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Study and Necessity of Using Intelligent Transportation Systems (ITS) and Their Impact on Transportation Management in Tehran

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ABSTRACT:
Information and communication technology, by entering various urban domains, has brought about tremendous changes and transformations. Cost reduction, accelerated operations, increased accuracy, and improved monitoring and control processes are some of the impacts of technology on urban management domains. Urban transportation systems are one of the areas that can be influenced by information technology and smart urban processes, and the results can be anticipated, foreseen, and then planned for sustainable urban development. The research question of the present study is: What is the necessity of using intelligent transportation systems in future transportation management? The metropolitan area of Tehran has been selected for a case study.

Keywords: Urban Traffic, Transportation, Intelligent Transportation Systems, ITS

INTRODUCTION:

Transportation development is one of the most important issues in Tehran. Improving the performance of transportation systems and its development in recent years has forced Tehran's transportation managers to optimally utilize existing resources and take advantage of new and intelligent technologies. The implementation of intelligent urban transportation and traffic systems, as one of the newest and most effective traffic management solutions, has been utilized in this regard.

In this research, from an urban management perspective, the definition of intelligent transportation and urban traffic systems is addressed, and the advantages and challenges of intelligent systems are also discussed and examined. The method of this research is descriptive-analytical, which was conducted using library resources, documentation, and previous research.

The results of this research showed that many traffic management solutions based on ITS technologies have the ability to effectively control urban traffic, and these solutions, through integration via information dissemination and appropriate infrastructures, have the ability to synergize their effects. According to studies, ITS services cover a wide range of services provided by this technology, but based on the different cultural, social, economic, and climatic needs and conditions of each city and region, some of these services are prioritized in the ITS programs of that area. In order to optimally utilize ITS services, it is necessary to plan and develop a comprehensive plan in the stages of determining strategies and orientations, as well as in the implementation stages of ITS projects, considering the regional conditions.

Importance and Necessity of the Research:

In today's world, urban transportation and traffic is an issue that all people are directly connected with in one way or another. With the growth and development of cities, the need for public services and facilities has also increased, which in turn will add new dimensions to the general issues of Tehran, especially the issue of urban transportation and traffic. Considering the progress of human society and human attention to preserving the environment and increasing security, the need for a new transportation system seems more necessary than ever. The traditional transportation system is no longer able to meet the needs of modern humans. The need for more speed, more safety, less environmental damage, and most importantly, more comfort and tranquility; all indicate that modern humans need a transformation in the transportation industry. From this perspective, the use of modern and new technologies has led to a tremendous transformation in the transportation industry. (Mortazavi-nia, 2018)

In recent years, transportation engineers, along with expertise in telecommunications, electronics, computers, and other related fields, have taken advantage of information and communication technology solutions to build intelligent transportation

systems or ITS. These systems have provided a desirable and suitable infrastructure for achieving the set goals and can help achieve dynamic and smooth mobility in a communicative society and provide better services to citizens. The creation of an electronic municipality is one of the goals that can be pursued through the use of these systems, providing a new horizon in the provision of services to citizens. It should be noted that the use of intelligent transportation systems is not considered the only solution to transportation problems in advanced societies, but these systems, as a suitable infrastructure, can help reduce the negative consequences of the twentieth century in the field of transportation and provide newer and more effective solutions to meet transportation needs in the twenty-first century. (Aboulhasanpour, 2016)

The heavy and problematic traffic in Tehran is due to the increasing growth in the number of vehicles and the lack of sufficient expansion of traffic routes for them. Most people believe that major traffic problems in urban areas are due to the inappropriate or inadequate structure of streets to absorb and move vehicles.

But the reality is that other factors, such as traffic control equipment and systems, also affect traffic conditions and can improve favorable physical traffic conditions or, if inadequate, exacerbate existing problems. In third-world and non-industrialized countries, including Iran, traffic management is often done using traditional methods. In recent years, the main traditional management approaches have included: building freeways and highways, widening existing roads, limiting traffic, and increasing the public transportation fleet. Investment policies in the field of transportation and traffic have shifted from solutions based on the development and construction of urban transportation and traffic networks to traffic management solutions such as demand management and traffic control using information technology methods.

Currently, information technology has also been considered in the field of traffic management, so that traffic management methods using information technology have appropriately benefited from modern technology to develop traffic and meet the needs and demands of users. (Mojahed-Dini, 2017).

