Emerging Transportation Technologies

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ABSTRACT

Transportation is an integral part of our contemporary society. It provides the means of movement of people and goods and drives economic development. The transportation industry is undergoing a significant revolution, driven by emerging technologies. From self-driving cars to electric scooters, advancements in technology are reshaping the way we move people and goods. The advancements create a more efficient, connected, and eco-friendly transportation ecosystem. Artificial intelligence, autonomous vehicles, big data analytics, blockchain, drones, electric vehicles, and the Internet of things are identified as the emerging technologies that are transforming transportation, making it more efficient, sustainable, and connected than ever before. This paper helps the readers improve their strategic decision-making by giving them an overview of emerging technologies in the transportation industry.

KEYWORDS: technology, emerging technologies, transportation, transportation industry

INTRODUCTION

Since our earliest civilizations, transportation has been vital for connecting cultures, sharing knowledge, and building prosperous societies. Ancient Rome, for example, would never have become the empire it was without its roads and bridges. We rely on transportation to move people and products in the safest, most efficient ways. Figure 1 shows a typical transportation [1].

Transportation industry, being one of the largest existing industries, is experiencing disruptive technological advancements. The industry is undergoing a huge transformation, driven by emerging technologies that are reshaping the way goods and people are transported around the world. Emerging transportation industry trends meet the growing demand for autonomous operations, digitalization, and sustainability. The industry witnesses the widespread adoption of emerging technologies like AI, IoT, drones, and blockchain. These innovations are improving efficiency, enhancing safety and revolutionizing the customer experience.

Transportation technology has always evolved in leaps, from the steam engine to digital navigation. We now stand at the cusp of a convergence of innovations ranging across autonomy, electrification, sharing, connectivity, and sustainability. Transportation technology gets us from Point A to Point B more efficiently (and environmentally friendly) than ever before. It encompasses the tools, improvements and methods that move people, animals and goods across the globe. Transportation technology uses vehicles and infrastructure like railways and highways to support travel and covers movement via land, water, air, and even space. As the urban population surges, the transportation industry faces the challenge of developing effective and efficient strategies to utilize available infrastructure and reduce traffic congestion. The transportation sector is undergoing a profound transformation, driven by the rapid development of new technologies. Innovations in transportation technology are essentially born out of three necessities: efficiency, ease, and safety. As transportation technologies like artificial intelligence become more advanced, vehicles themselves will

improve and the way we get from one place to another will improve [2].

WHAT ARE EMERGING TECHNOLOGIES?

Technology may be regarded as a collection of systems designed to perform some function. It can help alleviate some of the challenges facing business today. Emerging technology is a term generally used to describe new technology. The term often refers to technologies currently developing or expected to be available within the next five to ten years. Any imminent, but not fully realized, technological innovations will have some impact on the status quo.

Emerging technologies are shaping our societies. They continue to affect the way we live, work, and interact with one another. Emerging technology (ET) lacks a consensus on what classifies them as "emergent." It is a relative term because one may see a technology as emerging and others may not see it the same way. It is a term that is often used to describe a new technology. A technology is still emerging if it is not yet a "must-have" [3]. An emerging technology is the one that holds the promise of creating a new economic engine and is trans-industrial. ET is used in different areas such as media, healthcare, business, science, education, or defense.

The characteristics of emerging technologies include the following [4]:

➢ *Novelty:* Emerging technologies are typically new or novel, meaning they have yet to be widely adopted or used. They often represent a significant departure from existing technologies or processes.

➢ *Potential for Disruption:* Emerging technologies have the potential to disrupt existing markets, industries, or ways of doing things. They may also displace existing businesses or industries.

➢ *Uncertainty:* Because emerging technologies are still in the early stages of development, there is often a high uncertainty surrounding their future potential and impact. It can be challenging to predict how they will evolve.

➢ *Rapid Change:* Emerging technologies often evolve rapidly, with new developments and innovations emerging frequently. It can make keeping up with the latest trends and advancements challenging.

➢ *Interdisciplinary*: Emerging technologies often involve multiple disciplines or fields of study, such as computer science, engineering, and biology. They may require collaboration across different fields and industries to develop their potential fully.

