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Modern Approach to the Restructuring and Modernization of Railways

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Abstract: *Intellectual transport systems as a new type of control systems. The need to create and apply intellectual transport systems. The differences between information management systems and intellectual management systems and their features as a means of overcoming information barriers are shown.*

Keywords: *management, transportation, intellectual systems, decision making, technology management, information technology, intellectual technology.*

A modern approach to the restructuring and modernization of railways should be qualitatively new approaches, one of which is the use of intellectual transport systems (ITS)[1]. The use of intellectual transport systems in many countries is dictated by the modern technical development of society, the level of technology and the requirement for the qualitative development of transport systems.

Modern transport management is a scientific direction that integrates a complex of scientific directions: control theory, geoinformatics, spatial knowledge [3], system analysis [4, 5], transport systems theory, remote sensing, geodetic support [6], information modeling , topological analysis , etc. As the theory and methods of transport management develop, it becomes possible to manage more and more complex systems.

The initial ideas of management using feedback and mathematical models have evolved into the ideas of management using information and intellectual systems and technologies. At the same time, the purpose of transport management becomes more complicated. The previous goals – to achieve the desired state, behavior, stability and properties of controlled systems in the conditions of the surrounding world, which lead them to this state and stability, have been supplemented with new ones.

“The strategy for the development of the digital economy until 2030 in Uzbekistan” will include the introduction of identification cards(ID-cards), providing broadband Internet access to 11 thousand social service institutions, programs "Smart Agriculture", "Digital Agriculture", "Electronic Medicine", "Electronic Education", " intellectual Transport System" and others [7].

New targets due to the necessity of solving the problems of management in the conditions of growth of the traffic flow, growth in the number of vehicles, demand growth speed [9], the requirement of increasing traffic safety, given the emergence of new threats, reducing the time of adoption of administrative decisions, a fundamental failure to operational decision-making due to the growing complexity and volume management information.

The development of the management methodology was mainly carried out in three directions: the expansion of classes and types of optimal control problems, the complication of control systems, and the integration of previously qualitatively different management methods into a

single complex. Modern integration of qualitatively different management methods into a single complex with increasing complexity and information volumes is possible only with the use of intellectual approaches.

The widespread development of telecommunications systems and networks has set a specific task of network management of transport systems. The development of space technologies required the use of space communication and navigation methods for railway transport management [8]. These technologies require the use of intellectual solutions. intellectual management is effectively implemented only in the information space [9, 10]. This set the task of creating an information environment in the transport sector that allows for efficient and efficient management of transportation processes and traffic safety.

Traditionally, the methods of organizational and technical management were separated [1, 11]. One of the features of modern management methods using intellectual technologies and intellectual information systems is the increasing integration of management methods. In general, responding to the ever-increasing requirements for transport management and taking into account new conditions and requirements leads to the need to create and apply intellectual transport systems.

Modern development of transport systems consists not so much in creating safe transport and road construction, but in creating new control systems, new technologies, and first of all intellectual transport systems – "ITS". Term: intellectual transport systems is a universally recognized international term, a new trend in science, technology and business, as one of the most effective measures to solve transport problems [12].

The development of ITS is associated not only with the emergence and improvement of tools, but also with the emergence of new conditions. In particular, real information relations have begun to play a significant role in information technologies. The development of information management technologies (IMT) is associated not so much with the advent of computers and databases, but with the emergence of a new information communication environment. This environment dictates special forms of relations in society, which are called informational.

Information relations – relations caused by objective connections between objects of the general information field [13], reflecting direct, indirect, primary and secondary connections between real objects and their parts.

In the management aspect, the following definition of an intellectual transport system can be given.

intellectual transport systems (ITS) – systems created on the basis of integration of automation tools for transport control and management, information and communication technologies, dynamic geographical data and a united information environment in the transport infrastructure, vehicles, focused on improving the safety and efficiency of transport flows and transport users.

The intelligence of transport systems is manifested in the possibility of obtaining operational solutions in a short time, during which a person is not able to develop a solution. The intelligence of transport systems is manifested in the possibility of obtaining new solutions and the accumulation of experience with its entry into knowledge bases. The intelligence of transport systems is manifested in the ability to solve complex problems, the level of complexity of which excludes the possibility of their solution by a person.

Academician Glushkov V. M. introduced the concept of the first and second information barriers according to the criterion of complexity (impossibility) of managing a complex social economic system. In essence, he connects these barriers only with the fourth information revolution. The

analysis of the evolution of society shows that, in fact, humanity has overcome various information barriers since ancient times.

Some types of information barriers were caused by new requirements for information interaction or the information need to solve new problems using existing information. Navigation was created as a means of overcoming the information barrier caused by the need to determine the location of the movement of vehicles in the presence of spatial information of various contents.

Research on decision-making and thinking processes has led to the emergence of knowledge models and inference rules. This can also be considered as overcoming the information barrier caused by the need to solve and analyze complex information.

From these positions, intellectual systems can be considered as a means of overcoming the information barrier caused primarily by complexity, and secondly by the volume of information and the inability to human as a system of processing and analysis in a given period of time to analyze it and get an adequate solution.

The property of intellectual systems is the ability to perform creative functions, which are traditionally considered the prerogative of a person. In other words, an intellectual system, unlike an information system, is able to be active in the absence of human influence or direct instructions.

An intellectual system is a technical or software-technical system capable of obtaining creative solutions to problems belonging to a specific subject area, knowledge about which is stored in the memory of such a system. In a simplified way, the structure of an intellectual system includes three main blocks – a knowledge base, a solver, and an intellectual interface [14].

