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INFORMATION SECURITY IN INTELLIGENT TRANSPORTATION SYSTEMS TRAFFIC MANAGEMENT

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The societal trajectory increasingly emphasizes the adoption of measures aimed at enhancing living standards, with a key focus on meeting the mobility needs of the populace. Paramount among these objectives is the efficient utilization of time, financial resources, and energy, while optimizing the outcomes achieved. Presently, the advancement of intelligent transport systems (ITS) represents a promising avenue in the evolution of the transportation sector in developed nations.

Vehicle manufacturers are actively innovating new technologies geared towards enhancing passenger and cargo mobility. Integration of these technologies into both public and private transportation systems holds the potential to enhance reliability, bolster safety measures, and mitigate environmental impact. A typical schematic representation of the principal components of ITS is illustrated in Fig. 1.

Fig. 1 demonstrates a simplified information structure of ITS functioning and decision-making. The presence of three main blocks and buffer links between them makes the process of data transmission, analysis, and processing fast and efficient. The "information security system" is the main element in the decision-making system by transferring information from publicly available peripheral services and devices to servers.

The procedure for communication in transportation systems using infrastructure equipment that provides processed information to administrative centers is similar for vehicles.

Modern ITS programs implement the function of transmitting information and monitoring a number of technical parameters of vehicles, both in terms of their onboard sensors and computers. They are represented by controllers of electronic systems for managing the work processes of vehicle components, assemblies and systems. At the same time, the main technical components are telematics tools focused on receiving and transmitting signals (information) in order to solve problems related to the organization of remote diagnostics of the technical condition of vehicles [1].

The complex hierarchical structure and the presence of a large number of levels within it has led to the emergence of separate networks and subsystems.

Vehicle Ad Hoc Networks (VANETs) have grown out of the need to support the growing number of wireless products that can now be used in vehicles. A VANET system performs a significant range of functions to ensure safety and analyze or warn of hazards. The main advantage is the ability to receive related

value-added services, such as vehicle security, automated bank payments, traffic analysis, advanced navigation, and local search-based services such as gas station, restaurant, and hotel locations. The use of such networks of this type

