RESEARCH INTO INTELLIGENT TRANSPORT SYSTEMS (ITS) TECHNOLOGIES AND EFFICIENCY

ADITYA JAKHAR Corresponding Authors *

MBM UNIVERSITY, Jodhpur, Rajasthan[1], Department of structural Engineering (Transportation engineering), MBM UNIVERSITY, Jodhpur, Rajasthan, India E-mail: {**adi.jakhar02@gmail.com**}

Abstract

Intelligent transportation systems encompass a broad range of wireless and wire line communication based information and electronics technologies to better manage traffic and maximize the utilization of the existing transportation infrastructure. Any system that moves people and goods from one place to another falls under the scope of transportation engineering, which includes: Highways and roadways. Railways., Public transport systems. In this paper we have review comparative study of transportation optimize solution of civil work for gathered good efficiency and accuracy of smart infrastructure. the intelligent transportation system utilize high quality infrastructure based recent civil machine framework The purpose of a transportation system is to coordinate the movement of people, goods and vehicles in order to utilize routes most efficiently.

Keywords: **transportation engineering, infrastructure, comparative study, review work, intelligent smart transportation system, ITS, civil engineering, etc.**

Introduction: ITS purpose is to gather information about traffic conditions and traffic flows on roads and to present it in non-distorted form for control systems (GPS, route control and creating public transport control systems, commercial transport control systems, electronic payment and tax collecting systems, etc.) Control systems themselves can be defined by qualitative parameters: controlling scope, expedition, adaptation, controlling algorithm and collecting systems efficiencies, variety and utility of the information they deliver. Intelligent electronic transportation control system usually contains such main parts: information collecting subsystem; information processing subsystem; information transmission subsystem; controlling subsystem; subsystem of interfaces between separate hierarchical levels.

ITS contain a set of technical tools connected to general information processing complex. Since at least two systems working according to common algorithms and connected using interfaces may be considered as minimal integrated system, in that way electronic ITS is also an integrated system [1] (video surveillance signal processing, controlling system, etc.). The main part of the system that collects information from video cameras consists of digital video cameras and special video signal processing and transmitting cards that are installed in proper road sections and crossroads. Such system helps to get the real time information regarding traffic conditions in road sections of interest; therefore, all this information can be efficiently used to control the transport traffic. All signals from digital video cameras are transmitted to central systems that analyze traffic flows. Presently the statistical information is collected in the real operating objects where video cameras with software support are connected that are able to recognize cars and their licence numbers. When this information is collected it is possible to evaluate efficiency of information collecting subsystem in detail [2–8].

Interest in the intelligent transportation system comes from problems caused by traffic congestion and a synergy of new information technology for simulation real time and communications networks. Traffic congestion has been increasing worldwide as a result or increased motorization, urbanization, population growth and changes in population density. Congestion reduces efficiency or transportation infrastructure and increases travel time, air pollution and fuel consumption. Now a day's development of roads has created a new havoc which lead to the increase in the accident cases all across the world, in order to over-come from such a problem, Intelligent Transport System holds a good point. Intelligent Transport System is designed for the urban/state/private road transport organization. The system consists of a backend and a hardware component to provide an integrated solution for the driver console unit, electronic ticking machine passenger information system amid vehicle tracking system. Intelligent Transport System provides a single solution for transport companies to schedule and monitor buses with the help of advance technologies such as GPS, Wi-Fi and GPRS. Intelligent Transport System facilitates better public transport services by considering the bus earning, public safety and security. This paper basically discusses the impact and the various application fields or Intelligent Transport System for road transportation. Also, this paper put forward the implementation or various transportation technologies that will be vital for homeland security, vehicular surveillance along with technologies that can make our ride safer and economical.

Intelligent Transportation System technology can be defined as the application of information technology to surface transportation in order to achieve enhanced safety and mobility while reducing the environmental impact of transportation. [1] ITS aims to facilitate a national multi-modal surface transportation system that features a connected transportation environment around vehicles of all types, the infrastructure, and carry-in passenger devices to serve the public good by leveraging technology to maximize safety, mobility, and environmental performance.[1] Its covers all modes of transport and considers all elements of the transportation system- the vehicle, the infrastructure, and the driver or user, interacting together dynamically. The overall function of ITS is to improve decision making, often in realtime, by transport network controllers and other users, thereby improving the operation of the entire transport system. The definition encompasses a broad array of techniques and approaches that may be achieved through standalone technological applications or enhancements to ether transportation strategies. [2] ITS offers scope for integration, and some argue that it is only through integration of its components that ITS will achieve its full impact. ITS includes array of information! data depending upon the requirement of the implementation theme, and simultaneously integrating these components together to get a good “Info structure” environment for the traffic planning, control and management and boosting the system effectiveness. ITS relies on wide range of technologies and functions such as Communications (Microwave, internet, Bluetooth), Geographical Locations, Geographical Information System, Data acquisition and exchange, Camera system and Artificial vision, Detection and classification, In-vehicle systems and Digital Mapping. In this paper we will discuss the potential of these transportation technologies for sustainability of environment and various application fields.

