American Journal of Science and Learning for Development

Volume 1 | No 2 | Dec-2022

Structure and Functions of Intelligent Transport Systems

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Abstract: *In this article given functions and structure of intellegent trsnport systems. Nowadays ITS plays an important role in the management of urban transport systems and safety of people and transport movement.*

Keywords: *structure, functions, ITS, transport, social, road, sustainaility, infrastructure.*

INTRODUCTION

In the field of transportation, the need to meet the demand for cargo and passenger transportation services is a concern of the whole world. Intellegent transportation systems (ITS) created using intelligent information and communication technologies provide economically, environmentally and socially sustainable solutions that provide efficient and rapid access to information. These solutions mainly enable the integration of road transport with other transport modes in a way that each mode complements the other, creating a more efficient global transport system.

Many different applications related to ITS, which are of great importance in solving the problems of road transport, which are the most used in cargo and passenger transportation in Uzbekistan, have been implemented in developed countries, and developing countries are also increasingly using these technologies. is using more. It is intended to present the ITS architecture used by analyzing applications in Uzbekistan and some developed countries. After reviewing how internationally accepted architecture and standards were created and existing applications in Uzbekistan, the components of this architecture were identified.

RESAERCH AND METHODS

Global economic downturn of recent years has led to a severe reduction in demand, which has led to a significant reduction in production, trade and transport worldwide , and has had an immediate impact on the entire world. In 2021-2022, the decrease in the volume of cargo transportation was greater than the decrease in the volume of trade, and the decrease in the volume of trade was greater than the decrease in production . These declines have led to losses in the employment sector, especially in advanced economies. Another consequence of the crisis was the acceleration of the transfer of economic assets from developed economies to developing economies, and this change was also evident in the transport sector.

Most important factor in the formation of this situation is the fact that the activity in the field of transport is closely related to economic development and fluctuations in the business world. Economic growth, continuous population growth and increasing urbanization have become more decisive for the future of the sector in the transport sector, which is significantly influenced by macroeconomic indicators. Higher per capita income and population growth will increase the need for both passenger and freight mobility. Developing countries such as China and India have also seen post- crisis growth in passenger and freight traffic. In addition to these, the world 's foremost demands for safe, timely, shorter and more convenient transportation have accelerated the

development of transportation in recent years. Taking into account the integrated operation of transport modes supported by logistics services, the creation of an efficient and effective transport infrastructure within the framework of this development, there was a need to implement a policy that gives priority to the human factor and minimizes the damage to the environment . In this context, the concept of sustainability, which emphasizes efficiency and effectiveness, is directly related to safety elements, energy consumption reduction and efficient use of land.

Given the critical role that transport plays in poverty prevention, employment and education opportunities, access to markets and utilization of underutilized land, the need for sustainable solutions to address the growing challenges, especially for developing countries, is likely to increase in the future . The Industrial Revolution, which began about 200 years ago, the Manufacturing Revolution, which has a 100 -year history and emphasizes the use of information and efficiency in production, and the Management Revolution, which occurred during this period by adding information to information. The 2000s encompassed the rapid development and change of information and communication technologies.

Intelligent transportation systems (ITS) are designed and created using information and [1]communication technologies to meet the growing demand for passenger and cargo services in the transportation sector in a more efficient, safer and environmentally friendly way. Fast and efficient access to information offers environmentally and socially sustainable solutions. Such solutions essentially ensure the integration of road transport with other modes of transport, each mode complementing the other and creating a more efficient global transport system. In addition, for a transition economy that is building high -tech infrastructures that help to eliminate gaps and obstacles in road networks, in terms of ensuring fast and safe mobility, which is one of the main priorities of the formation of society. The added value of such solutions is based on social justice and cannot be denied.

This thesis aims to reveal the possible ITS architecture in Uzbekistan by studying the applications in some developed countries and the existing applications in Uzbekistan. In this direction, how internationally accepted architectures and standards are created is discussed and an ITS architecture proposal is presented by evaluating current practices in different countries and Uzbekistan.

