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Environmental Sustainability through Intelligent Transportation System for Traffic Management in the Smart Cities

ABSTRACT

Congestion, hazardous driving, and stormy weather can all cause public transportation delays in urban areas, making life difficult for those who rely on it. Decision-makers in the public transportation sector are starting to think about their customers' resilience and the speed with which they can restore regular service. Few studies have been undertaken in recent years on the reliability of urban rail networks, and those have barely scratched the surface of the issue. The automobile industry and its researchers and manufacturers have prioritized several goals, including reducing production costs, reducing carbon dioxide emissions, improving driver comfort, and reducing trip times. If vehicles could exchange information with one another, it would have far-reaching implications for the transportation and security sectors. Professionals in each field may have varying objectives, making settling on an ordinary course of action difficult. Involvement and contributions from citizens benefit the city and individual neighbourhoods. A city's economic health, environmental health, transportation network, healthcare system, and educational opportunities are all directly influenced by this endeavour. Considering these many considerations, multiple groups have proposed solutions to the problem. The "smart city" movement in urban planning views cities as living, breathing ecosystems. People use various services and tools to facilitate their daily lives across multiple models in space and time. Multiscale modeling offers many opportunities and limits for advancing smart city research due to the enormous diversity of complex systems in smart cities. In addition to making systems much more reliable, these technologies or upgrades to the city's current ITS infrastructure can save a lot of money and make things run much more smoothly.

Keywords: Cyber Physical System (CPSs), Intelligent Transportation System (ITS), Roadside Unit (RSU), Traffic Control (TC), Central Traffic Management (CTM).

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INTRODUCTION

A wide variety of electronic, automated, and wireless technology falls under the umbrella term "intelligent transportation systems" (ITS). Because of the efforts of people, transportation can be enhanced. These technological advancements are anticipated to make surface transportation more efficient, user-friendly, and secure [1]. These technologies work together to establish links between pedestrians, cyclists, and drivers with the infrastructure they rely on (roads and public transit). Buses can now dock precisely thanks to autonomous guide ways and other automated technologies and components placed in vehicles. Modern collision detection technology and real-time data have significantly reduced accidents. Any one of these breakthroughs may make roads safer by giving drivers more accessible access to information and resources. The safety of transportation networks is improved by using cyber-physical systems (CPSs) [2]. All three are included under the umbrella term "ITS." From now on, "information technology and telecommunications" (ITS) shall be used everywhere the phrase "road transportation" was previously used. The acronym ITS stands for "Intelligent Transportation System" and describes a collection of devices used to manage vehicular traffic. Navigation and signaling systems with built-in guidance for drivers have been around for some time. The ability to hold natural conversations with pedestrians, bikers and each other is a hallmark of today's more advanced systems [3]. The Intelligent Transport System (ITS) can be used in many contexts, such as driverless cars and intelligent garages. Multiple types of nomads and fixed components can make up an ITS system. Several ITS tools are already available to assist travelers in reaching their destinations as quickly and affordably as possible. Significant fuel savings, such as those exhibited, are potential for implementing ITS in-highway management, public transit, and automobile production. The rise of "participatory sensing," the spread of "smart cities," and the fact that location data is available through mobile networks and social media have all led to a lot of different kinds of mobility data. Cities can improve street safety and traffic flow by putting Smart Traffic Management Systems in traffic cabinets and at crossings. This is a quick and cheap way to do both.

We include stationary and mobile ITS (like cars and computers) in this definition. Vehicles of all types and kinds need ITS connectivity [5]. Because users never voluntarily submit ITS information, it must operate in this fashion. Vehicles with vehicle-to-vehicle (V2V) communication features, such as two-way GPS information, may be eligible for this program. Adaptive cruise control is only one of many state-of-the-art

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safety features that are standard on all these models. While humans improve vehicle security and usability, they aren't always cooperative with the rest of the ITS system [6]. Intelligent vehicles are distinguished by their capacity for human control and two-way communication (V2V or V2I). These vehicles are equipped with many sensors to identify other cars and pedestrians in their immediate vicinity. Potential dangers and adverse weather could be screened for. Some of these vehicles may already have data-gathering and storage capabilities built in. The sensor on the roadside collects data, which it then relays to passing automobiles or the ITS. The receivers vote on which of two types [7] of the wireless message the sender will use. An intelligent vehicle can be used in place of a standard car in almost any circumstance. The data is exclusively utilized for fleet management; therefore, the driver does not benefit in any way. In other cases, data may be exchanged with unrelated parts of the ITS network.

