



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 4, April 2024

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

[ijirset@gmail.com](mailto:ijirset@gmail.com)

[www.ijirset.com](http://www.ijirset.com)

# Smart App for Multi Transport Service System

Sriswetha R, Ms. Devibala Subramanian, M.Sc., M.Phil., Ph.D.,

M. Sc Computer Science, Sri Ramakrishna College of Arts & Science, Coimbatore, Tamil Nadu, India

Assistant Professor, PG & Research Department of Computer Science, Sri Ramakrishna College of Arts & Science,  
Coimbatore, Tamil Nadu, India

**ABSTRACT:** The main objective of this part of the research is to describe the development of a Smart-SDS for multimodal freight transport management. Components of decision-making processes are integrated into the Smart-SDS structures. Computerized decision support processes involve many different components of the infrastructure. The assessment of situations is based on the criteria and priorities applied in the practice of specialist experts. The conceptual models applied in a computer-based system must allow the representation of dynamically changing and complex processes. Logistics and transport management processes must be in line with the requirements and goals of the 2030 Strategy for Sustainable Development. The Sustainable Development Agenda's goals (SDG) and targets are interrelated with all levels of policy implementation. This section describes the results of research related to the object—multi modal freight transportation. Developing a computer system to enable the operational management solutions becomes a daunting task. Decision support models can be developed under normal, well-established routine conditions. We understand that the concept of “logistics” originated from the regulation of hostilities, given the changes in this concept in the historical development of this type of science. However, the process of building a knowledge base (KB) becomes complex by creating rules for representation of activities describing formally—how to act quickly in unforeseen, extreme, asynchronous situations. The entire Smart-SDS system is integrated with the ICT infrastructure and with embedded systems. The development methodology of this type of Smart-SDS system (for multi modal transport management) combines modeling components, simulation models for subsystem behavior analysis and experimental studies with prototypical subsystems. Some of the results we get show outdated situation analysis. In war conditions, events and conditions can occur unpredictably, and forecasts become unpredictable. Once the environmental monitoring infrastructure is destroyed, the performance management system will not work. Rules that reflect fair operations and affect the environment in which transport should behave in unpredictable conditions will not work during the destruction of infrastructure in geographical areas.

**KEYWORDS:** Multi modal Transportation, Decision Support System, Smart Service Delivery System, Conceptual Model, Knowledge Based System.

## I. INTRODUCTION

The recent increasing urbanization is a severe multiple global problem that requires a multifaceted answer. The population living in urban areas has increased due to the increased inflow of people to the cities. The United Nations projects that the world's urban population will reach about 4.9 billion by 2030. This raises many issues, such as pollution, traffic, resources, etc. Due to the development of Internet of Things (IoT), there are a massive number of IoT devices that are connected to the network. Those devices continuously collect data and transmit the data to computing nodes for further analysis. Due to the significant progress of deep learning techniques, many applications leverage deep learning to analyze the collected data and achieve “intelligence” and “automation”. Hence, based on the data analysis and IoT infrastructures, “Smart Cities” as a general application that includes smart grids, smart transportation, smart manufacturing, smart buildings, and much more, have become more popular.

The implementation and application of cutting-edge communications, electronic, and computing capabilities enable information transfer, traffic flow control, and the administration of transportation networks. Four key concepts, sustainability, integration, safety, and responsiveness, are prioritized when adopting and implementing emerging technologies in transportation systems. These principles will be crucial in attaining the main goals of smart transportation, which are access and mobility, environmental sustainability, and economic development.



## II. METHODOLOGY

This literature review used a formal, systematic process to identify and screen articles on smart transportation technologies and applications. For the identification of articles addressing our topic of review, we searched for articles in the four significant databases named IEEE Explore, ACM Digital Library, Science Direct, and Springer by using the terms (“smart transportation” OR “smart transportation applications” OR “smart transportation technologies” OR “smart transportation architectures.” These terms were keyed in the databases to limit the search result to a more relevant article. Relevant articles included papers published in the past 22 years (2000–2022). A total of 123 articles from the search were screened and assessed based on the title and abstract. We excluded articles not focusing on smart transportation applications, architectures, and technologies, reducing the number of relevant articles to 94. The selected papers were downloaded and read in full. A second assessment was made based on the following criteria. The first criteria excluded articles that provide no empirical data, such as abstracts, editorials, conference summaries, short papers, and book chapters. Second, all non-English written articles were excluded. Third, similar duplicate articles were removed. After these criteria had been fulfilled, 87 articles remained. After these selections had been made and downloaded, we conducted a further backward reference search to learn more about this body of knowledge development. This method analyzed the citations in the selected articles related to the terms searched earlier. By doing that, we included 16 more articles resulting in a total of In total 103 reviewed articles, as depicted in Figure 1. The remainder of the paper is structured as follows: Section 2 lists the different architecture and frameworks used by smart transportation systems. Section ?? presents the background of different technologies used in intelligent transportation systems, further expanding on the challenges presented by each technology. Section 4 presents the most prominent applications of ITS. Section 5 discusses the current challenges, possible opportunities, and future directions. Section 6 then concludes this paper.