Research Objectives:

Main Objective:

Study the necessity of using Intelligent Transportation Systems (ITS) and their impact on transportation management in Tehran.

Secondary Objectives:

- Definitions of intelligent transportation system and traffic control
- Impact of intelligent transportation system and traffic control

Conceptual Definitions:

In 1998, the Intelligent Transportation Society of America provided a definition for the ITS idea in the form of a general and acceptable statement:

"People use technology in transportation to save money and time in their daily lives."

Then in April 1999, the U.S. Department of Transportation published a more formal definition as follows:

"The Intelligent Transportation System collects, stores, processes and distributes information relating to the movement of passengers and goods."

In addition to the definitions introduced so far, there are other definitions for ITS.

For example:

Intelligent Transportation System (ITS) is the application of information technology to improve the performance of the transportation system. The term ITS also refers to a set of tools, facilities and expertise that includes traffic engineering concepts, software, hardware and telecommunications technologies. These tools and expertise are used in a coordinated and integrated manner to improve efficiency and safety in the transportation system. (Chowdhurry et al., 2003)

Intelligent transportation systems refer to the combined application of communications, control and information processing technologies in the transportation system. Using ITS saves lives, saves time, money, energy and has environmental benefits.

These systems include all modes of transportation and examine all elements of the transportation system such as vehicles, infrastructure, and drivers or users. The overall role of ITS is to improve real-time decision making for transportation network controllers and other users, and consequently improve the overall performance of the transportation system. (Ministry of Roads and Transportation, 2007)

Research Background:

A) Foreign Research:

Camila Ariza et al. (2019) in an article titled "Sustainable Urban Transport, What Can We Learn from Copenhagen?" examined the state of sustainable transportation in some capitals and metropolitan areas of Latin America. They concluded that transportation currently accounts for one-fifth of global energy demand and one-quarter of carbon dioxide emissions. In this regard, the city of Copenhagen, Denmark, has planned that by 2025, about 75 percent of trips in the city will be made on foot, by bicycle, or by public transportation, and only 25 percent of trips will be made by car. Currently, there are more bicycles than residents in Copenhagen. In other words, there are 520,000 citizens and 560,000 bicycles in the city, and Copenhagen is planned to become the world's first carbon-neutral capital in 2025. The authors conclude that Latin American capitals, especially Bogotá, the capital of Colombia, are following a positive trend in making their urban transportation networks more sustainable.

In articles by Dameri and Rosenthal-Sabroux (2014), they examined the history of smart city development.

According to the findings of this article, the idea that a city can be digital and smart, and that technology, especially information and communications technology, can be used to improve quality of life, seems old. However, more precisely, the starting point for discussions on the smart city concept was in 1994. Between that year and 1997, not much was added to the literature on smart cities globally. After that, writings and notes increased steadily until 2005. This trend faced a decline from 2006 to 2009, and from 2010 onwards, the growth of the literature more than doubled from one year to the next. This article acknowledges that the signing of the Kyoto Protocol in 1997 and the commitment of signatory governments to reduce greenhouse gas emissions in 2000, the increasing spread of the internet in people's lives and businesses in 2008, and the introduction of the concept of a smart planet and the formulation of the Europe 2020 strategy in 2010 were among the important milestones on the path to the smart city.

Cooke and De Propris (2011) studied and analyzed smart urban growth, identifying elements such as planning, transportation, economic development, housing, local community development, and natural resource protection as components of smart urban growth. Emphasis was placed on walking, providing facilities for cycling, improving public transportation systems, integrated and interconnected systems and networks as components of transportation in the smart city.

B) Domestic Research:

Abdolkarim and Ebrahimi Dehkordi (2017) conducted research on planning intelligent urban transportation systems with an emphasis on multi-story parking facilities in coastal cities. This applied and descriptive-analytical research used a qualitative data analysis method. After basic studies on intelligent transportation systems and understanding them, the most important functions and services that these systems can provide to users were examined. One subset, an intelligent parking guidance system and the implementation of multi-story parking facilities in coastal cities to attract tourism and provide safe and reliable transportation services for travelers and tourists visiting coastal cities, was proposed as a solution to problems arising from lack of suitable parking in coastal cities. The results indicated that with proper planning, implementing this intelligent system in high-traffic coastal cities, especially during holidays, can efficiently serve citizens by preventing unnecessary driving in parking areas, reducing traffic during peak hours, and saving time.

