

ORIGINAL RESEARCH ARTICLE

Understanding integration issues in intelligent transportation systems with IoT platforms, cloud computing, and connected vehicles

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ABSTRACT

The fast improvements in information and communication technology have altered the transportation business, resulting in intelligent transportation systems (ITS) that aim to improve transportation network safety, efficiency, and sustainability. Cloud computing, networked automobiles, and IoT platforms are driving this shift. Infrastructure for current civilization must include transport. The effectiveness of transport infrastructure is vital for all countries' individual mobility, trade, and economic development. Traffic congestion, fuel price increases, and CO₂ emissions have all increased in recent years, posing problems for modern civilization. It is crucial to improve transportation efficiency and safety. To develop a sustainable, intelligent transportation system, it is necessary to seamlessly integrate and interoperate with cutting-edge technologies like linked cars, the Internet of Things (IoT), and cloud computing. To respond to difficulties facing the transportation industry, which include rising fuel costs, high CO₂ emissions, expanding congestion in traffic, and greater dangers on the highway, integration concerns must be concluded.

Keywords: cloud computing; Internet of Things (IoT); transportation system; CO₂ emissions

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1. Introduction

Transportation infrastructure causes traffic jams, parking shortages, longer commutes, higher glasshouse gas emissions, and more accidents. Global urbanisation exacerbates these issues. ITS IoT integration is challenging and time-consuming. Car, traffic light, and road infrastructure connection and data sharing depend on how well ITS's complicated design integrates IoT technology. ITS components and IoT systems employ several communication protocols and data formats, making integration problematic. "Intelligent transportation systems" use cutting-edge technology to increase infrastructure efficiency, safety, and sustainability^[1]. ITS history, need, traffic management, environmental problems, and transportation alternatives are included in starting textbooks.

Transport sector ITS growth reflects a focus on traffic management, safety, and the environment. ITS's ability to enhance, safe, and ecologically friendly transportation systems requires understanding the complicated relationship between technology and transportation^[2]. To guarantee seamless data flow and compatibility when integrating these dissimilar systems, thorough consideration of interoperability and standardization is necessary. The enormous volume of sensitive data gathered and shared in ITS might be subject to cyber-attacks; thus, it is also imperative to guarantee the security and privacy of linked systems^[3]. It will be possible to realize the full potential of IoT in ITS by addressing these integration difficulties, which will result in better traffic management, increased safety, and more effective transportation systems. The way individuals save, access, and use digital information proved completely transformed by the disruptive technology known as cloud computing. Cloud computing enables people, companies, and organizations instant access to a wide range of computer services and resources by utilizing the strength of remote servers and internet. In addition to providing scalability, flexibility, and efficiency, it is away with the requirement for expensive infrastructure expenditures^[4]. Significant hurdles are presented by ITS integration problems in linked cars. First and foremost, providing seamless data interchange and communication between various components is essential. Combining multiple hardware and software platforms, communication protocols, and data formats is necessary for successful information sharing. The process of integration is made more difficult by the inclusion of real-time traffic data, weather information, V2V and V2I communication, and compatibility with a wide variety of automotive brands and models, each of which has its own set of features and standards. In order for intelligent transportation systems (ITS) to become more extensively employed in connected automobiles, compatibility issues need to be resolved. In order to fulfill the full potential of connected technology and achieve widespread acceptance of ITS components, it is necessary for these components to be compatible with a diverse range of vehicles^[5]. The integration process also raises concerns about data security and privacy. A significant quantity of private information, such as location information and personal preferences, is generated and exchanged by connected automobiles. Incorporating ITS requires careful consideration of safeguarding this data from unauthorized access while maintaining data integrity and user privacy. Finally, cooperation among many parties, including vehicle manufacturers, infrastructure providers, and software developers, is required to integrate ITS in connected cars. Building a cohesive and interoperable system involves coordination, standards-setting, and dispute resolution^[6]. Intelligent transportation systems (ITS) must overcome several restrictions to deploy successfully. Connecting sensing vehicles supporting real-time traffic, weather, V2V, and V2I communication is tough. Due to the wide variety of automobile makes and models with different features and needs, integrating Intelligent Transportation Systems (ITS) into linked cars is difficult. Despite numerous hurdles, networked technologies will only attain their full potential if ITS components and automobiles are compatible. The high upfront expenses for building and maintaining ITS infrastructure are significant drawback. Developing a vast network of sensors, communications, and data management platforms would need substantial financial expenditures, which might be problematic, especially in areas with few resources. Dependence on reliable and continuous communication networks is another restriction. ITS significantly depends on real-time data flow among cars, infrastructure, and control centers. The efficacy of ITS solutions can be hampered by network interruptions or gaps, which may adversely influence safety and effectiveness^[7].