Due to the increasing trend in road transport in Uzbekistan in recent years, along with some problems such as air pollution, traffic safety and traffic congestion, the general framework of ITS is drawn, and the standards are defined, history, architecture and ma information is provided.

In emergencies, it is difficult to create transportation systems that move people together from one point to another, minimize fuel consumption and vehicle emissions , deliver goods, and provide the most beneficial trips in terms of time and cost. Indeed, creating a transportation system that minimizes accidents and maximizes the system's capabilities by alerting drivers to all kinds of situations such as weather conditions around vehicles, traffic jams, and other potential hazards can be seen as a truly challenging goal. However, the use of technologies produced by today's scientific developments in various fields for a safe, efficient and sustainable transport system is generally described as Intelligent Transport Systems (AUS) applications.

various sources it is said that the definition of ITS applies to information and communication technologies developed for other types of transport, ITS is a concept that appeared in road transport accepted in international standards . AUS is a systems engineering program that uses information and communication technologies to operate and manage infrastructure and superstructures in the highway network, which consists of intercity and urban roads. AUS is an engineering discipline that involves the research, planning, design, integration and operation of various systems and applications to improve the efficiency of road transport systems, ensure their safety, increase their environmental benefits, and manage transport and infrastructures. This discipline includes strategic planning, system architecture, technology interoperability, data and communication in multiple modes and across jurisdictions, real-time data monitoring, timely and accurate user data.

2.1

ITS stakeholders consist of technical experts and, broadly speaking, many different users in a multidisciplinary structure within the industry. Each stakeholder must bring their knowledge and perspectives to the subject to plan, develop, manage and implement multimodal ITS.

Civil engineers, electrical and electronics engineers, systems engineers, urban and regional planners, logistics, policy, finance and business professionals, public safety and emergency personnel, and many people from various fields related to transportation infrastructure are AUS stakeholders. Sea and air transport are widely used in intercontinental transport, which is one of the integral elements of economy and trade, while intercontinental trade is mainly carried out by road and rail transport. Passenger mobility has increased due to the convenience provided by private vehicles. However, the impact of the crisis and the coronavirus on production and distribution channels around the world has reduced traffic, especially heavy vehicles. However, after the coronavirus and the crisis, it can be said that previous calculations in road transport have been fulfilled, which is very important for the recovery of the economy.

Uzbekistan, the transport sector is a very important part of the economy and in Uzbekistan 4.75 percent of gross output and total employment belongs to the transport sector. The number of people directly employed in the transport sector in Uzbekistan is around 643 thousand, and employment in road transport makes up 95% of employment in the entire transport sector.

Despite the changes taking place in passenger transport, especially in the air and rail sectors, it is observed that road transport still has the highest performance in the entire transport system.

There are many types of public transport, and those operating in Uzbekistan include buses, taxis, subways, trolleybuses, railways and air. Private cars, company cars, military and ambulance vehicles, factory and supermarket service buses are not part of public transport.

Table 1. Volume of passenger transportation in road transport, railways, air transport and electric transport (million roads)

Direction	2019 year	in % compared to 2017	2020 year	in % compared to 2017
Car	5915.2	105.8	5192.9	92.9
Railway	22.9	108.7	6.2	29.4
Metropolitan	79.2	128.6	38.8	63
Avia	3.24	147.5	0.9	40.9
Tram and trolleybus	4.53	159.8	1.6	56.4
Total	6.03 billion	106.1	5.24 billion	92.3

In Table 1, the volume of passenger transportation by existing means of transport in Uzbekistan is analyzed in relation to 2017. According to it, the volume of passenger transportation in road transport, railways, airlines and electric transport at the end of 2019 will be 6.03 billion. passenger, and by the end of 2020, 5.24 billion. formed a passenger.