Ahmadi et al. (2019) conducted a study aimed at presenting a model for prioritizing intelligent transportation development strategies to cover the strategic transportation management program. After reviewing the literature, using a strategic approach, urban intelligent transportation development strategies resulting from a logical and scientific management method were prioritized using a combined ANP and QSPM method, considering the internal relationships between different variables for realistic strategy presentation. The findings were ultimately compared using Spearman's rank correlation coefficient. The results showed that in both methods, the strategy of coordinating all governmental organizations and bodies to improve public infrastructure for developing intelligent transportation systems was prioritized.

Zali and Mansouri Birjandi (2014) conducted a study aimed at analyzing the key factors affecting sustainable transportation development in the 2025 horizon for the Tehran metropolitan area using structural analysis. For this purpose, 24 factors affecting sustainable transportation were extracted from Tehran's 2025 vision document and comprehensive plan. A questionnaire determined the importance of each factor, resulting in 18 important factors across five dimensions: economic, social, environmental, physical, and macro. The identification of influential and key factors affecting the future development of sustainable transportation in Tehran was carried out using structural analysis and MicMac software. The results indicated that the key factors were transportation infrastructure, compact urban development, culture-building, transportation system management, and new technologies.

Samandari and Samandari (2014) conducted a study titled "Investigating the Results of Applying a Futures Studies Approach to Strategic Planning in Tehran's Transportation Sector" with the aim of determining the concept of a suitable city in relation to the transportation aspect using a backcasting method in futures studies. The results showed that the most important factors in this area were three main factors: a) population growth, b) urban management, c) economic situation. The population growth rate and change of government and parliament were identified as the most critical variables among the influential variables, while the rate of road construction and the existence of legal requirements were among the secondary leverage variables as target variables and unpredictable events that were independent and highly influential.

Intelligent Transportation System:

An intelligent transportation system means the use and implementation of new technologies, such as electronics, communications, control systems, and other advanced technologies that improve mobility, safety, security, and efficiency in the transportation sector. This system, by reducing energy consumption and improving environmental indicators such as air quality, also enhances other measures and increases access to transportation modes. The intelligent transportation system is generalizable to different modes of transportation and, using automated tools and related planning, performs various operations of receiving and processing information, as well as traffic and transportation management and control. By limiting human factors in information processing or control and management processes, the quality of

decision-making and management processes is improved.

Intelligent transportation systems are one of the newest and most effective traffic management solutions that can create a new horizon for achieving dynamic and smooth mobility in an informative and communicative society, providing better services to citizens, in line with realizing electronic municipalities.

However, the implementation of intelligent transportation systems is not considered the sole tool for solving transportation problems, but rather a suitable foundation for reducing the negative consequences of the twentieth century in the field of transportation and providing a newer and more effective way of meeting transportation needs in twenty-first century life (Mortazavi-nia, 2018).

Required Systems and Equipment for Intelligent Transportation:

The systems and equipment required for making a route intelligent include the following:

1. Traffic Counting System
2. Intelligent Traffic Signal Control Equipment
3. Weigh-in-Motion System (WIM)
4. Automated Radio Information System
5. Weather Sensors
6. Speed Cameras
7. Variable Message Signs (VMS)
8. Automatic Vehicle Location (AVL)
9. Vehicle License Plate Recognition System
10. Automatic Incident Detection System
11. Advanced Traveler Information Systems (ATIS)
12. Closed-Circuit Television (CCTV) Cameras and Video Surveillance

Traffic Control Systems:

Traffic control systems have been implemented throughout Tehran to improve traffic flow, reduce the number of stops, and utilize the surrounding environment by reducing fuel consumption. One of the most important and common applications of these systems is traffic control.

This can be categorized as: increasing or decreasing the duration of red or green lights based on the presence of vehicles, coordinating green lights at nearby intersections on main thoroughfares to prevent constant stopping, and manual intervention in response to abnormal incidents such as traffic caused by accidents or major public events. This is done using sensors that provide information about intersection signals and a communication infrastructure that interconnects intersections and traffic control centers. Additionally, transportation control systems may include devices other than traffic signals, such as various message signs or speed control signs.