Contributions of this research

Transportation efficiency is enhanced by ITS thanks to the use of technology such as real-time traffic monitoring, adaptive traffic signal systems, and route optimization algorithms.

The importance of ITS in increasing transportation security cannot be overstated. Accidents and deaths on the road may be reduced with the use of technology linked vehicles, and V2I communication systems.

Congestion is lessened owing to ITS because it increases drivers' access to real-time traffic information,

encourages the utilization of less conventional modes of communication and streamlines highway signal timing.

This integration leads to more effective traffic management, better-informed decision-making, and enhanced overall system performance.

The need for improved road safety, growing fuel prices, rising CO₂ emissions that contribute to climate change, increased traffic congestion in urban areas, and rising fuel prices are just a few of the pressing challenges that ITS addresses.

This information may be utilized to construct more efficient and sustainable transportation networks by informing traffic planning, scheduling maintenance, and policymaking.

2. Related work

To increase traffic management effectiveness, road safety, and environmental preservation, the intelligent transportation system (ITS) concept was created^[8]. Liang et al.^[9] presented Edge YOLO, an Object Detection (OD) system that uses reconstructive convolutional neural networks and edge-cloud collaboration. Lv and Shang^[10] focused on ITS affecting transportation networks' Energy Conservation and Emission Reduction (ECER). The paper of Das et al.^[11] examines the problems, uses, and upcoming needs of intelligent transportation systems (ITS). The paper of Rajput et al.^[12] described a simple multi-module multi-layer vehicular cloud computing system built with parked car assets, cloud computing facilities, and vehicular networking technologies. The study of Abbasi et al.^[13] focused are capable of greatly hastening the completion of a variety of challenging vehicle routing problems, which are comparable to traveling salesman problems, enabling cloud-based installation of autonomous vehicles. The study of Lian et al.^[14] employed large amounts of information to analyze roadway security within the framework regarding connected automated vehicles as well as autonomous vehicles. Safeguarding IoT-based, environment-based smart/intelligent public transportation constitutes the innovative concept behind distributed ledger technologies. The reaped several benefits in ITS's applications from the unique solution PC that was proposed utilizing block chain technology^[15]. The paper of Richter et al.^[16] provided a strategy for handling this challenging problem based on methods already tested in creating and testing autonomous driving systems and city modelling. The paper of Sun et al.^[17] purposed to highlight security issues and concerns by providing a thorough assessment of cyber-security in the context of Connected and Autonomous Vehicles (CAVs). In-depth analysis of human-machine interaction in intelligent and connected vehicles was done in the study of Tan et al.^[18]. The paper of Hahn et al.^[19] thoroughly categorizes security and privacy risks in ITS. A CAV's three fundamental and vitally important features—sensing and communication technologies, human considerations, and information-aware controller design—are thoroughly examined^[20]. The proposed architecture's diverse functional components present an evolution of CIOV along with layer abstractions^[21]. The paper of Nascimento et al.^[22] provided a clear picture of the current state of AI on AV safety in this non-convergent setting.