Including:

- Passenger transportation in road transport - 5 billion 915.2 million in 2019. passenger, 5 billion 192.9 million in 2020. passenger (92.9 percent);

Passenger transportation in railway transport - 22.9 million in 2019. passenger, 6.2 million in 2020. passenger;

Passenger transportation - 79.2 million in 2019. passenger, 38.8 million in 2020. passenger;

Passenger transportation by air transport - 3.24 million in 2019. passenger, 0.9 million in 2020. passenger;

- Passenger transportation on trams and trolleybuses - 4.53 million in 2019. passenger, 1.60 million in 2020. passenger.

The fact that public passenger transport is considered one of the important elements of the socio-economic environment in the country's transport system indicates that it is of high not only economic, but also social importance. Passenger transport is a tool that shows the social and economic potential of the country and regulates the system of social protection of the population. Based on this, in order to further improve the public transport service organization system, to create a competitive environment and favorable conditions for carriers of all forms of ownership, as well as to increase the transport and transit potential of the republic, the President of the Republic of Uzbekistan dated March 6, 2019 "Cargo and Passenger Transportation System" Decision No. PQ-4230 "On radical improvement measures" was adopted and a number of benefits were granted to branch enterprises.

If we pay attention to the policy of developed countries, the issue of transport is in the main place. There are a number of advantages of public transport, including:

prevents traffic jams . Much of the heavy traffic on our roads in various cities around the world is due to the use of private vehicles and the perception of everyone wanting to use their own cars for their privacy and convenience. Recent studies have shown that a full transit bus in a public transit system is equivalent to about 55 cars on the road with one passenger;

it harms the environment less. This, in turn, is beneficial for our cities, whose air is highly polluted;

money is saved. Using public transport allows you to save up to four times more money than you would spend on a private car. Regular use of a private vehicle incurs maintenance costs and other additional charges, such as parking fees and speeding fines. By using public transport, you can save all the money that would otherwise be spent on using a private vehicle;

physical activity . Walking has been proven to relax the mind and improve mental health. Consequently, walking between public transport routines can improve mental health and physical well-being;

prevents depletion of natural and fuel resources . Trains, buses, ferries and trams significantly reduce dependence on fossil fuel reserves and materials that continue to destroy the natural environment.

will stimulate the development of tourism . Tourists can be much safer and more relaxed than using public transport systems such as trains and buses, as it gives them the opportunity to meet new and interesting people from different cultures.

buses and trains are much safer than private vehicles . Personal vehicle accidents contribute to higher fatality rates than accidents involving buses or trains. Every year, more than 40,000 deaths and many more injuries are caused by car accidents worldwide.

improves the safety of places with public transport . Research based on evidence from criminology reports shows that places with public transportation have improved overall safety and reduced crime. Public transportation areas are actually better lit and patrolled, as well as police officers, reducing crime and increasing safety by more than 80 percent.

If we pay attention to the statistics of Uzbekistan, road traffic accidents on public transport (buses) have decreased by four times in the last ten years . During the last 10 years (2011-2020), the following were committed by the drivers of the bus depots within the "Toshshahartranskhizmat" Joint Stock Company:

- ✓ the number of traffic accidents increased by 76 percent;
- ✓ 57 percent of those who died;
- ✓ the number of injured people decreased by 76%.

For comparison, in 2011: road traffic accidents - 74; deceased - 7; injured - 83.

In 2020: road traffic accidents - 18; deceased - 3; injured - 20.

For information, in 2020, the number of road traffic accidents decreased by 26% compared to 2019, and the number of deaths decreased by 60%.

In January-April 2021, a total of 2,242 traffic accidents were recorded in Uzbekistan. As a result, 557 people died, 1684 people were injured in various degrees. This, in turn, is a sign of the safety of public transport.

There are also a number of disadvantages of public transport, which are as follows:

- struggle for place;
- crush and satiety are companions of public transport;
- the speed of public transport is lower than that of private transport;
- public transport aggression nest;
- absence of public transport to the destination or transport exchanges;
- obsolete vehicles;
- it is necessary to speak in a low voice;
- unpleasant smell and not clean;
- and the main thing is that it does not meet hygienic requirements.

Based on the above, determining strategic directions for improving service culture and efficiency based on the use of modern marketing research in the market of passenger transport services is an urgent task.