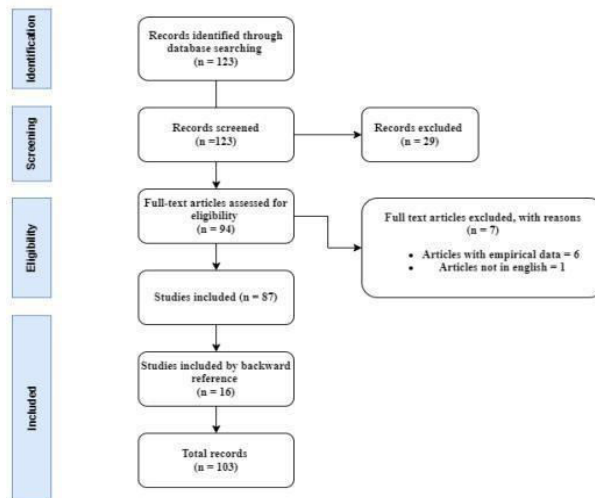


Figure 1. Methodology process used to identify papers reviewed (where n is the total number of papers).

## III. ARCHITECTURES AND FRAMEWORKS OF SMART TRANSPORTATION SYSTEMS

In this section, we discuss the various architectures and frameworks adopted for developing smart transportation systems. The architectures we discuss are distributed computing, centralized computing, and edge cloud computing. Additionally, we also discuss the various communication protocols that are used in smart transportation systems.

### V2V, V2X, V2I, V2P

Vehicular communication use cases are classified into four categories: V2X refers to Vehicle-to-Vehicle (V2V), Vehicle-to-Infrastructure (V2I), Vehicle-to-Pedestrian (V2P), and Vehicle-to-Network (V2N) communications. V2V and V2P communications are primarily between cars or vehicles and vulnerable road users (for example, pedestrians and bicycles) to transmit position, speed, and direction information to avert accidents. Figure 2 below shows the components of the vehicular communication protocol. Direct connection between automobiles and roadside infrastructure, such as Roadside Units (RSUs), is part of V2I. The RSU acts as a forwarding node to broaden the range

of communications received from a vehicle. V2N transmission occurs between a vehicle and a V2X application server, enabling services such as entertainment streaming video and connection for dynamic route management. Using a wireless network, direct or indirect communication between two cars, or between a vehicle and roadside infrastructure can increase driver safety and mobility. The applications include cooperative driving assistance, decentralized probe vehicles, and user, and information communications. For example, with this technology, automobiles may broadcast a warning to other vehicles to avert accidents when changing lanes. Vehicular communication, which connects cars, roadside units, and pedestrians, is a vital technology in the Intelligent Transportation System (ITS). Concerns about location privacy and secure communication impede the adoption of smarter and safer modes of ITS. Gupta et al. presented a secure and trusted V2V and V2I communication approach based on edge infrastructures, in which trusted cloudlets are used to authorize, check, and verify the authenticity, integrity, and anonymity of messages exchanged in the system rather than direct peer-to-peer communication. Moving cars or roadside equipment are dynamically linked to adjacent cloudlets, where security measures may be established to clean or prevent fraudulent communications and prevent rogue vehicles from communicating with other vehicles.

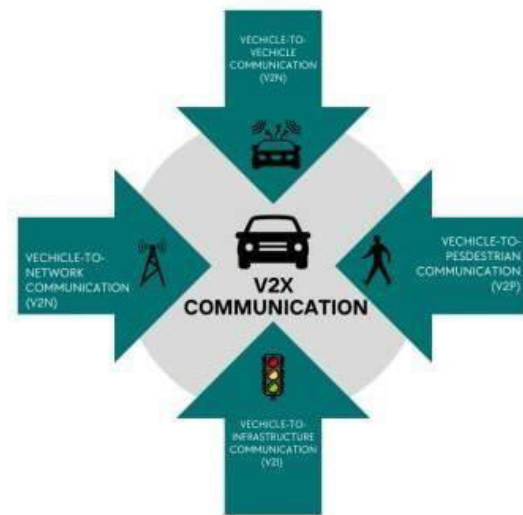


Figure2. Vehicle to Everything Communication(V2X) protocol.