The study of Arthur et al.^[23] conducted a thorough examination of the available research to investigate the function of cloud-based computing for ITS and related automobiles, providing information on pertinent taxonomy and real-world applications of the advances. Furthermore, they underscored the imperative for future research to focus on achieving fully autonomous edge cloud computing solutions for vehicles and ITS. The research of Zhao and Jia^[24] the authors provided a comprehensive summary of existing knowledge regarding the impact of advanced transportation networks on environmentally conscious urban residents. They highlighted that technologies such as electric propulsion and autonomous driving represent just a few instances of how these systems leverage state-of-the-art technology to mitigate the sustainability implications of transportation. The study of Ali et al.^[25] conducted a comprehensive review of research conducted over

the past five years, examining the application of Digital Twin (DT) technology within intelligent transportation systems, with a specific emphasis on its implementation in electric mobility and autonomous vehicles. Their detailed analysis further dissected the various subgroups within intelligent transportation that leverage DT technology in conjunction with IoT and 5G applications. The work of Peyman et al.^[26] the authors delivered an exhaustive examination of contemporary approaches to integrating IoT into intelligent transportation systems (ITS). They delved into the complexities introduced by cloud, fog, and edge computing, and proposed a solution for addressing the edge/fog computing context through the utilization of adaptive optimization algorithms. The study of Finotti et al.^[27] provided to statistical indicators, seldom utilised in damage detection, to define acceleration readings in time. Thus, utilising raw dynamic data statistics, this research compares two machine learning methods to identify structural changes. These approaches employ CNNs and SVMs. A simple supported beam model is used for initial numerical simulations. The paper of Zouka^[28] provided into the most pressing problems with today's traffic management systems and offers solutions such security standards that include data validation and authorisation services.

Intelligent transportation systems (ITS)

ITS work to cut down on CO₂ emissions, increase traffic flow and safety, and save vehicle wear, travel times, and fuel usage. **Figure 1A** shows that new technologies continue to influence transportation networks. To achieve the key goals depicted in **Figure 1B**, it is crucial to accept and use developing systems in transportation that emphasize the four fundamental characteristics of sustainability, integration, safety, and responsiveness.

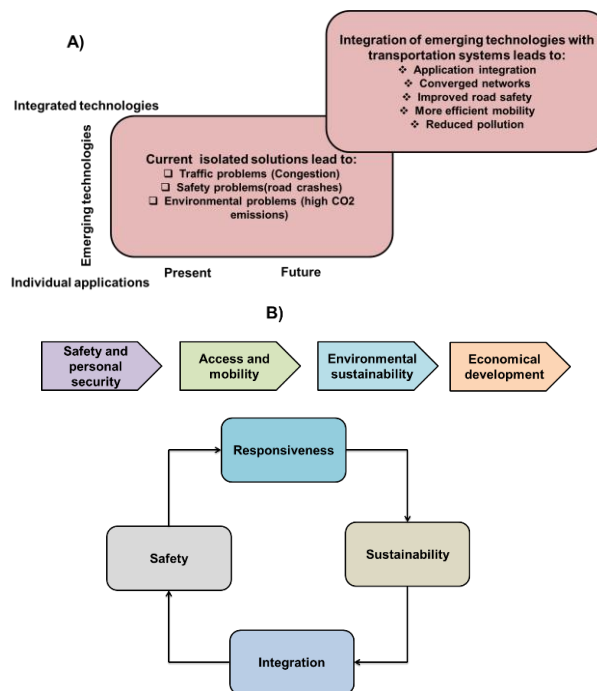


Figure 1. (A) Intelligent transportation system trends for future; (B) developing technology's effects on ITS.

New technology makes transportation infrastructures more durable. By using cutting-edge methods for collecting, analyzing, and disseminating intelligence in accordance with road conditions, organizations will encourage the efficient application of current transit systems in order to monitor management, and lead to the movement of vehicles. This might facilitate the management of congestion and lessen its effects. ITS is typically dependent on standalone systems. ITS will need to develop strategies that seamlessly integrate a wide variety of pertinent heterogeneous technologies, allowing for the collection of massive volumes of data, their processing, and the subsequent implementation of appropriate actions, depending on this current

knowledge. These activities include delivering a variety of incentives to vehicles, benefits that may impact fuel consumption and carbon gas emissions while controlling traffic flow, minimizing accidents, rerouting traffic to avoid collisions, and notifying emergency services with all the collected data an incident occurs.