Another traffic control measure is red light cameras installed at major intersections. Motion activation devices are designed to prevent unauthorized drivers from running red lights. The camera takes a series of photos and videos of violators, which are sent to a specialized team for review. Red light cameras are installed in high-risk areas to act as a deterrent against speeding and dangerous driving. How do red light cameras work? The red-light camera system detects and identifies vehicles that pass through after the light turns red using sensors or ground loops at the intersection. When the traffic signals are red, the system activates, and the camera is ready to photograph any vehicle that crosses the line. If the traffic signal is red, any part of your vehicle crossing the white stop line is considered a violation. Red light cameras also have internal radar technology with dual speed and red-light functionality.

Structure and Operation of ITS Components:

In general, ITS service packages can be part of an information chain.

The information chain includes acquiring data from the transportation system, communications, data processing, information distribution, and utilizing it for decision making, control, and supporting ITS users. What is important in ITS and the information chain are the systems concepts and technologies for the following: (Naghavi, Seyyedhoseini, 2011)

1- Information exchange and coordination in decision making between multiple centers (e.g. between public transportation and traffic management centers)

2- This functionality leverages the advantages of intelligent transportation systems that use communication, information and control technologies to provide vehicles with information about street and traffic conditions, as well as transmit vehicle status information to street systems.

3- Information exchange with other organizations or private sectors (e.g. for information service providers to distribute traffic information via mobile phones and the internet)

4- In electronic payment systems, ITS communicates with financial institutions to improve electronic payments for transportation. These communications include exchange of financial information, traffic information and other transportation-related data to improve efficiency and safety.

Intelligent urban transportation and traffic systems operate based on control and information technologies and consist of three main components: **(intelligent roads, intelligent vehicles and communication infrastructures)**

These three components collectively carry out the functional tasks of ITS systems. (Anonymous, 2004)

Intelligent Roads include highways and roads that fall under infrastructure facilities, consisting of various equipment such as lighting systems, traffic signs, surveillance cameras and other intelligent devices. Adhering to a proper standardized framework in installing and utilizing this equipment enables integration of different ITS components across a wide range of services to facilitate information exchange between system users including vehicle drivers and pedestrians.

Intelligent Vehicles are vehicles equipped with dedicated equipment to provide some of the services defined in the ITS system. Communication infrastructures are the technologies that enable the flow of communication between intelligent vehicles and intelligent roads. The information flow in communication infrastructure technologies includes stages such as data collection/reception, transmission, processing and distribution/utilization of processed information. For proper system operation, a chain of suitable communications between these stages must be defined and established.

In an ITS system, leveraging information and control technologies provides the necessary information chain to deliver services between the urban transportation/traffic system and ITS users.

There are different perspectives on categorizing **ITS subsystems**. Each subsystem consists of multiple components that can deliver a wide range of services within an integrated structure. For example, the U.S. ITS architecture considers 31 user service types, while Japan considers 172 user service types.

The ITS project classification based on the World Road Association (PIARC) classification approved by the International Organization for Standardization is as follows:

Table 1: Classification of ITS Projects Based on World Road Association (PIARC) Classification

Row	**Types of Subsystems**	**User Services**
1	Advanced Traffic Management Systems (ATMS)	Travel and Traffic Support Program
		Incident Management
		Demand Management
		Police/Traffic Enforcement
		Road Infrastructure Maintenance Management
		Traffic Control
2	Advanced Traveler Information Systems (ATIS)	Pre-Trip Information
		En-Route Information
		Public Transportation & Traffic Information En-Route
		Personalized Information Services
		Route Guidance & Navigation
3	Advanced Vehicle Control Systems (AVCS)	Enhanced Vision
		Automated Vehicle Operation
		Longitudinal Collision Avoidance
		Lateral Collision Avoidance
4	Commercial Vehicle Operations (CVO)	Safety Readiness
		Preventive Maintenance
		Electronic Screening/Vehicle Sensor Data
		Automated Roadside Safety Inspection
		Commercial Vehicle Safety En-Route
		Commercial Fleet Management
		Commercial Fleet Administrative Processes
5	Advanced Public Transportation Systems (APTS)	Public Transportation Management
		Responsive Demand Management
		Cooperative Transportation & Traffic Management
6	Emergency Management (EMS)	Emergency Notification & Personal Security
		Emergency Vehicle Management
		Hazardous Materials & Incident Clearance
7	Electronic Payment (EP)	Electronic Financial Transactions
8	Safety and Hazard Elimination (SHE)	Public Travel Security
		Enhanced Safety for Vulnerable Users
		Intersection Collision