It is necessary to correlate widely used information systems and intellectual systems. Information systems and represent a solver based on processing algorithms, pre-compiled by a person. Information systems (IS) process and eventually simplify the original information collection and prepare it for final use by another intellectual system called "man". An intellectual system is human assistants in decision-making.

Thus, intellectual systems have emerged as a means of overcoming a number of information barriers and allow you to get results that can not be obtained by information systems and many human-machine systems.

The control object is in a state that should provide the desired result (products or services). Products or services are delivered to the consumer, satisfying their information needs.

The management object and the management process are affected by the information situation in which it is located. At the same time, the object of management, the information situation, the result of activity and consumers are located in the external environment, which is mostly not predictable and has a disturbing effect on all these objects.

To control the state of the listed objects and the external environment, an intellectual controller is used. It transmits information from the situation analysis to the database, knowledge base, and experience repository. This experience serves as the basis for the analysis that is carried out in the intellectual analyzer.

The intellectual analyzer generates two groups of assessments: management effectiveness assessments (evaluation of the result) and assessments of management actions and means of implementation, including management performance (evaluation of actions).

These groups of assessments in the form of an upward information flow are received by the "expert" and "teacher", respectively. The teacher evaluates the effectiveness of the actions and, if

necessary, makes adjustments to the management process. The expert evaluates the degree of achievement of the goal by the result and can also make adjustments to the management process.

These adjustments in the form of descending information flows are received by the intellectual control subsystem, which can make adjustments to the control goal and form new control actions. If there is no need to adjust the management goal, then the control actions are formed according to the old rules and criteria.

Here we should emphasize another difference between information management systems and intellectual management systems. Information systems use criteria for evaluating the effectiveness of management set from the outside.

Intellectual transport systems occupy a special place among other intellectual systems. intellectual transport system (ITS) - a distributed intellectual system for accounting, registration, coordination, control, management of traffic flows and the state of transport infrastructure, as well as relations between the transport sector and the municipal administration.

An intellectual transport system can be considered as a kind of intellectual information system (IIS), but there are a number of qualitative differences between most IIS and ITS in a number of factors.

Locality and distribution. Most IIS are local systems and are located at a certain point in space. ITS are spatially distributed systems. This imposes an additional requirement for the accounting and use of spatiotemporal information and generally complicates the process of analysis and management in ITS.

The uniqueness and mass character of the control objects. Most IIS manage a single object, although analyze a large number of parameters. ITS manages multiple objects, taking into account their mutual movement and changing environmental conditions. This imposes an additional requirement to account for and use complex heterogeneous statistical and deterministic models and complicates the process of analysis and management in ITS. This imposes an additional requirement on ITS to solve the tasks of coordinating objects and creating coordination management models.

The on-premises environment and heterogeneous environment. Most IIS control an object that is located in a changing, but relatively homogeneous, external environment. ITS manages several objects taking into account their mutual movement in the conditions of significant changes in environmental factors. This imposes an additional requirement to take into account significant changes in environmental factors and the use of complex heterogeneous models and models of the dynamics of the external environment and the dynamics of interaction with it of the control object.

The scale of the information space. Most IIS manage an object based on the creation and use of information and intellectual models in the local area. ITS manages multiple objects and individual objects based on the organization and application of a single information space.

The minimum scale of ITS operation is a small region. The maximum scale of action is the global space on the earth's surface. This feature of ITS imposes additional requirements on the creation of a single information space at different scales. In accordance with this, there is a need to use network technologies for managing objects and resources [15].

Navigation. Most IIS control an object that is in relatively stationary conditions in a local area of space. ITS manages objects whose position must be determined in geocentric coordinate systems on the entire earth's surface. This imposes an additional requirement on the ITS to solve

navigation problems for determining the location of transport objects at any geographical point on the earth's surface.

Integration with the methods of Geoinformatics. Most IIS control an object that is in relatively stationary conditions in a local area of space. ITS manage objects, using spatiotemporal data and their processing technologies used in geoinformatics. This imposes an additional requirement for ITS to integrate intellectual technologies with geoinformatics technologies or to use geoinformatics technologies in solving management problems in ITS [16].

Level of development. Most IIS use the latest advances in mathematics, logic, and technological innovations. ITS concepts and principles are intellectual , but due to much more complex management tasks, they still occupy an intermediate state between information and intellectual systems. ITS lags behind the IIS in terms of software, linguistic and logical-mathematical tools for implementing more complex transport management tasks. They also lag behind the IIS in supporting human activities. Therefore, the current state of ITS gives reason to attribute them more to "smart" systems than to intellectual ones.

This imposes an additional requirement on ITS to create new software, linguistic and logical-mathematical tools for the implementation of transport management tasks.

Management objects. The IIS and ITS can be used for management. For ITS, management is one of the main functions. The objects of ITS management are mobile objects and transport flows. The IIS manages a single object more often. Its manages a set of objects.

The nature of the interaction. ICS function independently and often serve a single object or solve a complex task that is not related to spatial information. ITS functions operate in real time and solve problems in real space, taking into account time constraints. Therefore, they require the unity of coordinates and time in the field of object management.

ITS has significant differences from information systems (IS).

1. Information systems use information as a basis, while ITS primarily uses knowledge and secondarily uses information.
2. Information systems process information and offer options for decisions that a person makes. ITS uses knowledge and information and not only offers solutions, but also performs decision-making actions themselves without human intervention. In addition, unlike IS, ITS requires two subsystems: the supporting and the providing one.

Modern intellectual transport systems are a new type of control systems that have replaced automated control systems and information management systems. They take into account such important factors as distributed information and spatial relationships. They are closely integrated with space technologies. intellectual transport systems focus on a system of rules as the basis for decision-making. intellectual transport systems serve as a decision-making tool in the face of high complexity and large amounts of data.

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