3. Vehicle connectivity and ITS

The support of various cutting-edge communication technologies, an automobile’s “Dedicated Short-range Communications (DSRC)” and “Wireless Access for Vehicular Environments (WAVE),” connected vehicles concentrate on “vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), and vehicle-to-device (V2X)” communication channels to improve environmental, transportation, and safety applications. The linked car idea makes use of the following:

- Technology for connected vehicles.
- Applications for connected vehicles.
- Institutional and policy concerns with connected vehicles.

The term “connected vehicle technology” refers to establishing and implementing an effective platform that enables development of complex human interactions, development, adoption, and fusion of new technologies. It also identifies and addresses technological challenges similar to positioning, scalability problems, and other technical difficulties, including grouping moving vehicles for better interaction, reliability of clusters, transfer efficiency, and durability to errors. New challenges include **Figure 2** illustrates wireless vehicular networking situations and the establishment of standards for interoperability.

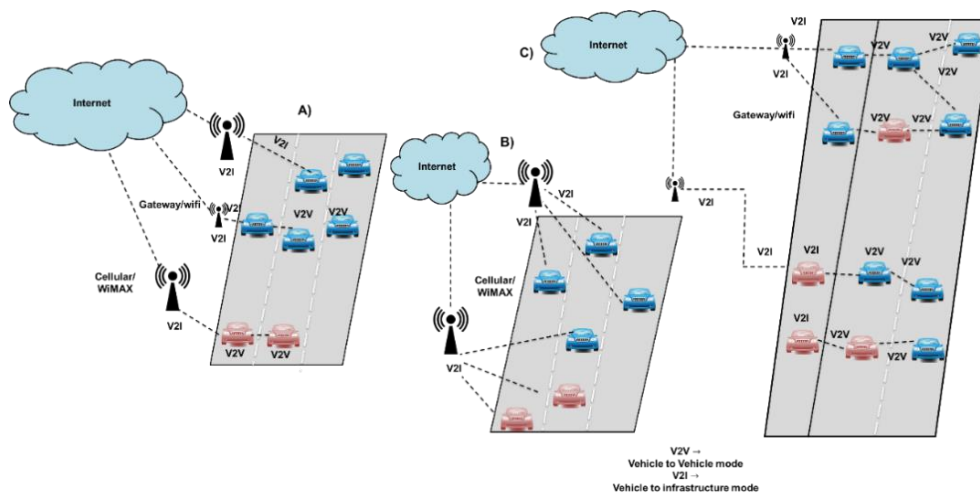


Figure 2. Scenarios for wireless vehicular networking, (A) vehicle to vehicle mode and vehicle to infrastructure mode (V2V and V2I); (B) broadband wireless vehicles, and (C) peer-to-peer (P2P) network.

Creating apps to solve transportation issues is the main goal of connected car applications. The primary study topics include real-time data capture and management, road weather management applications, and vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications for safety. These programs and services must facilitate secure data transport. Considering crucial institutional and policy concerns that might impact the effective development of platforms and applications is the last emphasis concerning the connected vehicle policy. In this situation, the research team, which may include the Department of Transportation, important business partners, and automakers, to evaluate the benefits, dangers, and effects related to the effective adoption of connected car technologies and applications, state and municipal governments, advocacy organizations, and common people.

