Modern geoinformation technologies and their use in transport management

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Abstract. The article is devoted to the analysis of the use of modern geoinformation technologies in the field of transport management. The author reveals the content and principles of transport management considering the use of modern geoinformation technologies. The author examines such geographic information technologies as self-driving systems, GPS systems, on boarders and automotive radars. The author concludes that these technologies make it possible not only to manage transport and ensure transport security, but also to optimize the process of managing transport infrastructure and transport operations. They can also play a role in the development of branding for modern transport.

1 Introduction

Digitalization of the economy in transport has led not only to the active development and implementation of information technologies in transport, but also to significant changes in the field of interaction and application of computer science methods in various sciences. The result of this interaction was the emergence of a young interdisciplinary science - geoinformatics, the areas of research and methods of which are of key importance for the development of intelligent transport systems.

The increasing complexity of transport logistics and supply chains increasingly relies on the use of information management systems, but increasingly we are talking about intelligent transport management systems. These management systems must consider geographical factors, which is important when planning transport logistics and organizing transport operations. In this case, geographic information systems and technologies can serve as an active tool for transport management.

The development of geographic information science has been inspired by advances in common information technologies such as global navigation satellite system (GNSS) sensors, broadband networks, cloud computing, and service-oriented and distributed data processing architectures.

Currently, the development of transport is impossible without the use of this data. If earlier, transport logistics, for example, was managed by a separate person - a dispatcher, then now this can and is done by intelligent transport systems using artificial intelligence. However, the dispatcher profession does not disappear. A person is needed who will provide support, monitoring and control in this area.

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Geoinformatics is a term that was coined in 2000 and refers to the words "geo" (i.e. "earth") and "computer science" [1]. The main focus of this branch of scientific knowledge is on the use of modern information technologies (for example, databases, decision support systems, the Internet), communication technologies (for example, wireless networks, cell phones) and solutions for internetworking (for example, protocols, standards for maintaining information activities) to study various geographic objects and data. In this regard, geographic information technologies help organize transport logistics.

Geoinformatics in transport has great scientific and research potential. Since its functioning is impossible without the work of the human-machine system, its study can help clarify the connection between natural and artificial intelligence. Active implementation of information technologies and research in the field of AI, as noted by V.A. Lektorsky, can be an important way of understanding natural intelligence, and indeed all human cognitive abilities [2]. Thus, the interaction between man and technology shows that human nature is highly adaptable and constructible. This problem is developed within the framework of the cognitivist epistemology of E. von Glasersfeld [3], P. Watzlawick [4].

According to these researchers, a person is distinguished by the ability to learn and self-learn because of obtaining not information, but knowledge. In this regard, knowledge acts as a cognitive construct, based on which a person not only understands the world of technology, but also organizes the semantic space of meanings and values that are vital for him. Knowledge is always born because of human interaction with technology. Therefore, the problem of transport management will always have an axiological (value) significance.

In addition, the development and application of various geographic information technologies is impossible without considering the general scientific methodological base, the use of empirical and theoretical scientific methods, which at the applied level help to successfully create and implement specific geographic information systems in transport [5].

2 Materials and methods

The successes of geoinformatics are associated with the development of such sciences as geography and computer science. Therefore, at the empirical level, the subject of study became geographic systems and the scope of their application in transport logistics. A special role in our research is played by intelligent transport systems, the specific consideration of which is based on statistical and comparative methods of scientific research. Currently, the problem of using intelligent transport management systems is widely discussed in the scientific literature [6-8].

To analyze the content and principles of transport management, taking into account the use of modern geographic information technologies, the study used an interdisciplinary approach, a method of system analysis, which made it possible to consider the connection of geographic information systems with the field of transport management. The study of existing scientific and technical publications related to the use of intelligent systems in transport made it possible to obtain a general understanding of scientific developments in this area, as well as become familiar with various methods for creating and using intelligent systems in transport.

Among the existing methods for studying intelligent transport systems, the following methods are actively used today:

1. A modeling method that allows you to create computer models of the transport system, transport and logistics in general. The result of successful use of this method is the assessment of operational efficiency and risk management in case of failures of transport systems.

2. Empirical methods, which include field tests, observations and user surveys. This makes it possible to obtain real data on the behavior of the transport system and assess user satisfaction with the operation of one or another type of transport.
3. Optimization and nonlinear programming methods that are used to determine optimal solutions. The main goal of using these methods is to find optimal solutions in the field of minimizing delay, increasing throughput, and improving transport infrastructure.

These methods are, in our opinion, the main ones, but not the only ones in the field of development and use of intelligent transport management systems. Of course, they make it possible to study and improve transport systems, which leads to increased efficiency and safety of transport, reduction of traffic jams, improved logistics, and increased user satisfaction with transport services. Studying the use of geographic information technologies on modern intelligent transport systems is impossible without considering monitoring and analysis of the effectiveness of the development of the latter.

3 Results and discussion

Geoinformatics plays an important role in improving the efficiency and sustainability of transport systems. It integrates the use of geographic information system (GIS), remote sensing and global positioning system (GPS) to analyze and manage transportation processes.