VMS Board:

Regarding the VMS (Variable Message Sign) board, we first point out that the VMS board is a device for traffic control where the displayed message can be changed by the following methods:

1- Manual
2- Mechanical
3- Electromechanical

Information in the following areas is presented to the audience by displaying on the VMS board:

- Traffic congestion and accidents
- Construction operations
- Maintenance and repairs
- Severe weather conditions
- Road conditions
- Scheduled events and occasions
- Movable bridges
- Toll booths

The main application of variable message signs (abbreviated as VMS) is "traffic control" which are designed with the approach of informing drivers on-site and influencing driving behavior, correcting traffic flow and its performance. VMS boards are installed in gantry form or on poles on the road shoulder, or in cantilever form over the road, and the information on these boards is generally displayed in real-time (On Time). Additionally, the control and transmission of this information is done from a center or locally.

ATMS (Advanced Traffic Management System):

This type of intelligent system (ATMS) detects traffic situations and transmits them to the control center via communication networks. It then improves traffic control strategies by combining all the information. Additionally, ATMS utilizes existing facilities for flow control and conveying information to drivers and other relevant sectors of traffic management such as gradient level measurement, speed control, incident management, electronic toll collection, vehicle control, etc.

AVCSS (Advanced Vehicle Control and Safety Systems):
It utilizes advanced technologies in vehicles and roads and assists drivers in more easily controlling their vehicles in order to reduce accidents and increase traffic safety. This includes features such as collision avoidance control and warnings, driver assistance, automated highway control, etc.

CVO (Commercial Vehicle Operations):
It utilizes the three initial technologies of ATIS, ATMS, and AVCSS in commercial vehicles such as trucks, buses, taxis, ambulances, etc. to improve their efficiency and safety. This system also includes automatic vehicle monitoring, computer-aided management and scheduling, and electronic payments.

APTS (Advanced Public Transportation Systems):
This includes providing travel information to passengers, such as bus arrival times or available seats, as well as automatic vehicle monitoring, vehicle location systems, computer scheduling, and electronic ticketing.

EMS (Emergency Management Systems):
Transporting the injured or sick person into the ambulance, coordinating with the command center to dispatch to a medical center - this is usually the nearest medical center within the incident area that can provide necessary services to the injured/sick person. This system also allows transferring the patient to a medical center near the incident location. At this stage, the 115-emergency personnel hand over the injured/sick person along with necessary medical history to the doctor or emergency supervisor at the medical center, completing their mission. If the incident site is remote or on the road or under unfavorable conditions, specialized equipment such as helicopters are used to transport the patient.

EP (Electronic Payment):
Utilizing electronic services to perform tasks that no longer require in-person visits, such as electronic banking systems, business gateways, obtaining permits, online shopping, etc.

HSE (Safety and Hazard Elimination):
Every year, many people suffer heavy and sometimes irreparable damages due to road accidents in the country. This has caused transportation authorities to have a special focus on road safety issues.
Another application in pedestrian safety is through intelligent intersections that enable organized vehicle and pedestrian traffic flow and prevent accidents and control traffic.

The analysis and review of ITS systems from the perspectives of transportation, traffic, and urban management:
Transportation is a fundamental human need, and due to its importance and role over time, humanity has been driven to utilize the latest technologies. Today, we are witnessing another evolution that, unlike previous examples, does not significantly change the form of communication but rather focuses more on content. The use of communication and information technology in transportation, and ultimately the realization of intelligent transportation systems, is that profound transformation of the present era that has reshaped the nature of this industry. Today, intelligent transportation systems are regarded as an independent discipline, but the interdisciplinary nature of intelligent transportation systems and related matters requires the specialized use of sub-fields such as electronic engineering, telecommunication and radio systems engineering, computer engineering and informatics, alongside civil engineering disciplines like transportation planning, traffic engineering, structural engineering, and road engineering (Amiri, 2020).
Intelligent transportation systems are broadly categorized into two groups based on their application and interaction with urban traffic:
The first category includes systems directly related to urban traffic.
The second category comprises systems that, although not directly related to traffic issues, their existence helps improve urban traffic conditions. To better explain the implementation of intelligent transportation systems, the perspectives of transportation/traffic and urban management are examined separately.
From the transportation and traffic perspective, intelligent transportation systems, by utilizing multiple available infrastructures and using communication facilities and other operating systems, manage the flow and traffic of cities and maintain smooth urban traffic flow. In addition to individual functionalities, these systems are capable of organizing and managing urban traffic at a higher level of integration.
Some common systems in this area include:

1- Intersection and arterial route management and control systems;
2- Highway management system;
3- Public transportation management systems;
4- Passenger information system;
5- Electronic fare and toll payment system.