Emerging technologies are worth investigating. They are responsible for developing new products or devices. As emerging technologies continue to evolve, engineering is poised for a transformative future. Emerging technologies have driven innovation and progress in today's rapidly evolving digital landscape. The collective impact of emerging technologies such as artificial intelligence, machine learning, big data, and the Internet of things is undeniably transformative. Some emerging technologies are shown in Figure 2 [5].

TRANSPORTATION INDUSTRY

Transportation has come a long way since the first wheel rolled and the first sail caught wind. From steam engines to internal combustion vehicles, technology has continuously pushed the boundaries of how we move people and goods. The transition to fully autonomous vehicles and ships has already begun and will dominantly prevail in the near future. The transportation industry is working towards improving consumer comfort and convenience. From autonomous vehicles and drones to blockchain and artificial intelligence, these innovations are shaping the future of transportation and logistics. The innovations promise to reshape transportation in momentous ways in the coming decades. To stay ahead in this rapidly evolving landscape, senior executives in the transportation and logistics industries must actively embrace these technological innovations and take strategic actions to capitalize on the opportunities they present.

EMERGING TECHNOLOGIES IN TRANSPORTATION INDUSTRY

The transport system is always changing, and new technologies are becoming an important part of it. There are a number of emerging technologies that are having an impact on the transport system. The impact emerging technologies have on the transport system varies greatly between different nations. Some of the emerging technologies are shown in Figure 3 [6]. Emerging technologies in transportation include the following [7,8]:

1. *Artificial Intelligence:* Artificial intelligence has been, and will continue to be, a key component of transportation management systems. Artificial intelligence (AI) and machine learning (ML) technologies offer tremendous potential for optimizing operations, improving efficiency, and enhancing customer experiences in the transportation industry. AI can be used to "learn" about constraints, such as capacity, regulations, and hours of service, and properly plan shipments. Efficiency in transportation is being enhanced by artificial intelligence (AI), which

predicts traffic flow delays. Autonomous vehicles navigate using AI algorithms for object detection and recognition. Safety on roads improves with machine learning analyzing driver behavior to detect drowsiness. AI reduces traffic congestion and accidents in the transportation industry. AI and machine learning (ML) are technologies that can improve efficiency, optimize operations, and enhance customer experiences.

2. *Internet of Things:* The transportation industry is becoming smarter with the Internet of things (IoT). Embedded sensors in IoT gather data from transport vehicles, tracking their condition and performance. Traffic congestion systems equipped with IoT devices predict and redirect vehicles to faster alternate routes. This speeds up delivery and reduces congestion, leading to less energy consumption. IoT enables the development of smart warehouses with automated inventory management, reducing errors and delays. By embracing IoT, transportation and logistics companies can drive operational efficiencies and deliver better customer experiences. The use of an IoT-enabled fleet management solution can boost performance by improving asset visibility and vehicle utilization, reducing wait times at destinations, and providing proactive maintenance-related cost savings.

3. *Electricification*: When it comes to cars, electrification of vehicles is at its tipping point. Electrification involves the use of electric vehicles that run on batteries instead of petrol, diesel, or crude oil. Road transportation is increasingly electrified in recent years. Electrification or electric transportation is transforming the transportation industry on a large scale. The industry is increasingly adopting driverless vehicles. Large-scale electrification solutions are accelerating the development of charging infrastructure and innovative batteries. Connected cars impose speed limits based on traffic conditions, aiding in accident prevention. The expected contribution of transportation electrification to carbon neutrality is all based on the assumption that the generation of electricity used for transportation is from renewable energies.

4. *Electric Vehicles:* The fast-growing adoption of electric vehicles (EVs) marks a seismic shift in transportation. EVs have several environmental and economic benefits over internal combustion engine vehicles. They emit fewer greenhouse gases and pollutants than their petrol or diesel counterparts. They offer a sustainable mode of goods transportation. Trains, capable of carrying large volumes of goods over long distances, present another green alternative. They help decrease the number of vehicles on roads, promoting green transportation. Moreover, public transport systems are increasingly adopting these green technologies, which significantly improve urban air quality. EVs are hitting cost and convenience parity with conventional vehicles. Many countries have set aggressive EV adoption targets. Several automakers like Volvo and GM plan to go fully electric by 2030 or sooner. As electric vehicles become more popular, the need for robust charging infrastructure becomes essential. Building an extensive network of charging stations is critical to supporting the widespread adoption of electric vehicles. Figure 4 shows an electric car [9].