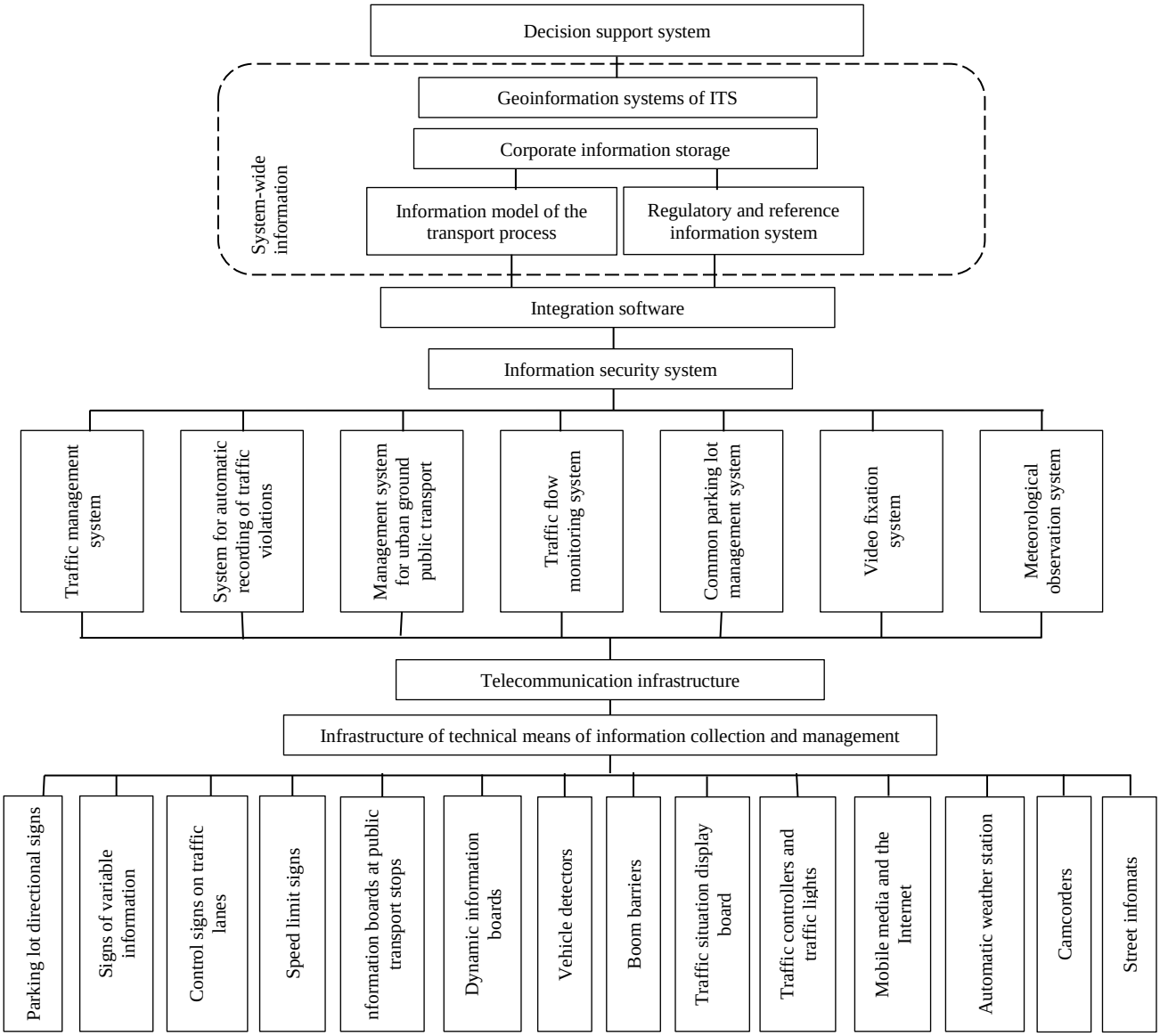

Figure 1 − Typical structure of a decision support system

In intelligent transportation systems, each vehicle acts as a sender, receiver, and router to transmit information to the network. The analysis of the received information is used to ensure safe and free traffic flow.

ITS is − a system of integrated management of information and communication elements compared to classical transportation systems. This allows to increase productivity, quantitative indicators of traffic flows, efficiency in the transportation of passengers and goods; transport safety and passenger comfort. Changing approaches and trends in the transportation process and its research is one of the foundations of intelligent systems [2]. The relevance of their application is

represented by numerous programs and projects, the introduction of new training programs and association funds at the national and global level.

The growing need for mobility of the population of urban areas is realized through the continuous improvement of requirements for the quality and safety of travel. The urban transportation planning process is subject to certain requirements and infrastructure constraints. Society will not give up on meeting the need for mobility, so there is a need to introduce innovative, sustainable and energy-efficient solutions that will contribute to an appropriate level of quality of life. However, an increase in mobility rates will lead to a significant increase in road accidents, losses, and costs [3].

One of the most important information components of the ITS is a special transport network (VANET), whose nodes are represented by vehicles and specialized communication modules. The main purpose of this type of network is to notify road users of emergencies. This functionality is organized through the automated distribution of messages from road safety applications through the network [4].

With the expansion of the scale and transition to sustainable urban mobility and the introduction of methods and means of coordinated traffic management, the need to develop a structural and logical scheme for managing traffic flows and communication processes between these elements becomes apparent.

The main element of the structural-logic scheme (SLS) is the traffic flow. Together with the elements of the environment and the road (a component of the VDM), it forms the block "Sustainable Development and Sustainable Urban Mobility" (Fig. 2).

The above-mentioned functional block is influenced by the "Traffic Organization" block. As mentioned earlier, one of the effective measures of traffic management is traffic intensity control. This block acts as a buffer between other components of the SLC.

The intensification of the development of the information and communication structure, which would provide road users not only with safety-related data, but also with new types of information services, formed the Information block.

This integration of information, communication technologies and automation tools into the structural components of the transport infrastructure expands the possibilities of transforming intelligent transport systems (ITS) into a digital society [4].

VANETs are part of the ITS concept, which serves as a highly dynamic, self-organizing network structure for transmitting information about traffic and incidents.

VANETs are the starting point for building a full-scale ITS, as they can function both in conjunction with infrastructure stations and in isolation. The high cost of deploying the infrastructure part of the ITS additionally emphasizes the importance of VANETs as part of the overall integrated system [3].