Existing Relevant Works Smart transportation based on IoT technology promises to give citizens more flexible, efficient, and safe transportation options. Traffic safety is one of the significant issues that individuals face in congested cities. In this aspect, IoT can be more proactive in identifying human mistakes and preventing road accidents. Therefore, in order to achieve safer roadways, IoT-based solutions must be developed. Phametal offered a unique algorithm that improves the current cloud-based smart-parking system’s efficiency and creates a network architecture based on Internet-of Things technology. They suggested a system that assists users in automatically finding a free parking spot at the lowest possible cost based on new performance metrics to compute the user parking cost by considering the distance and the total number of vacant spaces in each car park. The simulation results suggest that the algorithm improves the likelihood of successful parking and reduces user waiting time. Janet al. created a model for evaluating transportation data using Hadoop and Spark to manage real-time transportation data. The data is distributed to the smart transportation system using the suggested system and decision mechanism based on the processed data networking system. The peer-reviewed results of evaluating the suggested approach reveal data processing and real-time distribution to citizens in the shortest possible time. Deepalxmi et al. used IoT to develop a novel system for smart transportation called Smart Vehicle Assistance and Monitoring System (SVAMS). SVAMS is an intelligent transportation system (ITS) that addresses various traffic challenges.

#### IV. CHALLENGES IOT TECHNOLOGY

It is not without peril. All connected items link together in several ways, including WiFi/Ethernet remotely through IP protocols, proximity Bluetooth for battery savings, NFC, and other medium-distance radio networks. Hidden behind it are possible dangers to data security, physical security, device security, legislation, privacy, encryption, authentication, and many other issues that must be solved so that these impediments do not obstruct future progress.

Several issues are now prominent due to data uploading by sensors, actuators, and intelligent appliances that post the acquired data to the internet, thereby increasing traffic. As a result, the most significant issues these systems face relates more to traffic volumes. Soltanmohammaetal.explored the traffic concerns of M2M communications over LTE, concentrating on the challenges imposed on a radio access network's access channel and traffic channel. They also outlined the benefits and drawbacks of remedies provided by other scholars. They were curious about the problems caused by M2M communication on cellular LTE and LTE-A networks . Another issue is the security of IoTdevices concerning smart transportation, which is critical. Most of the data acquired by IoT devices is personal and requires privacy. These sensitive data in IoT may be an open invitation for attackers to capture and consume in various ways. However,preserving privacy in IoT is challenging for severalreasons. For starters, the CPU in IoT devices is restricted and cannot perform sophisticated instructions. Additionally, the security algorithm's power consumption must be low because most IoTdevices utilize batteries.

. Existing Relevant Works The emergence of these self-driving technologies offers various benefits to smart transportation. Some of the benefits are improved safety, increased efficiency, greater accessibility, enhanced productivity, improved mobility, and better traffic management. A significant benefit of an autonomous vehicle is thatit can improve traffic conditions by increasing per-vehicle occupancy and decreasing the fleet of vehicles on the road. Additionally, autonomous cars could perform intelligent fleet management by carefully communicating with their counterparts, reducing traffic jams. Furthermore, current autonomous vehicles have 360 degrees vision which help sreduce accidentssignificantly. Andersonetal researched to prove thatautonomous vehicles can reduce the poisonous gas disseminated into the air by selecting the best trip routes, consequently improving fuel efficiency. Additionally, Mobility-as-a-Service (MaaS) and car sharing are promising applications enabled by autonomous vehicles that do not require redundant human interactions. The MaaS paradigm will help consumers save money, time, space, and even human resources (such as drivers). The driver ofan autonomous vehicle can sit back, relax, and take pleasure in the ride. The autonomous car allows designers to create immersive passenger experiences that would not otherwise be possible. Tesla is one of the current autonomous vehicles worth discussing, which utilizes a software application called "summon". Owners of Tesla vehicles can summon their vehicles via the mobile application. Thus, the car can drive itself to a designated parking spot, such as a basement, and the owner can request to have it parked anywhere. Cars with this feature can also be parked in tight spaces where exiting is difficult.

## V. CHALLENGES AUTONOMOUS DRIVING SYSTEMS

It plays a critical role in smart transportation systems, enhancing safety, reducing traffic congestion, and making transportation more sustainable. However, it is important to acknowledge that these systems require extensive development and ongoing innovation to address the technical, legal, and ethical issues associated with their deployment. Here, we will discuss some challenges this system faces.