METHODOLOGICAL APPROACH

3.1 Information Collection In terms of information the study is principally based on online research, considering elaborated scenarios, short scenarios, research publications and projects goals which are equally important for the objective of this paper because all of them presented novel ideas and interesting functionalities of ITS and Ambient Intelligence in the future world.

3.2 PROBLEM IDENTIFIED Based on various literature available, the problems are identified they are logically placed in three

CLUSTERS: 1) Lack of Traffic Management System.
2) Homeland Security System and Vehicles Operation.
3) Vehicle to Vehicle Co-ordination and implementation of new technologies.
4) civil infrastructure is need to improve due to lack of mobility demanded.

CLUSTER 1: Lack or Traffic Management System Traffic management system is meant to handle large mass of traffic efficiently, but due to presence of large crowd of vehicles the complexity of management system increases and these systems somehow fails to handle the crowd., which results in decrease in mobility, reduced fuel consumption, higher travel time and pollution.

CLUSTER 2: Homeland Security System and Vehicle Operation Homeland Security System and Vehicle Operation refer to the security and surveillance on the traffic system and vehicles. It helps in keeping the track on the trip of vehicle and real-time identification of vehicle and driver driving the vehicle. The problem identified is that there is no such efficient has been developed.

CLUSTER 3: Vehicle to Vehicle Co-ordination and implementation of new technologies This cluster is most important from the point of implementation of ITS, vehicle to vehicle coordination refers to the onboard information regarding the nearby vehicle: this would facilitate in collision control, coordinating them on the basis of the trips planned by the driver. Implementation of new technologies is rare in developing countries. Here the problem identifies is that there is no such technology implemented for public transportation system even though the technologies are available. The ultimate solution to these clusters is provided below:

Cluster 1: This clusters deals with the traffic management system. Hence the proposed solution to this cluster is implementation of properly programmed traffic management system, that means by implementing the GPS, GIS & Remote sensing, the congestion in particular route can be easily known and hence the route can be diverted. Digitalizing and centrally controlling the traffic system, will lead to efficient and economical mobility along with sustainability to the environment.

Cluster 2: This cluster deals with homeland security system and vehicle operations, the proposed solution to this cluster is implementing the wireless communication network with the vehicles and infrastructure by creating an "info structure" environment: this would enable to keep each vehicle on track, by giving each vehicle a unique identity digitally. Hence within the blink of eyes the vehicle record would be on screen: this system would also enable to identify and know the previous trips of vehicle.
Cluster 3: This cluster deals with vehicle to vehicle coordination, the proposed solution is implementing the wireless communication network between the vehicles by using Bluetooth, wifi, various sensors etc: this would enable vehicles to be in contact with each other, and hence collision will be eliminated.

Critical Appraisals Intelligent transportation system holds an important point in reducing the conventional cultural problems. There are also the merits and demerits of implementation of intelligent transportation systems. Intelligent transportation when used efficiently it does optimum use of road,

traffic and travel data, continuity of traffic and freight management, road safety and security, integration of vehicle and infrastructure, reduced travel time, increased fuel economy, and hence environment sustainability is achieved. Along with such merits there are also demerits of this system. the system failure will lead to stoppage of the vehicular movement, vehicle and passenger data security is of major concern.

5. SOCIAL ACCEPTANCE Needless to say that the project should be accepted by the citizens of the city as they are the intended users and the patrons of ITS. Their acceptance of ITS is Critical. Citizens should be educated about what they expect from The project and what are the end benefits of ITS. This should be done in earnest line educating public and quashing rum ours is a time consuming task

6. TECHNOLOGIES TO BE IMPLEMENTED for Environment Sustainability When it comes to environment conservation, various transportation technologies which is must have to be adopted such as:

6.1 ELECTRONIC ROAD Tolling This would enable in reduced waiting time, increased mobility and reduced fuel consumption.

6.2 ADVANCED DRIVER ASSISTANCE SYSTEM This would increase the safety of vehicle mobility, driver would be assisted on demand irrespective to time for any situation and hence the emergency time can be tackled easily.