4. Sensing vehicle connectivity support

The ability to sense platforms to access, gather, and analyze precise sensor data will be crucial for

prosperity of connected automobiles. Urban sensing technologies and intra-vehicular sensors are the two most significant sensing platforms for gathering data on traffic situations. Cellular networks, WiMAX, 802.11p, and DSRC/WAVE are communication technologies used in automobile contexts. In several settings, these technologies can allow activities to enhance flow of traffic, traffic safety, and ITS applications. MEMS, wireless communications, the internet, and cloud computing will allow smart, flexible, efficient, and easy-to-use road transit. Cloud services find the fastest route between two places in real time using distance, road width, traffic count, intersection delay, and speed. Authorised drivers will pay for cloud-hosted platform and application access instead of installing sensors and devices in each vehicle^[29]. Intelligent transportation systems (ITS) may securely interface with roadside devices using current monitoring infrastructure^[30]. To avoid getting lost or being sent to the wrong location, this technique employs an Android app to choose the route taken by the car. The driver logs the owner’s location using latitude and longitude coordinates, and then transfers that information to a computer through Bluetooth or USB. GPS coordinates are compared with data from an Android app using code in a Raspberry Pi system file^[31].

Only DSRC-equipped vehicles may operate in three different modes: infrastructure-free (V2V alone), infrastructure, and mixed (V2V + infrastructure) (**Figure 2A**). Internet communication is a capability of vehicles with other broadband wireless access technologies (**Figure 2B**). People with cell phones and Internet connection, for instance, can create a peer-to-peer (P2P) layer network online. They also have a combination access situation (**Figure 2C**) when cars are DSRC and other internet wireless access technologies, as shown in **Figure 3** and **Table 1**, architecture of cloud density (vehicles/hour). **Table 1** demonstrates cloud architecture service level and vehicle density. This scenario measures automobile traffic per hour. The chart demonstrates service 20, 40, and 60 cloud architecture service levels. System vehicle service quality levels. This table displays 500–1000 vehicle concentrations per hour per service level. By density, table displays “service lack (%)”. Cloud architecture service inadequacies (%) delays or outages cars. Vehicle density reduces service lack (%) at all three service levels. Cars connected to the cloud infrastructure improve service delivery, decreasing delays and shortages. Urban transportation and traffic management must comprehend how vehicle densities affect cloud architecture and service quality.

Table 1. Architecture of cloud density (vehicles/hour).

Service	Lacking in service (%) Vehicle density (per hour)		
	Twenty	Forty	Sixty
500	1	5	13
600	1	5.3	12
700	1.3	4	11
800	1.2	4.6	9
900	1.6	4.3	8
1000	1.8	4.2	7

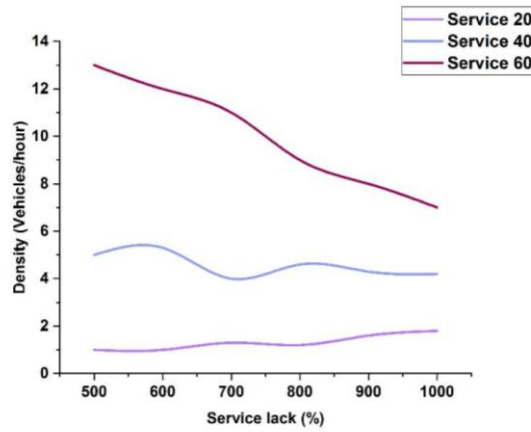


Figure 3. Density of clouds (vehicles/hour) architecture.

5. Connected vehicle challenges

Before the linked vehicular environment is effective, it must overcome several obstacles despite many connected vehicle research initiatives being mostly focused on raising enough awareness to encourage governments and automakers to spend money putting in place the appropriate and required infrastructure for cars, roads, streets, and avenues. As previously indicated, a connected car environment also includes various heterogeneous new technologies working together complementarily. The creation of algorithms that provide intelligence to communication devices put inside automobiles so they may decide what current technology to utilize based on present climate and quality of service features of a desired application and the data security methods employed to enable secure information exchange is then required. Applications for emergencies need a network connection with minimal latency. Vehicles may soon begin monitoring the physiological characteristics of their occupants via an internal wireless sensor network.