5. *Autonomous Vehicles:* Autonomous vehicles (AVs), also known as self-driving cars, are another groundbreaking technology that is revolutionizing transportation. AVs use various sensors, cameras, and AI algorithms to navigate and operate without human intervention. New truck engine technology will involve the use of self-driving autonomous vehicles that do not depend on human interference. With new truck engine technology, we expect to see more self-driving/driverless cars and trucks. The potential benefits of AVs include improved road safety, reduced traffic congestion, and increased mobility for people with disabilities or limited access to transportation. Autonomous technology promises improved road safety by reducing human error and better traffic flow through vehicle-to-vehicle coordination. Some experts predict autonomous cars will be commonplace by 2030. They believe that fleet vehicles including buses, trucks, and taxis will take control and make independent decisions. The future of driverless cars seems inevitable despite some consumer hesitation and societal concerns. Figure 5 shows some autonomous cars [9].

6. *Mobility as a Service:* Mobility as a Service (MaaS) platforms are an emerging concept that seamlessly integrates various transport modes through a single-user app. MaaS apps allow travel planning, booking, payments, and ticketing across public transport, rideshares, scooters, and bike shares. The provision of transport services on-demand is ensured by Mobility-as-a-Service (MaaS). This is a single app that allows users to plan, book, pay for, and ticket travel across multiple modes of transportation. This service

consolidates various digital channels, enabling users to plan and book multiple mobility modes through one platform. For users, MaaS brings the convenience of seamless end-to-end journey planning and payments. It simplifies payments with a subscription model and a pay-as-you-go model. As more users shift from private cars, MaaS can transform urban mobility.

7. *Blockchain:* Blockchain technology offers significant potential for enhancing transparency, security and efficiency in supply chain management. It enhances visibility in the transport sector. It enables real-time asset tracking, facilitating precise operation planning. The decentralized structure of blockchain fosters transparency and deters fraudulent transactions. Blockchain technology introduces transaction transparency and document immutability. Document safety is backed by blockchain, hence, no change occurs without the approval of both parties. By leveraging blockchain technology, companies can streamline processes, minimize fraud and improve traceability of goods, and optimize their logistics operations.

8. *Drones*: Drones have moved from military to widespread consumer use within a decade. Drones and Unmanned Aerial Vehicles (UAVs) are transforming the way goods are transported, especially in remote or hard-to-reach areas. Delivery drones have the potential to provide fast and efficient delivery services, reducing the need for traditional delivery vehicles and associated carbon emissions. UAVs are used in surveying and monitoring applications, aiding in various industries like agriculture, disaster response, and infrastructure inspection. Amazon and UPS are testing drones to expand fast, cheap last-mile delivery. Autonomous drones, increasingly used for delivering medicines and groceries, ensure quick product delivery to any location.

9. *Maglev Trains:* Trains, capable of carrying large volumes of goods over long distances, present another green alternative. They help decrease the number of vehicles on roads, promoting green transportation. Maglev train (short for "magnetic levitation") is a train that uses magnetic levitation to carry passengers at high speeds. A new high-speed train in China is designed to carry passengers at a speed of 370 miles per hour, more than 150 mph faster than the world's fastest passenger trains now in operation. The train uses electromagnets to levitate just above the track and provide forward propulsion, eliminating the friction caused by metal wheels on conventional trains, as well as the wear and tear and related maintenance expenses. Because maglev trains are not powered by fossil fuels, they are better for the environment too. Figure 6 shows a maglev train [2].