6.3 HUMAN MACHINE INTERFACE ONBOARD This would enhance and involve the human with the intelligent transportation system, and there will be much interactive way of communication between human and machines.

6.4 VEHICLE TO VEHICLE COMMUNICATION SYSTEM This would lead to safe understanding between vehicles and infrastructure and increase mobility based on the knowledge of surrounding infrastructure.

Road safety is an important subject to study in both the technical and academic fields of road transportation. In recent years, there has been a significant rise in the number of studies that look at how intelligent transportation systems (ITS) can be used and what role it plays in making roads safer in different countries. Nevertheless, there are still relatively few in-depth quantitative and qualitative analyses published on the topic of ITS's role in ensuring road safety. For this purpose, the main goal of this study is to look at a thorough quantitative and qualitative analysis of how ITS is used in road safety as a part of transportation engineering. In this study, we reviewed the scientific studies done on the use of ITS in studies of road safety from 1990s to 2022.

The safety of most people on the roads is one of the main goals of transportation policy. So, when planning, constructing, and operating roads and streets, safety is a top priority. The importance of safety in everyday actions like driving reflects its place as an integral part of human life . "Road safety" means the steps that are taken before an accident to make sure everyone is safe and to lessen the severity of any injuries or deaths that might happen. One common measure of road safety is the number of fatalities and injuries that have been avoided . In fact, one might argue that the number of deaths and injuries on the roads is inversely proportional to how safe the roads are. When trying to make roads as safe as possible, it's important to have a full understanding of the problem at hand, as well as a full understanding of all the important parts and an estimate of how much each one matters . Many valuable studies have been done in the field of road safety due to the importance of the issue . Bassani et al., (2020) analyzed data on VRU-related traffic accidents in Turin between 2006 and 2016. The Italian National Institute of Statistics' (ISTAT) database of transportation road accidents was utilized in their geographical

distribution study. Data pertaining to crashes was geolocated and then analyzed using tools from a geographic information system. Space-time distributions of VRU-involved collisions were constructed using cluster analysis and a kernel density estimate. According to their results, concentrations were most common near intersections. Also, many of these were located along high-traffic corridors with significant cross-sections . To confirm and expand the use of driving simulators for analyzing two-lane road safety, Karimi et al., (2020) investigated passing behavior in passing zones. Fifty-four volunteers participated in different traffic situations on a two-lane rural highway segment in validation research using a fixed-base interactive simulator. After conducting a drone survey of the actual section to record videos and extract data on actual passing operations, a 3D model and its environmental features were generated. In the two-tailed K-S test, the acceptable gap, the effectively accepted gap, the perceptual response time, and the time to the collision were all the same between the field and the simulator at a 95% confidence level Bauernschuster, and Rekers (2022) investigated how speed limit monitoring operations (SLMO) that were only planned to last a single day affected motorist safety. Media efforts warning the public about the perils of speeding accompanied SLMO. Using registration data on police-reported incidents in a generalized difference-in-differences technique, the results showed that SLMO reduces traffic accidents and deaths by 8%. However, after the SLMO day, none of the effects remain. Moreover, there is evidence to show that individuals drive more slowly and responsibly on SLMO days in order to avoid penalties; no change in driver behavior was seen despite efforts to educate speeders on the risks of speeding Since the end of the last century, many researchers have investigated the effectiveness of simulation and traffic conflict techniques for road safety analysis Laureshyn et al. proposed a framework for putting all traffic encounters into a severity hierarchy based on some operational severity measure. They suggested that a set of indicators based on small-scale behavioral data be used to describe an encounter . Guido et al. focused on the analysis of road safety from two different perspectives: microsimulation and observational data. Using a technique for processing video images, they compared a set of safety performance indicators from an experimental case study to see how well microsimulation matched "real" driver behavior and traffic conditions . Several studies have concentrated on the analysis of road safety through traffic flow simulation in road network intersections, which are notorious for having the highest number of accidents. Essa and Sayed developed conflict-based safety performance functions (SPFs) for signalized intersections at the signal cycle level using the generalized linear models (GLM) approach . In 2019, a comparison of different micro-simulation models for evaluating safety at intersections has been presented by Astarita et al. . Gallelli et al. proposed a method for calibrating and validating a simulation model capable of reproducing observed vehicle conflicts at roundabouts . Mishra et al. showed how video analytics can be used to find both pedestrian–vehicle conflict hotspots and vehicle–vehicle conflict hotspots at road intersections . Many researchers use a variety of methods and systems to increase road safety. Researchers are now using traffic simulation to figure out how intelligent transportation systems (ITS) affect road safety ITS is one of the most important technological systems in the field of transportation. Intelligent transportation systems are high-tech programs that help users learn more and use transportation networks in a safer, more coordinated, and "smarter" way by offering new services related to different kinds of transportation and traffic control. In fact, it was made by transportation engineers with the help of experts in fields like telecommunications and communications, electronics, computers, etc., using the information technology of intelligent systems. Technology and science have grown a lot in the last few decades and are still improving. Also, with significant advances in artificial intelligence and hardware technologies, the performance of intelligent systems and their analysis have improved in many fields. The ITS has improved safety and sustainable mobility by using technologies like measuring, analyzing, controlling,