The architecture of the VANET network involves the interaction of cars with other vehicles and with the infrastructure (base) network located along the road (RSU). VANET differs from other wireless networks in the following ways [3]:

1) Dynamic topology.
2) Uneven density of nodes.
3) Restriction of movement.
4) The presence of obstacles (buildings, structures, etc.).
5) Lack of a single center for management and control over the topology.
6) Uneven communication traffic and problems of service quality and security.

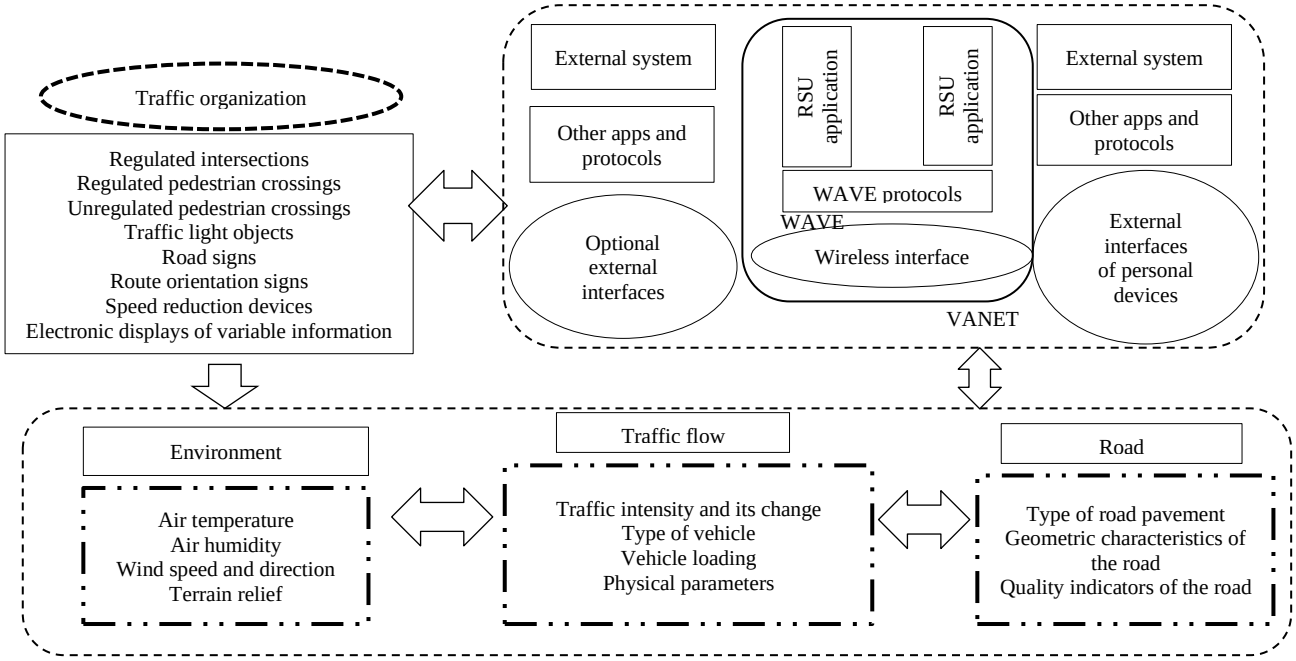

Figure 2. − Structural and logical scheme of the traffic flow functioning

Security issues require careful evaluation and study when developing automotive communication networks. VANET security is crucial, as its very existence relates to critical, life-threatening situations. It is important that relevant information cannot be inserted or changed by an attacker [4]. The system must determine the responsibility of drivers while maintaining their privacy. These problems are difficult to solve due to the size of the network, the speed of vehicles, their relative geographical location, and the stochastic connections between them. The advantage of vehicular networks compared to the more common ad hoc networks is that they provide sufficient computing and energy resources.

Therefore, Intelligent Transportation Systems are considered as requirements for the efficient operation of telecommunication networks. Approaches to improving vehicle safety based on information exchange between network nodes necessitate the creation of specialized systems. One of the major problems that arises when designing such large-scale systems is the balance between such indicators as simplicity of organization, efficiency of operation and economic profitability. The simplicity of organizing a VANET includes the ability to implement a new solution