10. *Intelligent Transportation Systems* (ITS): These systems aim to improve road safety, supply-demand coordination, intersection control, and smart parking. Intelligent transportation systems (ITS) utilize various technologies ranging from core applications such as traffic signals, control, and monitoring systems to useful applications such as parking guidance and decision-based information systems. The rise of the Internet of things (IoT) and smart city technologies has enabled the development of connected transportation systems. These systems use real-time data and sensors to optimize traffic flow, monitor vehicle performance, and enhance overall transportation efficiency. Intelligent transportation solutions have enabled agencies to establish better two-way communication between dispatch, vehicles, and passengers during trips. The expected contribution of transportation electrification to carbon neutrality is all based on the assumption that the generation of electricity used for transportation is from renewable energies.

11. *Smart Infrastructure:* Smart infrastructure refers to roads, bridges, and traffic systems embedded with sensors and connectivity to enable real-time monitoring and dynamic response to conditions. The rise of the Internet of things (IoT) and smart city technologies has enabled the development of connected transportation systems. These systems use real-time data and sensors to optimize traffic flow, monitor vehicle performance, and enhance overall transportation efficiency. For example, smart highways can alert approaching vehicles to hazards ahead. Smart streetlights can adjust brightness based on traffic and ambient light. Smart parking systems can guide drivers to vacant spots.

12. *Green Transportation:* Transport modes are embracing green energy, utilizing alternative fuels and technologies to minimize environmental impact. Vessels designed for eco-friendliness outperform traditional ones due to lower greenhouse gas emissions. Moreover, the use of alternative fuels like hydrogen, liquefied gas, and synthetic fuels is gaining momentum in marine and aerial transport. These fuels help curb pollution and harmful emissions.

13. *Big Data:* Data is forever changing the world. Big data describes blending advanced analytic techniques (such as machine learning and pattern recognition) together with a huge assembly of structured and unstructured. Owing to the large volumes of real-time data being generated daily as a result of the rapid surge in urban migration, the existing conventional data-processing tools are deficient to effectively realize the key targets of an smart city transportation ecosystem. Big data has been proposed as the key technology that can efficiently address data-related challenges in the transportation industry, due to its ability to obtain, store, manage, and analyze large volumes of data to extract useful information needed for implementing ITS. Some big data platforms have been used tremendously for research in smart city transportation. Researchers have utilized big data to try and solve challenges to improve the transportation system for smart cities. Advances in technology such as IoT, social media, etc. have widened sources through which huge amounts of data can be generated and collected from devices, vehicles, sensors, and people, for utilization in ITS. With the advent of smart cities and ITS, sensors, GPS devices, smart phones, automatic fare collection (AFC) systems, etc., have been deployed to generate data daily from passengers, infrastructures, and transport services. Data analytics is the process of inspection, selection, transformation, governance, and representation of data, with the goal of discovering useful information and assisting or boosting decision-making systems. Figure 7 presents data collection sources [10].

Other emerging technologies in the transportation industry include cloud computing, robotics, smart mobility, smart parking, hyperloop, electric scooters, last-mile delivery, and flying taxis.

APPLICATIONS OF EMERGING TECHNOLOGIES

Transportation is at the cusp of a remarkable revolution, driven by a convergence of emerging technologies and innovative trends. Emerging technologies and shifting trends are reshaping the way we move people and goods across the world. Common areas of applications of these emerging technologies include [11]:

➢ *Advanced Traffic Management Systems:* Advanced traffic management systems leverage technology to optimize traffic flow and reduce congestion. These systems use real-time data from cameras, sensors, and GPS devices to monitor traffic patterns and adjust traffic signals

accordingly. By dynamically adapting traffic signals to current conditions, transportation authorities can improve traffic flow, reduce travel times, and lower fuel consumption, contributing to a more sustainable transportation system.