- Regulation: The complexity of autonomous vehicles poses major technical challenges when it comes to their validation and testing. For traditional vehicles, current standards exist, such as that from the International Standardization Organization (ISO), which defines the functional features that their vendors must adhere to during manufacturing. However, these standards cannot be applied to an autonomous vehicle because of its ability to make sole decisions, unlike traditional cars that require humans to make these decisions. Therefore, due to the high uncertainty of the predictions that these vehicles may make in different driving scenarios, it is impossible and impractical to meet all the requirements to validate and test autonomous cars.

Security and Privacy: Although promising study findings, security, and privacy remain fundamental barriers to the widespread use of connected automotive technologies. During allcommunications, user and location information, must be kept safe, which might be a challenge for autonomous vehicles because all of the inherent security risks connected with sensors, communication networks, and short-range communications can easily be transferred to them .As a result, security will be important in the future development of self-driving automobiles . Selfish individuals, hackers, angry employees, or terrorist groups would all be interested in a completely automated system like an autonomous automobile. In the worst-case scenario, such cars may be utilized for terrorist acts without the need for a driver.

## VI. APPLICATIONS OF SMART TRANSPORTATION SYSTEMS

In this section, we examine the main current smart transportation systems. Thesesystems are divided into seven classes based and their functionality as depicted in Figure 5. We divided these systems to provide a structured understanding of

the different types of systems and compared their functionalities pertaining to smart transportation systems.

### Route Optimization

Urban regions frequently have traffic congestion, which is only worsening as more vehicles are added to the road. In order to reduce traffic congestion, route optimization proposes the optimum path for a given destination. Both the amount of time it takes to travel and vehicle emissions are decreased by reducing traffic congestion. The route optimization problem has been widely challenged and researched in the literature by applying various technical approaches to the IoT infrastructure. Google was one of the first companies to harness the potential of crowd-sourcing for developing new services. All modern mobile devices are compatible with the free Google Maps app. Integrated GPS, accelerometer, and gyroscope sensors are found in mobile devices. In 2009, Google unveiled a brand-new service that would provide users access to traffic data within Google Maps. Fixed location sensors or other monitoring systems did not gather the traffic data. Using the maps application, the end user's mobile device can submit anonymous information about their location and speed. To reduce congestion, Google Maps can now recommend other routes based on traffic data.

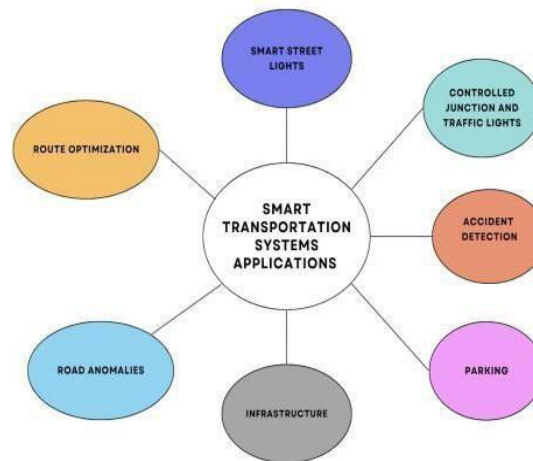


Figure3. Transportation Systems.

**Accident Detection Accident detection and prevention,** A domain of smart transportation, is critical for every city because an effective preventative strategy can help save lives. If drivers maintain greater concentration while on the road, accidents can be avoided. An accident prevention system allows drivers to be notified about critical situations and allow them to act promptly. By identifying accident-prone locations or accidents that have already occurred in the live traffic network, accident detection can also help to reduce the number of accidents and traffic congestion. Machine learning has shown to be particularly helpful in identifying traffic incidents, as well as in identifying patterns that may result in new accidents and alerting drivers to help them avoid them. The research's authors [37] suggest an IoT cloud platform to enable traffic visualization and early alerts about unexpected slowdowns that could cause accidents. The established configuration would include Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), and a novel approach called IoT as a Service (IoTaaS). Devices installed in volunteer vehicles will be used to collect GPS data, which is then transmitted over a 4G network to a cloud server. With the help of the OpenGTS platform and Open Street Maps, the cloud server manages GPS data. To facilitate further analysis, the data is stored in a SQL format and a Distributed MongoDB database. The use of Docker containers supports the scalability of the back end. The system response time is a crucial factor in the implementation's success, and the suggested solution can transmit an alert over a distance of 1 km in a little under 120 ms.