The main methods and tools of geoinformatics in transport management include the following:

1. Geographical (spatial) analysis of the use of transport systems and transportation. Geographic information systems (GIS) are used to analyze spatial data such as road maps, public transport stop locations, residential density, etc. With the help of GIS, it becomes possible to create digital models of transport flows, successfully forecast transport logistics and optimize the distribution of transport resources.
2. Routing and planning: GIS allows you to optimize route planning, considering various factors, which may include factors such as traffic, distance, time, cost of transport. Taking these factors into account allows you to develop efficient routes for trucks, public transport or even pedestrians.
3. Traffic Management: Geo-informatics plays an important role in urban traffic management. Using traffic data collected from cameras, sensors and GPS, digital dynamic traffic models and traffic flow forecasts based on real-time traffic information can be successfully created. This allows optimizing the management of traffic lights, manage variable signs, and prevent traffic jams.
4. Visualization and Monitoring: GIS allows geographic information to be visualized on maps, making it easier to understand and make decisions. They also allow real-time monitoring of traffic flows, resource allocation, signaling systems and other aspects of transport management.
5. Environmental Analysis: GIS allows analysis of socio-economic and environmental factors affecting the transport system. Based on this analysis, it is possible to develop transport development strategies, optimize the location of stops and transport hubs, predict the impact of new infrastructure projects, etc.

Thus, geoinformatics offers many methods and tools that can help in intelligent transportation management. The use of these methods can provide better transport and transportation management systems.

4 Conclusion

The main geoinformation technologies in the field of intelligent transport management include the following:

1. Automatic systems. They represent a hardware system. which, with the participation of a dispatcher or even without his participation, can control a vehicle and moving it along a given trajectory. These include, for example, autopilots in road transport, which are widely used today, or, for example, autopilots for controlling railway vehicles.
2. GPS systems that allow you to measure distance and time through navigation satellites. Using GPS systems, the position and exact characteristics of the vehicle are determined, the coordinates and direction of its movement are determined.
3. On boarders are a specially designed computer that is installed directly on a specific vehicle. You could say. that they act as navigators and at the same time allow you to determine the status of a particular vehicle in real time.
4. Automotive radars, which help in managing and organizing vehicle logistics in conditions, for example, of limited visibility or limited space for parking a vehicle.

Thus, geoinformation technologies in transport are specific tools that allow optimizing the intelligent management of transport systems to implement successful transport operations, operate transport and build transport logistics.

They not only help improve the performance of transport systems, but also improve safety. In addition, they can be used to improve the branding of individual modes of transport.

Transport branding as a set of tools and a process of brand management, consists of developing a trademark for transport products, positioning, market promotion, ensuring reputation, as well as regular support for compliance of transport with market requirements.

The goal of transport branding is to create long-term preference for an object, in our case a car brand. The main task of branding is to convey to the target audience (buyer, partners, authorities) the essence of the offer, issued under the name of the brand and the formation of a positive attitude towards this brand.

Automotive branding objectives include as follows:

1. creation of a clear and understandable image of the car;
2. making it popular, that is, known among the target audience, easily recognizable by consumers;
3. stimulating preference for the brand; if there is an alternative, making the choice of a preferred car natural;
4. formulating the value of this car in the minds of the consumer;
5. creation of the opportunity to receive a brand price premium.

A brand premium represents the opportunity to sell a marketing item at a higher premium than the market average. The price premium of a car brand, for example, is formed based on the willingness of the brand's target audience to buy more readily, quickly and more expensively branded goods, relying on the brand's fame and popularity, as well as in anticipation of additional emotions and benefits from the purchase of such items.

The main elements of automotive branding include a trademark; packaging and labeling; advertising messages; PR events.

The package of work on "brand design" includes the following:

1. "naming", that is, developing a brand name;
2. brand description;
3. identifying the value of a brand or car brand in the eyes of the consumer;
4. creating a brand design, as well as formulating principles for promoting and popularizing the brand.

Thus, automotive branding, and more broadly vehicle branding using geographic information technologies, is essentially the use of geographic data and tools to create a unique visual identity and communicate a vehicle brand. This can be useful for companies to attract attention to their products or services, increase brand awareness and create a positive image among the user of a particular vehicle.

The main ways to use GIS for vehicle branding include the following:

1. Graphic Design: GIS allows you to create designs, logos and graphic elements that can be placed, for example, on the body of a vehicle. Graphic design can include the use of unique colors, shapes, creative images and text elements that will help a particular vehicle stand out from others and attract attention.

2. Interactive maps: Using an interactive map on a vehicle can help road users successfully navigate and obtain information about the location and services of a transport company. For example, in obtaining information about taxi services, delivery, bus transportation, to track the location of transport and the expected time of its arrival.

3. Implementation of Dashboards: Geo-information technologies enable the creation of in-vehicle dashboards that can display various brand-related data and messages. For example, a dashboard could display special offers, advertisements, contact information, or even interesting facts about the company.

4. Placement in geographic context: GIS allows the placement of a vehicle in specific locations that can be associated with a specific brand or product. For example, vehicles may be located near landmarks, popular locations, or locations associated with company activities. This can make the brand and its vehicles more visible to people in the area.

5. Social Media Integration: Geospatial technologies can be used to connect to social media platforms and spread brand awareness through them. For example, the vehicle may be equipped to take photos or videos that users can share on their social media accounts such as Instagram or Twitter. This helps expand the reach of brand messages and increase user engagement.

These methods allow the use of geoinformation technologies for vehicle branding. They help companies stand out from competitors, attract the attention of potential customers and create a positive brand impression.

Thus, geographic information systems and their use in transport management represent a complex set of technical tools and solutions in the field of optimizing transport management and creating its image among vehicle consumers. The basis for the operation and management of transport is certainly digital modeling and specific geoinformatics methods. Therefore, general management principles should include digital modeling and geoinformation monitoring of transport systems, the creation of intelligent transport support systems, etc. importantly, they must include a value component, since their use is impossible without human participation.

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