From an urban management perspective, in addition to aspects directly related to urban transportation, there are other necessities and reasons for ITS applications in cities that cannot be directly associated with transportation systems. However, to fully benefit from

its advantages, it is appropriate to also leverage overall urban management.

These can be presented within the following areas:

- Integration of information systems in cities;
- Unified management of executive operations at the city level;
- Crisis and natural disaster management;
- Providing facilities in urban services;
- Management of urban emergencies;
- Systems integration. (Anonymous, 2004)

Advantages of ITS:

As a complete and intelligent system, intelligent transportation systems provide numerous advantages. Some of these benefits include:

1. Increased utilization efficiency of infrastructures.
2. Improved transportation system efficiency: Using intelligent transportation systems increases the efficiency of the transportation system, leading to increased passenger satisfaction and reduced transportation costs.
3. Improved safety and reduced accidents: Intelligent transportation systems enhance communication between vehicles and traffic control centers, thereby reducing accidents and creating safer conditions on highways and intersections.
4. Environmental improvement: Intelligent transportation systems contribute to reduced fuel consumption and air pollution, consequently improving the environment.
5. Automated statistical operations, information, notifications, data processing and transfer.
6. Improved safety and efficiency of transportation systems through the implementation of new electronic technologies.
7. Improved traffic flow: Using intelligent transportation systems enhances traffic flow and reduces travel time for people and goods.
8. Increased public confidence in the transportation network and customer satisfaction.
9. Improved quality of life: Reducing time wasted in traffic and increasing productivity in society improves the quality of life in cities.
10. Elimination of human errors in data preparation, transfer and processing through intelligent transportation systems.
11. Overcoming limitations resulting from using fixed and low-efficiency systems.
12. Reduced need for continuous and concurrent human presence at operational levels.
13. Reduced time wasted in traffic: These systems reduce time wasted in heavy traffic, increasing societal productivity.
14. Automated control of some traffic flow operations, regulations, tolls, etc.
15. Overcoming fundamental transportation issues such as accidents and environmental pollution.
16. Higher customer attraction through improved services and passenger information.
17. Enabling seamless multimodal travel for passengers.
18. Increased travel speed, reduced travel time and fuel consumption. (Amiri, 2020)

Disadvantages of ITS:

Today, the use of Intelligent Transportation Systems has some drawbacks and limitations. In general, new technologies such as information technology and Intelligent Transportation Systems have been created to achieve coordination, faster information transfer, cost reductions, and other benefits. However, this depends on the existing transportation structure in each city, especially Tehran. The implementation of an intelligent transportation system in different cities is accompanied by varying performances and results. Consequently, many plans defined for establishing Intelligent Transportation Systems in cities face numerous limitations. (Amiri, 2020)

The following are some of the disadvantages of this system:

1- 1-The lack of appropriate laws or the adaptation of existing laws to the use of new equipment is one of the limitations that arises in the design and implementation of Intelligent Transportation Systems in cities.

2- The lack of coordination between different organizations in employing Intelligent Transportation Systems is another problem that exists in this area in cities.

3- The high initial cost of purchasing and implementing the system is another disadvantage that arises in establishing Intelligent Transportation Systems in cities.

The following table shows the advantages and disadvantages of the Intelligent Transportation System:

Table 2: Advantages and Disadvantages of Intelligent Transportation Systems

Row	**Intelligent Urban Transportation and Traffic Systems**
Advantages	Increased utilization efficiency of infrastructures
	Automated statistical operations, information, data processing and transfer
	Improved safety and efficiency of transportation systems
	Reduced need for continuous and concurrent human presence at operational levels
	Overcoming limitations resulting from using fixed and low-efficiency systems
	Elimination of human errors in data preparation, transfer and processing
	Increased public confidence in the transportation network and customer satisfaction
	Automated control of some traffic flow operations, regulations, tolls, etc.