The discovered information is then transmitted to hospitals during a situation of emergency. or other nearby emergency vehicles, such as ambulances, so they get ready for arriving of people in a car. Contrarily, assistance, and entertainment applications don't require to adhere to rigorous quality of service standards. To select a network that's going that matches those demands, they must create new, sophisticated algorithms that can continually sense variables and ambient circumstances; as shown in **Figure 4** and **Table 2**, the volume of people and freight moving is measured by Transportation Services Index (TSI). **Table 2** below displays combined TSI, freight TSI, and passenger TSI for the years 2019–2023. A TSI of 110 for passengers, 109 for cargo, or 110 for both might indicate a decline in service in the next year. All of these metrics point to rising curiosity about transportation throughout time. 133 passengers and 120 tons of cargo were the TSI for 2023. A rise in TSI scores may be traced back to an increase in both the quantity and quality of passenger and freight services.

Table 2. Transportation Services Index^[32].

Years	Transportation Services Index (TSI)		
	Passenger TSI	Freight TSI	Combined TSI
2019	110	109	110
2020	115	112	125
2021	126	113	120
2022	130	115	118
2023	135	120	133

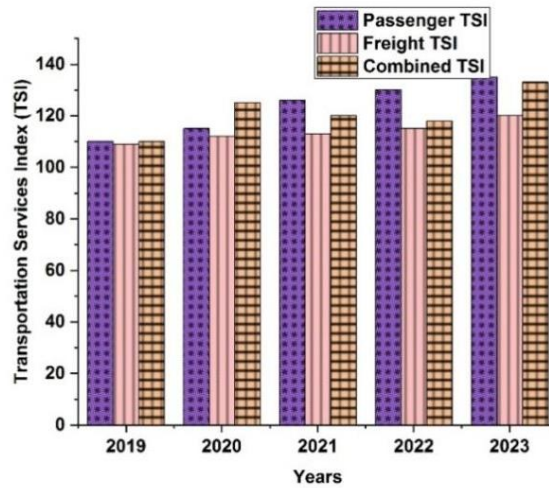


Figure 4. Transportation Services Index.

6. Integration of ITS and cloud computing

A cloud computing system typically includes an application, infrastructure, and a platform. Utilizing resources like computing, storage, software, and infrastructure Layer as a Service (IaaS) creates virtual servers or PCs. A sophisticated virtual computer with powerful computing, networking, and sensing features and plenty of storage, for instance, is used by a vehicle with Internet connectivity to execute apps and programs. Platform as a Service (PaaS) (the platform layer) sets up components to support services.

Application development and deployment for the cloud environment are possible for drivers. The Software as a Service (SaaS) layer provides applications in the cloud that are used on a pay-as-you-go basis. In this context, vehicle clouds, which may supply a wide range of computing services, deliver certain programs, including traffic reports and a smart navigation system, as shown in **Figure 5**. **Table 3** demonstrates the cloud computing tiers are explained by a 2019–2023 table showing service category popularity and growth. Platform, infrastructure, and SaaS are deployment methodologies. IaaS, PaaS, and SaaS rank cloud computing ecosystem relevance in 2019. In subsequent years, all three groups grew significantly. 67.2 percent, 47.5 percent, and 195.6 percent of companies will utilize IaaS, PaaS, and SaaS in 2023. This architecture employs IaaS as the basis, PaaS for app development and SaaS for full cloud apps. In cloud computing, SaaS grows quickest, followed by PaaS and IaaS.

Table 3. Layers of cloud computing^[33].

Years	Infrastructure as a service	Platform as a service	Software as a service
2019	17.8	11.57	61.11
2020	28.04	18.05	100.38
2021	35.4	25.8	129.9
2022	49.3	35.9	148.6
2023	67.2	47.6	197.6

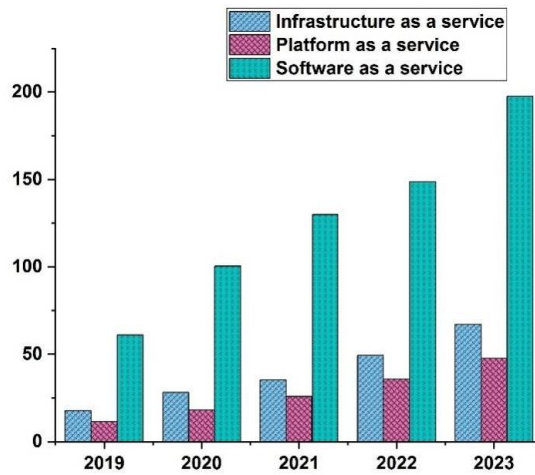


Figure 5. Cloud computing layers.