➢ *Mobility for Smart Cities:* The transportation system as an integral part of the society and a key element in the smart city (SC) ecosystem generates large volumes of data daily. People are increasingly engaging with smart city platforms in multiple ways (e.g., mobile devices, connected cars, smart homes). Smart city initiatives integrate various transportation technologies to create a seamless and efficient mobility experience. Connected and autonomous vehicles, smart traffic management, and integrated public transit systems enable citizens to move around cities more effortlessly and sustainably. Smart city projects focus on enhancing the quality of urban life, reducing pollution, and promoting multi-modal transportation options. For example, the city of Las Vegas, NV is going to test sensors that passively detect pedestrians and respond by changing traffic lights automatically at several street crossings in popular pedestrian areas. The advancement of new technologies in big data, AI, machine learning, deep learning, and Internet of things (IoT) will further shape the framework of a SC and revolutionize the different sectors in SCs. Figure 8 depicts different components of transportation for smart cities [10].

➢ *Smart Roads:* Smart roads is an all-inclusive term for digitally enhanced road systems. They are a component of smart cities, a tech-first approach to city planning, construction, management and public services. Typically, smart roads embed sensors in their infrastructure, which may serve a variety of purposes. As smart roads collect data on traffic flow and public transit systems, these heavily integrated communication networks are able to assist in reducing congestion. Figure 9 illustrates a typical smart road [12].

➢ *Freight and Logistics Optimization:* Efficient freight and logistics management are vital for sustainable transportation. Advanced analytics and AI algorithms optimize freight routes, load distribution, and delivery schedules to minimize fuel consumption and emissions. The adoption of electric and hybrid delivery vehicles further contributes to reducing the environmental impact of the transportation of goods.

➢ *Decentralized Mobility:* Decentralized mobility platforms are emerging, allowing individuals to rent out their vehicles or participate in car-sharing

programs. Peer-to-peer mobility solutions enable a more efficient use of existing vehicles, reducing the need for car ownership and, consequently, the number of vehicles on the road. This model promotes resource sharing and contributes to a more sustainable transportation ecosystem.

➢ *Smart Mobility:* Smart mobility requires responsive, flexible, and intelligent designs that use technology and data to improve transportation for pedestrians, bicyclists, drivers, and transit users of all ages and from every walk of life.

➢ *Transportation Management System:* Historically, transportation management systems (TMS) have offered a strong ROI. The primary reason companies buy a TMS is for freight savings. These freight savings can be attributed to simulation and network design, load consolidation and lower cost mode selections, and multi-stop route optimization. As freight costs have continued to rise, companies have looked more and more to their TMS to mitigate these rising costs.

➢ *Public Transportation:* This is a crucial element of any efficient transportation system. It provides an affordable and sustainable way for people to move around the city, reducing traffic congestion and air pollution. Cities can improve public transportation by investing in infrastructure, such as bus rapid transit or light rail systems. Active transportation, such as walking and cycling, is another important element of an efficient transportation system. It provides a healthy and sustainable way for people to move around the city, reducing traffic congestion and air pollution. Cities can improve active transportation by investing in infrastructure, such as bike lanes and pedestrian walkways.

BENEFITS

There may be a substantial capital and operating cost advantage for high-quality public transportation compared to today's infrastructure intensive solutions. Transportation tech has responded with eco-friendlier forms of transport, like electric vehicles and maglev trains, which reduce consumers' dependency on oil in favor of renewable energy. Traditional modes of transport are being reinvented to align with the demands of the modern world due the emerging technologies. Other benefits include the following [12-14]:

➢ *Automation:* Transportation is one of the industries that has been significantly impacted by automation. The use of automation in transportation has brought about significant

benefits, such as increased efficiency, reduced costs, and improved safety. Automation in transportation is not limited to self-driving cars and drones; it also includes automated logistics, autonomous navigation, and autonomous transport operations, which are replacing manual handling to improve efficiency and reduce errors.

➢ *Sustainability:* Technology is pivotal to developing sustainable transportation systems. EVs, renewable energy integration, lightweight materials, and electrified public transit are bringing down emissions. The focus is to not only improve the overall efficiency of transport operations but also to reach the ultimate goal of sustainability with minimum pollution. Technology is also used for environmental sensing and pollution monitoring to assess the impact of transportation on air and water quality

➢ *Carbon Neutrality:* The transportation sector has become one of the biggest sources of carbon emissions. Reducing carbon emissions and pursuing carbon neutrality in the transportation sector is a necessary step in the overall plan of achieving the global carbon neutrality. Many nations across the world have been actively implementing their commitments to achieve carbon neutrality and reduce carbon emission in response to the 2030 Agenda for Sustainable Development. This is achieved through the adoption and implementation of emerging technologies and policies on three aspects: low-carbon transportation infrastructure, transportation electrification and decarbonization, and intelligent transportation systems management.