	Overcoming fundamental transportation issues such as accidents, environmental pollution, etc.
	Higher customer attraction through improved services and passenger information
	Enabling seamless multimodal travel for passengers
	Increased travel speed, reduced travel time and fuel consumption
Disadvantages	Lack of existing laws or their alignment with implementing new equipment, etc.
	Lack of coordination between different organizations in implementing intelligent transportation systems
	High initial purchase cost
	High system implementation cost

The necessity of implementing ITS in Tehran and other cities

Given the unsatisfactory state of road safety and emergency response in the country, and the high rate of road accidents, leveraging the benefits of intelligent transportation systems in our country, especially in Tehran due to its rapidly growing population, becomes particularly important. The number of fatalities from road accidents in Iran is considerably higher compared to other countries. Therefore, Iran's position in regional and global transportation necessitates a fundamental improvement in the country's transportation safety. Utilizing intelligent transportation systems can lead to improved transportation safety, as these systems can reduce driving accidents and enhance emergency response when necessary (Mortazavinia, 2018).

Considering the proven benefits of intelligent transportation systems in other countries, implementing such systems in our country will have the following advantages:

1. Significant reduction in the number of road accidents and incidents, increased safety factor, and improved vehicle flow on urban roads and highways.
2. Reduced emergency response time in critical situations and increased societal satisfaction.
3. Electronic toll collection system for high-traffic roads, resolving issues such as long stops, unnecessary fuel consumption, and wear and tear.

Moreover, intelligent transportation systems have the capability to collect traffic data and information related to urban transportation, which aids in reducing travel time and improving vehicle routing. Additionally, these systems can contribute to reducing air pollution and urban traffic congestion, thereby improving the quality of life for citizens.

RESEARCH METHOD:

With the ever-increasing population and number of vehicles in Tehran, improving transportation has become one of the fundamental challenges facing urban communities. These challenges include issues such as environmental pollution, depletion of energy resources, increased material and non-material damages from accidents, increased wasted time, and rapidly growing transportation demand during peak hours. To address these challenges, appropriate strategic policies must be considered by city officials and decision-makers. These policies may include the establishment of intelligent transportation systems, development of public transportation, incentivizing the use of sustainable transportation, traffic regulation, improvement of transportation infrastructure, and so on. Appropriate strategic policies to address urban transportation challenges can lead to increased citizen satisfaction, reduced costs associated with accidents and air pollution, improved quality of life for citizens, and increased support for sustainable transportation.

In many countries, transportation and traffic problems have become one of the major social and national challenges, accounting for a significant portion of the gross national product. Safe, affordable, and efficient transportation is crucial as one of the main pillars of development policies in countries, as it can contribute to improving the quality of life for citizens, increasing the pace of economic development, and reducing pollution and casualties from accidents. To achieve this, transportation development policies in countries must be designed in a logical and effective manner.

By studying the above topics regarding the transportation system, its traditional, intelligent, and modern advanced forms, we realize that specialists, engineers, and special research groups in this field, using information technology to advance the intelligent transportation system, have been able to provide services that create comfort, safety, and welfare on a global scale, despite their unlimited challenges. Utilizing Intelligent Transportation System (ITS) services can be effective in controlling traffic and improving transportation in cities and different regions. These services include various communication, information, and software technologies that can improve transportation quality through cooperation and interaction with each other. However, for successful ITS programs to be realized, planners and decision-makers in different countries and regions need to prioritize ITS services based on their specific cultural, social, economic, and climatic needs and conditions.

For optimal utilization of ITS services, it is necessary that the strategies, orientations, and implementation phases of ITS projects align with the conditions of the region in question.

Moreover, for a successful ITS, it is essential to draw upon the experiences and studies of other countries and regions during the preparation and development of the comprehensive plan. Additionally, establishing

appropriate infrastructures for information sharing and cooperation among various ITS systems can contribute to both the synergistic effects of these systems and the improvement of transportation quality in different urban areas.

CONCLUSION AND RECOMMENDATIONS:

By studying domestic and foreign articles and with a new perspective, we can find suitable solutions for traffic in Tehran. As mentioned in the research path, ITS can also be used as a way to change people's lifestyles. The more aligned and coordinated the management systems and related organizations are, the more effective role they can play in ITS.