The road department makes informed decisions about when to remodel or repair avenues, change traffic patterns, or install new traffic lights; cloud computing might enhance ITS by storing and processing the gathered data and building a historical registry of avenue pattern behavior. The idea of a vehicular cloud recently comes into existence in **Figure 6**. Developing a vehicular cloud encourages third-party service providers to enable activities on VANETs that are not safety-related, such as services based on location Internet access, in-car chat, gaming online, and other wireless entertainment. Vehicle clouds' main advantage is that existing communication and transportation networks may be used by cloud vehicles, negating the need to install new infrastructure. A vehicular cloud-computing ecosystem uses automobiles' capabilities as portable cloud servers. As a result, cloud computing services are made available to customers (cars) that rent assets by vehicles equipped with sufficient capacity and Internet connectivity to operate as cloud servers. Customers must learn about mobile cloud servers, know their resources, communicate with them, and make resource requests. Specify the key functions of the three vehicular clouds. The first is network as a service, in which certain smart cars have a constant Internet connection, and others do not.

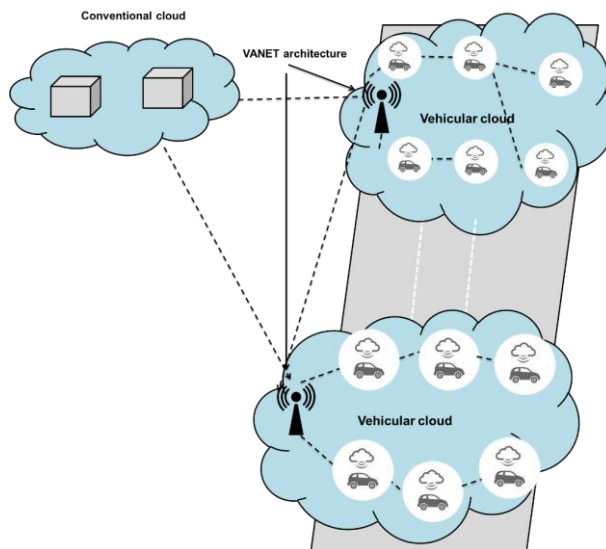


Figure 6. Cloud architecture for vehicles.

With this service, Internet-connected intelligent vehicles rent out their spare bandwidth to other users in exchange for a charge. The second option is storage as a service, where certain smart cars have large amounts of onboard storage that they can lend to other vehicles that might require more storage. The name of a third service is data as a service. In this case, people in a smart car may ask for certain information, a video

file, a map of the city, or information about a nation of roads. The term autonomous vehicular clouds (AVC), as defined, refers to coordinated autonomous vehicles with a variety of resources that may be dynamically assigned to authorized users. They anticipate that connected cars are getting access to the internet and built-in computing, storage, and sensor capabilities.

In a common scenario, connected car owners may rent out their vehicles' capabilities as needed and make money. Vehicular clouds, which offer services through linked cars, fall into two categories. The first form, Infrastructure-based vehicular cloud (IVC), is equivalent to a traditional cloud computing system. It uses roadside infrastructure network connections to deliver present applications to all vehicles. The second category, autonomous vehicle cloud (AVC) and intelligent vehicle cloud (IVC) are quite different; they allow for the spontaneous organization of cars into independent vehicular clouds to manage crises and roadside infrastructure.

7. Vehicle cloud challenges

Vehicular clouds must overcome several obstacles to succeed. Due to their great mobility, automobiles can impact the performance of the vehicular cloud, limiting their potential to act as cloud servers. The period that a vehicle may work as a cloud server within the range of another car is short, and the financial gains for cloud servers could be better. The identification of highly mobile cars and intricacy of relationships of trust among several actors due to sporadic short-range connections are added security and privacy issues with moving clouds. Another obstacle is the definition of selected network coding techniques to improve information distribution accuracy and effectiveness. However, considering the large number of clients and data sources involved, we must also consider network architecture and scalability.