➢ *Speed:* Instead of spending so much time in transit due to traffic congestion or long distance, transportation technology can provide a faster and more efficient travel experience at high speeds. This will mean that we can spend our time on more productive things.

➢ *Road Congestion*: Today, the global population is growing faster, as more towns are now becoming urban areas. The result is heavy traffic congestion affecting businesses, truck transportation, and logistics. Many cities have already maxed out their infrastructure. The future of transportation technology will help to reduce congestion and provide an alternative to traditional roads. This will obviously change the way our cities are built, as driverless vehicles that can drop us at our destination and pick us up later will make huge parking lots a thing of the past.

➢ *Affordability:* New transportation technology is expected to be affordable, eco-friendly, and inventive. Therefore, it will promote income equality across the globe. This means that no matter how much you earn, you will still be able to get to work safely and efficiently.

➢ *Accessibility and Inclusivity:* Technology is also driving advancements in accessibility and inclusivity within transportation. Ride-sharing and on-demand mobility services offer accessible options for individuals with disabilities or limited mobility.

➢ *Public-Private Partnerships:* The transportation revolution relies on collaboration between the public and private sectors. Public-private partnerships (PPPs) facilitate the deployment of innovative transportation solutions by combining resources, expertise, and regulatory support. Governments provide the necessary infrastructure and policy framework, while private companies bring in technological innovations and investments to drive progress in the transportation industry. Public-private partnerships, accessibility initiatives, and environmental monitoring further contribute to creating a sustainable and inclusive transportation future.

CHALLENGES

Transportation industry faces a myriad of challenges, including the development of efficient strategies to utilize available infrastructures and minimize traffic. There are valid concerns around data privacy, cybersecurity, liability in case of accidents, and job losses in driving professions. There is also debate around ethics and the ability of algorithms to make life-and-death decisions in complex scenarios. Other challenges include the following [12]:

➢ *Security*: As transportation becomes increasingly connected, ensuring security and safety is paramount. Hybrid truck technology comes with security risks. For instance, creators are obligated to not only learn how these new technologies operate but also how to secure them from hackers. Security is important to also prevent attacks or theft. Cybersecurity measures must be in place to protect connected vehicles and transportation systems from potential cyber threats.

➢ *Regulations*: Some of the biggest challenges facing flying taxis are the costs and regulations. There are several regulatory challenges in the world today as a result of climate change, overcrowding, wealth inequality, etc. As a result, there is a wave of innovation leading the transportation industry across the globe.

➢ *Last-Mile Delivery Challenges:* The last mile of delivery presents unique challenges in urban areas. Solutions like micro-distribution centers, delivery lockers, and drone delivery are being explored to address last-mile challenges. By optimizing the last leg of delivery, companies can reduce delivery times and carbon emissions.

➢ *Ethical Considerations:* While the benefits of autonomous vehicles are numerous, they also raise important ethical considerations. As the transportation world evolves, we are faced with big questions: Who would be responsible for paying for a collision involving a driverless car? Would it be the driver's car insurance company or the manufacturer's insurance? As of now, car companies have been footing the bill for crashes.

➢ *Poverty:* Affordable transportation technology that is eco-friendly and inventive will be necessary to address income equality throughout the world. Regardless of their salary, people still need to be able to get to work efficiently and safely.

➢ *Impact on Society:* The impact of autonomous vehicles on society could be significant. For example, autonomous vehicles could make transportation more accessible for people who are unable to drive, such as the elderly and disabled. Additionally, autonomous vehicles could change the way we think about car ownership. Instead of owning a car, people may choose to subscribe to a service that provides access to a fleet of autonomous vehicles.