and communicating. Several valuable literature studies on ITS and road safety have been published. Some of them have been broad in scope, while others have concentrated on particular areas within ITS, such as the charging of electric vehicles, V2X communication, and a number of other mobility solutions. Many studies have been highlighted by these analyses and reviews. They have been rather successful in their analysis, giving just broad, overarching numbers of articles and the many subject areas covered. Even though these studies have shed light on the topic at hand, a more thorough evaluation of the ITS and road safety literature using rigorous bibliometric approaches might provide even more nuanced findings. Focusing on the intersection between road safety and ITS, this study provides a systematic analysis of the topic. This research began with a database of more than 709 published articles and narrowed it down to identify more significant works and investigators since "ITS" is a generic word that may apply to a wide range of papers. This study focuses on the depth and breadth of studies conducted over the last three decades.

CONCLUSIONS: Implementing the use of Intelligent Transport System will definitely be going to affect our ride in a good way. Information Services remain fundamental to passenger satisfaction, which will encourage use of public transport and reduce the use of personal vehicles. This significantly contributes to saving the environment from heavy vehicle pollution and reducing congestion on city wads. At the end we conclude that I.T.S. holds a good point in providing us a good, safe journey

ORCID iDs

ADITYA JAKHAR Corresponding Authors https://orcid.org/0000-0002-1152-0680

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REFERENCE'S

[1] "Intelligent Transportation System standards program strategic plan for 2o1 1- 14" by B.Christie,Ann D. ,San G., Suzanne s. , R.I.T.A., US Dept. of Transportation (FHWA-JPO-1 1-052), page 6,7,21

[2] "its handbook" world road associations, page 1,4,6,67,81.

[3] RAN, B. Using Traffic prediction models for providing predictive traveler information. International Journal of Technology Management (special issue on the impact of information systems technology on operations management), 2004, p. 12–19.

[4] HUDDART, K. W. Traffic control. In J. Walker (ed.). Advances in Mobile Information Systems. Boston: Artech House, 2003, p. 140–153.

[5] KRAMER, U. (ed.); PRESTON, N. (eds.). Manmachine interface-black bool. Report to the PROMETHEUS Steering Commite, PRO-CAR 1, Prometheus Office, Stutgard, 2000.

[6] Telaid design guidelines handbook: for usability of invehicle systems by drivers with special needs http://hermes.civil.auth.gr/guide.html (Aristotle University of Thessaloniki).

[7] SHERRY, L. Report on non-traditional traffic country methods. Tanque Verde Loop Rd. Tucson, AZ 85748, 2001. 505 p. 6. OAKLAND, S.; FOLLOWER, R. Statistical process control, fifth edition. Cornwall: MPG Books Limited, 2003. 460 p.

[8] KEITH, J. Video Demystified: a handbook for the digital engineering, third edition. Eagle Rock: LLH Technology Publishing, 2001. 782 p. 8. BALAISIS, P.; EIDUKAS, D.; VALINEVICIUS, A.; ZILYS, M. Information electronic systems efficiency. Kaunas: Technological, 2004.

[10] JARAŠŪNIENĖ, A. Analysis of possibilities and proposals of intelligent transport systems (ITS) implementation in Lithuania. Transport, 2006, Vol XXI, No 4, 245–252.

[11] MILES, C. J.; CHEN, K. The intelligent transport system. Handbook. UK, 2004, p. 34–48.