Given the population growth and migration of people to Tehran, officials, in addition to providing appropriate facilities for citizens, should also consider supplying, maintaining, and improving the performance of ITS. Here are some recommendations to enhance ITS and have an impact on it:

1- Use of small, non-polluting modes of transportation for short distances (promoting the use of bicycles and electric motorcycles).
2- Creating more multi-story and mechanized parking lots across the city.
3- Relocating important central government offices from the center to less crowded areas.
4- Accurate and online information for passengers to use public transportation and arrive at stations on time.
5- Geometric redesign of highways, streets, and alleys (rebuilding the old urban fabric).
6- Promoting a culture along with proper driving education for people through the media.
7- Very heavy fines for improper driving.
8- Prohibition of buying and selling traffic schemes by the municipality (return of odd-even scheme).
9- Use of suitable minibusses and buses for organizations (dedicated organizational services).
10- Making the metro and bus lines operate 24 hours a day.
11- Prohibiting or fining single-occupancy vehicles.
12- Proper training for traffic police officers on dealing with traffic.
13- Road, street, and highway asphalt safety.
14- Increasing fast electric public transportation to reduce air pollution.
15- Changing the start and end times of offices and schools.
16- Reducing intracity travel by making offices and organizations smart.
17- Providing affordable and high-speed (international) internet infrastructure.
18- Employing efficient and educated managers with relevant degrees.

REFERENCES:

1- Abolhasanpour, A. (2016). Investigating the Effect of Employing Intelligent Transportation Systems in Facilitating Traffic in Isfahan, Quarterly Journal of Management Studies.

2- Mortazavinia, M. (2018). Intelligent Transportation System, 3rd Conference on Intelligent Decision Support Systems, Tehran, Iranian Fuzzy Systems Association, Islamic Azad University, Science and Research Branch.

3- Mojahedini, M. (2017). Indicators of Sustainable Urban Transportation with a Smart Growth Approach, 17th International Conference on Transportation and Traffic Engineering, Tehran, Transportation and Traffic Organization.

4- Saberi, M. (2010). Investigating the Performance of Intelligent Transportation Systems in Urban Traffic Management with Emphasis on its Application in Iran, 2nd Conference on Sustainable Urban Architecture and Landscape, April 2010.

5- Amiri, Khodabakhsh (2020). Organizing and Managing Urban Traffic with the Help of Intelligent Transportation Systems. Architectural Studies, Specialized Journal of Iranian Architecture and Urban Planning.

6- Samandari, Lotfollah _ Samandari, Ali (2015). Investigating the Results of Employing a Futures Studies Approach for Strategic Planning in the Transportation Sector of Tehran. 3rd International Conference on New Research in Management, Economics and Accounting.

7- Abdolkarim, Mehri _ Ebrahimi Dehkordi, Amin (2017). Planning Urban Transportation Systems with Emphasis on Multistory Parking in Coastal Cities. Annual Conference on Architectural, Urban Planning and Urban Management Research.

8- Zali, Nader_ Mansouri Birjandi, Sara (2015). Analysis of Key Factors Affecting Sustainable Transportation Development in Tehran Metropolis by 2025 (Structural Analysis Method). Journal of Spatial Planning and Planning, 19(2), 1-31.

9- Ahmadi, Tohid_ Fani, Zohreh_ Rezavian, Mohammad Taghi_ Tavakkolinia, Jamileh (2019). A Combined Model for Prioritizing Intelligent Transportation Strategies Case Study: Tabriz Metropolis. Journal of Geography and Planning, 23 (67), 25-44.

10-Anonymous. 2004. ITS Handbook of Japan, Ministry of Land, Infrastructure.

11-Chowdhurry,M and Sadek H.2003. Fundamental of Intelligent Transportation System Planning, Artech House, New York, 2003.

12-Camila Ariza, M., Camila Quintero, M., Alfaro, K. E. (2019) Sustainable urban transport: what can we learn from Copenhagen?

13-Dameri, R. P., & Rosenthal-Sabroux, C. (Eds.). (2014). Smart city: How to create public and economic value with high technology in urban space. Springer.

14-Cooke, P., & De Propris, L. (2011). A policy agenda for EU smart growth: the role of creative and cultural industries. Policy Studies, 32(4), 365-375.

Red light violation cameras across the city of Tehran

Intelligent Intersection Traffic Lights in Tehran

Traffic Monitoring and Speed Detection Cameras on Roads

Speed Cameras at Various Locations in Tehran

Surveillance Cameras in Urban and Suburban Areas of Tehran

Variable Message Signs

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