➢ *Societal Concerns*: Despite the potential benefits of autonomous vehicles, there are also concerns. One of the biggest concerns is the potential loss of jobs in the transportation industry. Additionally, there are concerns about the security of autonomous vehicles, as they are vulnerable to hacking and cyber attacks. Convincing the public to embrace autonomous vehicles requires addressing concerns related to noise, privacy, and affordability.

CONCLUSION

The transportation revolution, driven by emerging technologies, continues to transform the way we move people and goods. While all these emerging technologies have made important impacts on reducing carbon emissions from building transportation infrastructure, the implementation and public acceptance determine whether and how much the potential could be exploited. As technology advances, dramatic changes to urban transportation are coming to our roads and skies. In the coming

years, we expect innovations in the transportation industry that will greatly improve our lives, and minimize death, cost, and even anxiety.

The future of transportation may involve self-driving cars, drones, maglev trains, and more, all in an effort to reduce carbon emissions, increase autonomous travel, and promote safety and efficiency, especially in urban spaces. With the emerging technologies in transportation, we are expecting lots of changes in the future of transportation, as illustrated in Figure 10 [14].. The future of transportation beckons us to innovate, adapt, and prepare with wisdom. More information about emerging technologies in the transportation can be found in the books [15-22] and the following related journals:

➢ *International Journal of Transportation Science and Technology*

➢ *Transportation Research Part C: Emerging Technologies*

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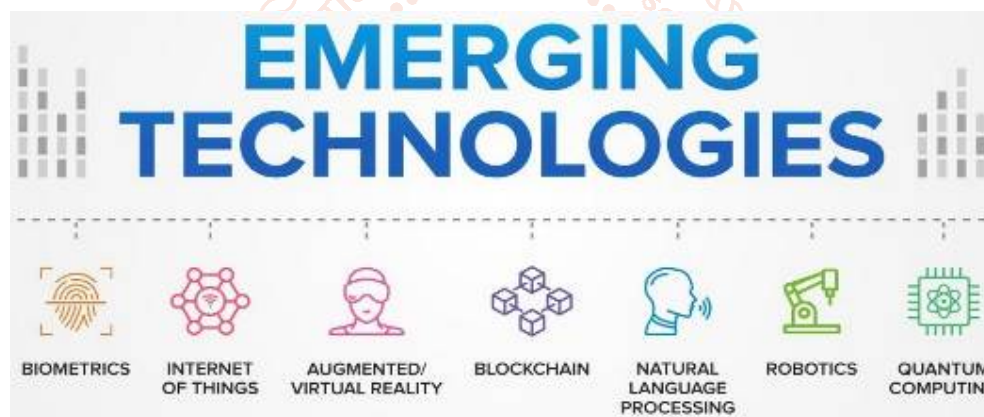
Figure 1 A typical transportation [1].

Figure 2 Some emerging technologies [5].

Figure 3 Some emerging technologies are in transportation [6]

Figure 4 An electric car [9].

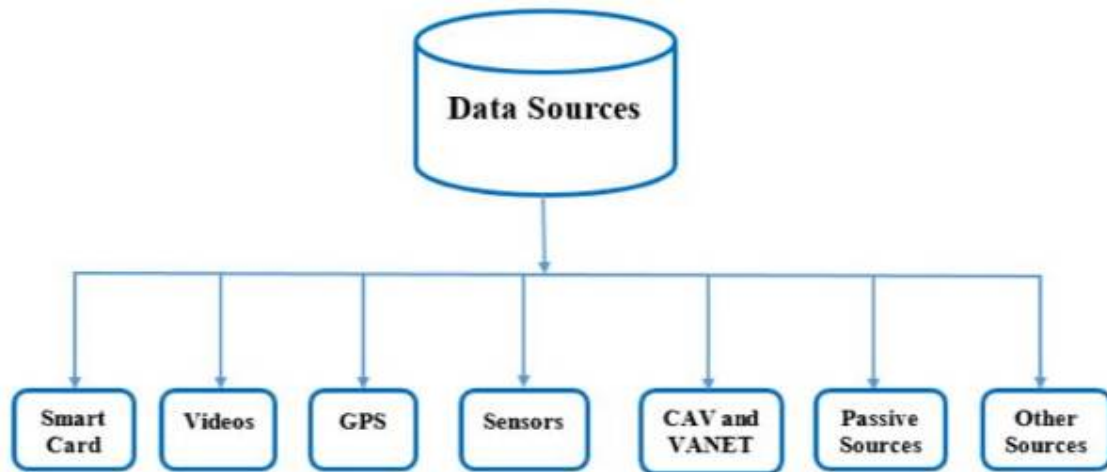**Figure 5 Some autonomous cars [9].**

Figure 6 A maglev train [2].