In particular, it is necessary to pay special attention to the implementation of research in such areas as further improving the quality of passenger transport infrastructure and the organization of customer-oriented services, the organization of effective marketing activities aimed at the harmony of the relationship between the customer and transport enterprises.

The reduction of energy resources is one of the important problems facing the world in terms of road transport. Fossil fuels are the main source of energy used by motor vehicles on the highway, and the use of alternative energy sources to fossil fuels has been on the agenda recently. According to the International Energy Agency (IEA), consumption in the transport sector accounts for 19% of energy consumption worldwide.

Due to changes in oil prices and dwindling oil resources , it is estimated that road transport may face serious challenges in terms of energy efficiency with increasing demand in Uzbekistan, a major importer.

of fossil fuels in road transport causes air pollution, and the increased use of motor vehicles also causes noise. Environmental impact, which is one of the main problems of road transport, is seen as another area where bigger problems may arise in the future if no measures are taken. According to the IEA, 23% of carbon dioxide (CO2) emissions from fuel consumption come from transport.

According to projections in Figure 1.1, this figure is expected to increase to 50% by 2030 and 80 % by 2050 .

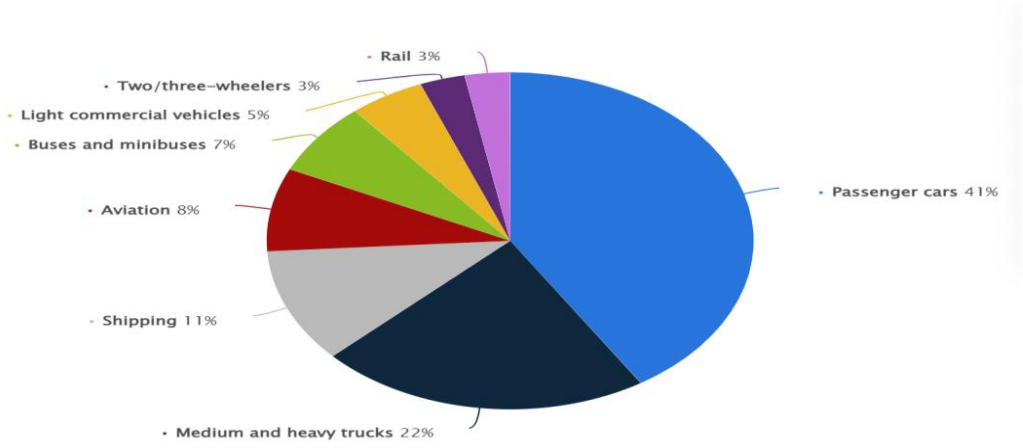

Figure 1.1. Information on **the impact of harmful substances on the environment (www.dataworldbank.org)**

Road safety is one of the most important problems in road transport. The concept of safety in the transportation system is the ability to transport one or more vehicles or goods from one place to another without causing any damage, with the least possible risk. Of course, negligible or zero risk is the goal in the long run, but experience shows that no human activity can be completely risk-free.

CONCLUSIONS

Caused by the movement of vehicles, drivers, infrastructure and vehicles have increased , especially in developing countries due to population growth, urbanization and vehicles. Although traffic accidents resulting in death, injury or material damage cause losses in terms of the national economy of countries, human deaths and injuries also cause social damage. At the same time, the high cost of investments in highways caused difficulties in financing the central budgets of countries. Due to market fluctuations and crises in the recent period, market conditions and credit volumes have deteriorated, particularly in North America and the European Union, making it difficult or costly to obtain the necessary financing. Therefore, the planned road and transport projects need real and current technical and economic foundations, and the implementation period of such projects is also important. Furthermore, it should not be overlooked that infrastructure investments aimed at increasing the length and width of highways provide temporary solutions rather than ensuring the efficient use of existing highway capacity, and that the available financial resources are not long-term and should be evaluated for sustainable solutions. In addition, with the increase in urban population, the more efficient use of urban roads and the planned integration of different modes of transport can have a positive effect on the financing of investments in different modes of transport.

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