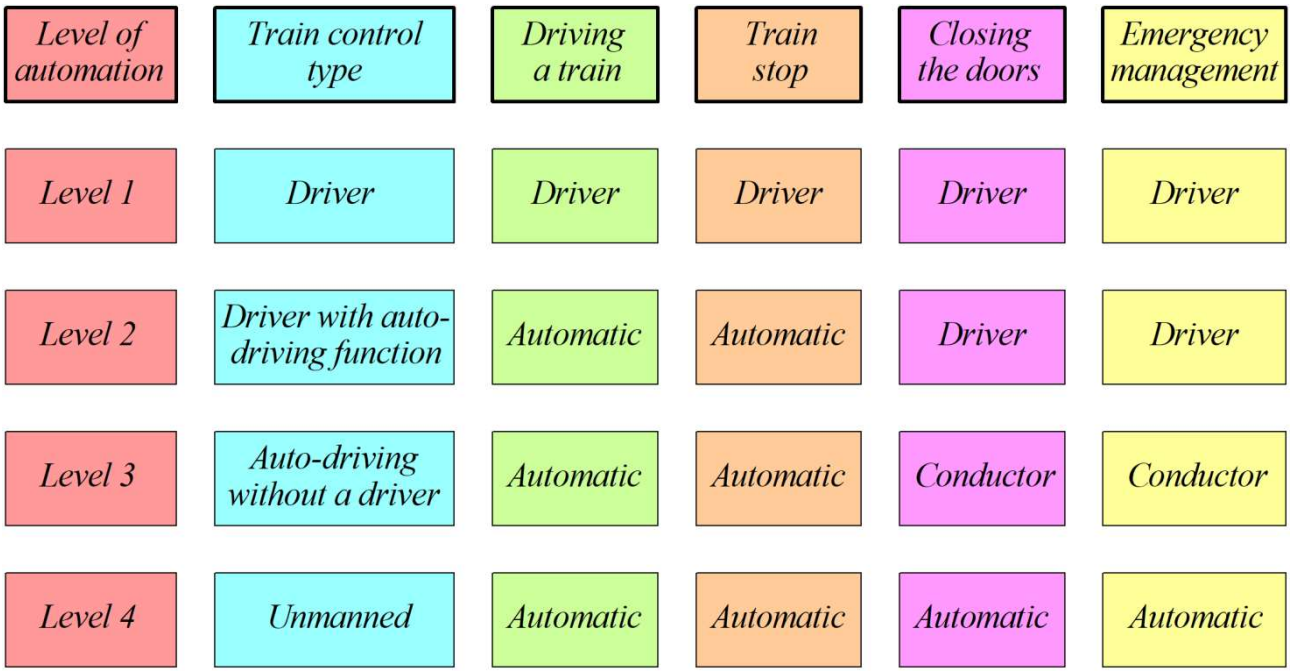

Fig. 1. Levels of railway transport automation

Level 2 is implemented due to traction control algorithms and braking for energy-optimal driving of the train along a given route with taking into account the schedule and readings of automatic locomotive signaling systems received by an inductive channel from rail chains.

Level 3 involves the possible absence of a driver in the cab, which requires the use of a technical vision system.

Level 4 involves the complete absence of a driver on board, which requires a significant change in the design of the locomotive (electric train). For example, automatic switches are installed on board, which cannot be turned on again if they are triggered without the presence of a person on board.

An automatic unmanned urban rail system has better system performance and flexibility, and less energy consumption than manual control. In the

framework of urban rail transit, research on autonomous technologies is aimed at solving the problem of huge passenger traffic in large cities.

Unmanned control requires the full integration of several complex systems: the security system (it provides information about the location of the train and its speed), automatic train control (automatic acceleration and braking), obstacle detection system (analyzes what is around the train, what is moving and what is static) and artificial intelligence (all information coming to the sensors must be processed and evaluated, and therefore optical and laser sensors must work in a single mode).

Unmanned railway trains are equipped with a highly automated advanced system for managing the transportation process. The track center controls inter-station communication, signaling systems, train operations and vehicle scheduling of the entire line network to automatically run trains. There are still many solutions to unmanned systems that can be implemented: radio jamming, on-board security system, microprocessor centralization.

The development of unmanned technologies is one of the most promising directions. In the future, this will lead to increased security, economic growth and social development in the country. The purpose of such technologies is to significantly change a person's life, satisfy their needs, reduce time loss, and eliminate such concepts as inefficiency and unproductiveness.

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NERUBATSKYI V. P., *PhD, Associate Professor*
HORDIIENKO D. A., *Postgraduate*
Ukrainian State University of Railway Transport
Kharkiv, Ukraine

OPERATION OF TRAINS WITH MAGNETIC SUSPENSION ON THE WAY OF RAILWAY TRANSPORT DEVELOPMENT

Every year there are more new and improved technologies that do not bypass railway transport. They make it possible to make passenger and cargo transportation economical, convenient and accessible to most segments of the population. The result of the development of modern technologies is the creation of trains with magnetic suspension [1, 2].

A magnetic train is a train on a magnetic suspension that moves and is controlled by magnetic forces. Unlike ordinary trains, such a train does not touch the surface of the rails during movement. At the same time, friction is eliminated due to the presence of a gap between the train and the canvas surface. The only braking force is aerodynamic resistance [3, 4].