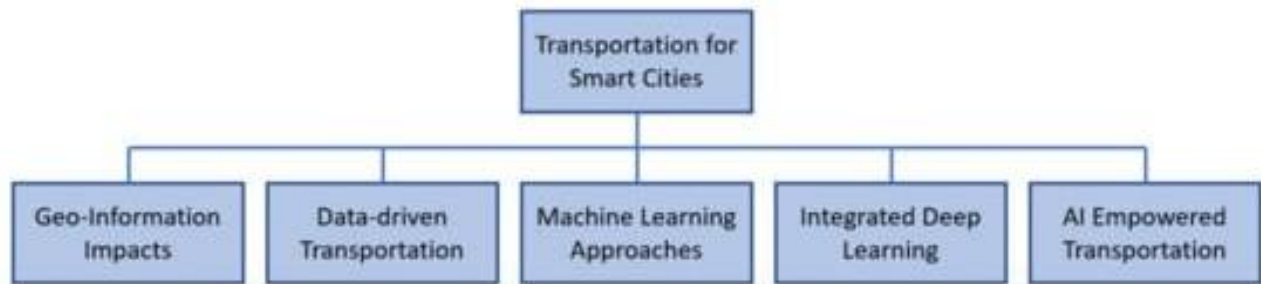**Figure 7 Data collection sources [10].**

Figure 8 Components of transportation for smart cities [10].
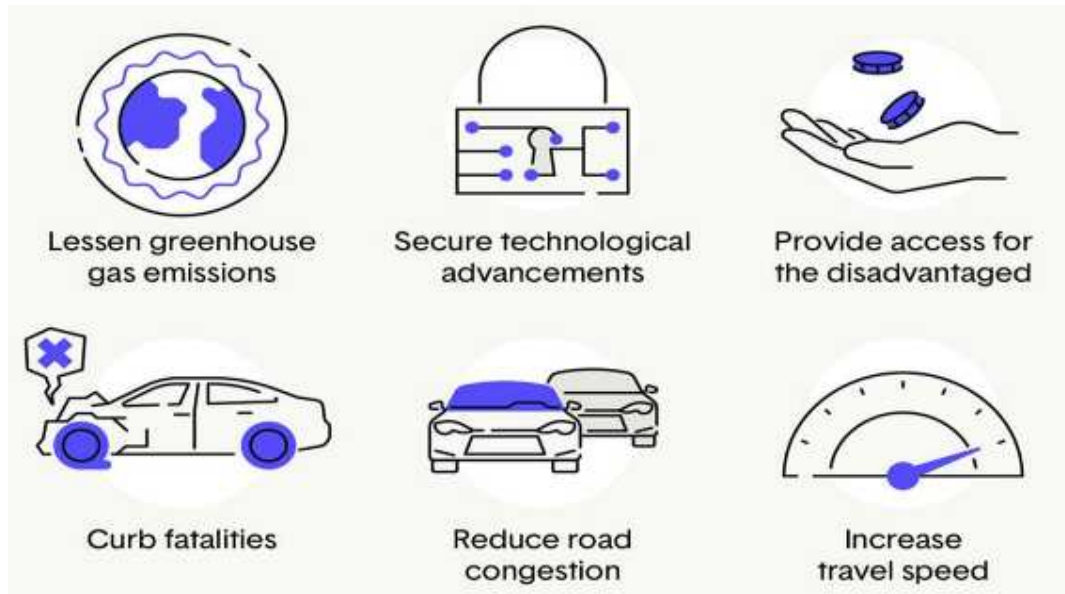

Figure 9 A typical smart road [12].

Figure 10 The future of transportation [14].