8. Integration of ITS and the Internet of Things

Human-to-human contact has traditionally been the predominant form of communication. But it is anticipated that everything will be connected in a short time. Information may be exchanged among things independently, and there will be many more things related to the internet than people, which may constitute a smaller proportion of information producers and users. The future of Internet communications is predicted to be dominated by machines interacting with other devices on behalf of people. The IoT era is the name given to this new vision, in which many new forms of inter- and intra-object communication will be possible. Recent work has proposed a taxonomy that will aid in defining the components needed to include every level of an OSI model of reference and utilize in the Internet of Things. The authors outline three IoT elements for people and devices to experience seamless, ubiquitous computing.

Intelligent transportation system integration has recently received some attention. The development of intelligent transportation systems built around object-to-object communication is beneficial in a combination of the IoT. For developing data on traffic conditions in the area where they are located, ITS may provide the hardware by using satellite positioning systems with IoT devices, sensor technologies, RFID tags and readers, and contemporary technologies. Road conditions, traffic incidents, road repairs, and avenues are just a few examples of information that could be included. For instance, a distributed system of wireless node sensors is possibly utilized to identify vehicular behavior. These nodes would then transmit their findings to processing units, using the information to make wise decisions, like altering the number of lanes available in each direction and the timing of traffic lights.

Additionally, cloud computing allows for the processing and storing of data on virtual servers. In the future, traffic and driver behavior can be predicted using wheel drive sensors and diadems that scan cerebral impulses to identify changes in mood, stress levels, or overall physical health. This will make it possible to alert neighboring cars about unsafe or aggressive driving behaviors, helping them avoid collisions. Integrating IoT components can lead to wiser management and enhanced transportation operations systems,

solving problems such as traffic jams, accidents, and ineffective transit. An immediate reaction to crisis resolution stand made possible by integrating IoT inside ITS and the gathered data created within the environment. As a result, they are using algorithms, protocols, and transportation infrastructure, and transportation information operates more efficiently thanks to information processing technologies that convey information swiftly and effectively, helping to address transportation issues like accidents, casualties, and congestion points.

9. Conclusion

Increased control, efficiency, and security in transportation are the main objectives of intelligent transportation systems disseminating pertinent information within the setting in which they are used. However, developing technology for transportation systems becomes crucial for ITS to be effective. The most relevant new technologies that can supplement ITS are some of those that we have highlighted in this paper. With wireless technology, connected vehicles enable connections between vehicles and between vehicles and infrastructure to share pertinent data. Along with complementing the advancement in transportation systems, they also demonstrated how cloud technology provides information and entertainment to drivers, emphasizing traffic management and road safety. Their final section discusses IoT operating with ITS by enabling connectivity with other Internet-capable technological equipment. They contend that by using the seamless integration of all three new technologies with ITS, they might develop more environmentally friendly transportation options and raise driving safety in the future.

Limitations

Rapid technological advancement may solve the paper's integration issues. Since new technology and standards might mistakenly impair integration, integration research must be updated periodically. This article covers one time period and may not reflect larger patterns. Real-world integration issues may alter, invalidating the paper's conclusions. The study considers alternatives; however, it might have used more real-world integration challenges. Readers would get your point. IoT, cloud computing, along with networked vehicles offer severe privacy and security risks. These issues are critical for transportation networks yet may not be studied. Integrated systems' energy and carbon footprints harm the environment. Publishers may ignore sustainability. Use of these technologies depends on user acceptance and behaviour, which might be difficult. Successful implementation requires understanding and addressing these issues.

Author contributions

Conceptualization, SKG and RS; methodology, SKG; software, AKC; validation, VSK, PT and AM; formal analysis, SK; investigation, PT; resources, SKG; data curation, AKC; writing—original draft preparation, SKG; writing—review and editing, RS; visualization, SKG; supervision, VSK; project administration, SKG. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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