## VII. CONCLUSION

In this paper, we gave an in-depth survey of smart transportation systems and applications by reviewing the major technologies currently used to develop smart transportation systems. We highlighted the challenges, history as well as smart transportation applications using these technologies. Additionally, we discussed the common architectures that provide the development schemes of smart transportation systems. We assembled several current research relating to these technologies as well as theoretical evaluations of these systems. We then aggravated the uses of these

applications into the segments that are applied in the smart transportation sector. Furthermore, the communication protocols used by these smart transportation systems to ensure functionality were analyzed. Common communication protocols were explained, as well as systems that currently use these protocols to improve the issues of the transportation systems. The challenges currently facing these systems have been addressed in this paper as well as future research that could have benevolent impacts in improving the issues of these systems in our society. In this paper, we gave an in-depth survey of smart transportation systems and applications by reviewing the major technologies currently used to develop smart transportation systems. We highlighted the challenges, history as well as smart transportation applications using these technologies. Additionally, we discussed the common architectures that provide the development schemes of smart transportation systems.

## REFERENCES

1. Tekler, Z.D.; Low, R.; Yuen, C.; Blessing, L. Plug-Mate: An IoT-based occupancy-driven plugload management system in smart buildings. *Build. Environment*. 2022,
2. afZhuang, D.; Gan, V.J.; Tekler, Z.D.; Chong, A.; Tian, S.; Shi, X. Data-driven predictive control for smart HVAC system in IoT-integrated buildings with time-series forecasting and reinforcement learning. *Appl. Energy* 2023
3. Low, R.; Tekler, Z.D.; Cheah, L. Predicting commercial vehicle parking duration using generative adversarial multiple imputation networks. *Transp. Res. Rec.* 2020
4. Kang, H.S.; Lee, J.Y.; Choi, S.; Kim, H.; Park, J.H.; Son, J.Y.; Kim, B.H.; Noh, S.D. Smart manufacturing: Past research, present findings, and future directions. *Int. J. Precis. Eng. Manuf.-Green Technol.* 2016, 3, 111–128. [CrossRef]
5. Kandogan, Y.; Johnson, S.D. Role of economic and political freedom in the emergence of global middle class. I.
6. How Many Cars Are in the U.S.? 2022. Available online: <https://www.fool.com/the-ascent/research/car-ownership-statistics/> (accessed on 20 July 2022).
7. Zhang, J.; Wang, F.Y.; Wang, K.; Lin, W.H.; Xu, X.; Chen, C. Data-driven intelligent transportation systems: A survey. *IEEE Trans. Intell. Transp. Syst.* 2011,
8. Eisele, W.L.; Fossett, T.; Schrank, D.L.; Farzaneh, M.; Meier, P.J.; Williams, S.P. Greenhouse Gas Emissions and Urban Congestion: Incorporation of Carbon Dioxide Emissions and Associated Fuel Consumption into Texas A&M Transportation Institute Urban Mobility Report..
9. Allen, H.; Millard, K.; Stonehill, M. A summary of the proceedings from the united nations climate change conference in doha qatar and their significance for the land transport sector. In *Proceedings of the Copenhagen: Bridging the Gap (btg) Initiative, Doha, Qatar*,
10. Nasim, R.; Kessler, A. Distributed architectures for intelligent transport systems: A survey. In *Proceedings of the 2012 Second Symposium on Network Cloud Computing and Applications*.
11. McGregor, R.V.; Eng, P.; MacIver, A. Regional its architectures—From policy to project implementation. In *Proceedings of the The Transportation Factor 2003, Annual Conference and Exhibition of the Transportation Association of Canada, (Congres et Exposition Annuels de l'Association des transport du Canada) Transportation Association of Canada (TAC), St. John's, NL, Canada*.
12. Guerrero-Ibanez, J.A.; Zeadally, S.; Contreras-Castillo, J. Integration challenges of intelligent transportation systems with connected vehicle, cloud computing, and internet of things technologies. *IEEE Wirel. Commun.* 2015.
13. Hong, K.; Lillethun, D.; Ramachandran, U.; Ottenwalder, B.; Koldehofe, B. Mobile fog: A programming model for large-scale applications on the internet of things. In *Proceedings of the Second ACM SIGCOMM Workshop on Mobile Cloud Computing, Hong Kong, China*.
14. Giang, N.K.; Leung, V.C.; Lea, R. On developing smart transportation applications in fog computing paradigm. In *Proceedings of the 6th ACM Symposium on Development and Analysis of Intelligent Vehicular Networks and Applications, Valletta, Malta*.



INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  [ijirset@gmail.com](mailto:ijirset@gmail.com)



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details