BACKGROUND/LITERATURE REVIEW

Because there are so many different uses for ICT, the job market is incredibly varied. Telematics and cameras can substantially assist public transit fleet management, especially traffic and pedestrian safety [18]. Radio wave technologies, such as wireless and RFID, allow some people to communicate across long distances. These methods help ensure people are safe. Some may be curious as to where such a large gathering is heading. To improve the lives of communities, workers, bikers, and pedestrians, another group could investigate measures to reduce carbon dioxide emissions, boost the efficiency of selected cars or fleets, or achieve other traffic objectives [19]. There are aspects of an intelligent transportation system that could be useful for transportation professionals to make their jobs simpler and safer.

Personal rapid transit, or PRT, is a game-changing idea for getting through congested urban areas. Possibly the best choice is to not go on the drive. There would be a fleet of autonomous pods that would transport people along a predetermined route. As PRT requires less energy to run than a car and produces fewer pollutants, it may be more enticing to those concerned about the environment than driving. The power needs of municipal PRT systems are pretty high. Think long and hard about the pros and cons of such limitless freedom. This essay contrasts two forms of authority and explores their similarities and differences. Battery technology and third-rail conductors are currently the focus of research. Propulsion and charging energy needs were calculated using rigid body mechanics and lumped powertrain data. It was then determined how much money was spent on fuel, how much was lost on parasitic energy, and how much was spent on electricity to run the company. We considered the initial investment and the company's running costs while making our projections.

Increases in the frequency and severity of natural and artificial disasters, as well as terrorist attacks, have brought renewed attention in recent years to the importance of bolstering community resilience. The reliability of a society's transportation system is a measure of its overall health and its capacity to recover after a disaster. Because people are so important, we need a solid defense. Various definitions, measurements, and methods have been developed via study to assess the reliability of transportation networks. In this literature review, we investigate the numerous dangers facing transportation networks, how their resilience can be evaluated, and the conditions under which these indicators are most helpful. These findings call for a re-evaluation of concepts like durability, efficiency, and the passage of time. Plans are evaluated for effectiveness while written to guarantee the best possible outcomes.

Researchers now have access to many data on how people drive because of the expansion of linked car technology. This data is being incorporated into the Basic Safety Messages initiative (BSMs). In this study, we will investigate the viability of using BSMs to track whether accidents happened during trials using high-fidelity driving simulators in a lab environment. Two scenarios were developed in a driving simulator to replicate head-on crashes brought on by drivers who strayed from the road. Those roads are too dangerous for anyone but the most seasoned truck drivers.

INTELLIGENT TRANSPORTATION SYSTEM MOBILE COMPONENTS

ITS case study will use mobile components [34].

Use of the Vehicle

Space and time can get complicated when nodes help control an automobile. Sensor data can be examined for inconsistencies in the face of abrupt changes. The most recent three readings from a temperature sensor can be averaged to derive an average temperature. It is possible to avoid collisions thanks to the sensors installed in vehicles, which can detect environmental changes and alert the driver. Both weather and minor defects in the tire can be ruled out as potential causes of low tire pressure. Humans are much simpler to repair than machinery [35]. While this hardware may not have as much computing power as other options, it should let users swiftly clean out data. Information can be sent more quickly when the devices are near one another.

Route

Readings from a global positioning system are often unreliable. The GPS device should be able to detect any alterations in a distant location. Individuals may work together to find each other in a V2V scenario. Extra-terrestrial anomalies can be explained and fixed if no other cars turn up where witnesses have seen them. The cost of finding and resolving problems with space and time navigation could be high. Neither finding nor fixing it would be cost-effective, making them extremely unlikely [36].

In most cases, it is more potent than the car's on-board electronics, which keep tabs on the engine's temperature and tire pressure. Logic dictates that if these objects can communicate with humans and occasionally replicate the PC experience, then humans should be able to do the same. It's not just a great option since it has a lot of storage and processing power. If vehicles need to talk to one another, V2V communication could become very active. Possible explanation: modern navigational aids boast more powerful processing capabilities. Perhaps it can handle more complex data-cleaning procedures.

Driver

Assuming the role of the driver, this is correct. If something goes wrong while driving, it might be challenging. Proximity sensors should be tested to ensure that the system can quickly apply the brakes or swerve to avoid a collision. Strange geographical anomalies may emerge when a fleet of autonomous vehicles works together to analyze data and make driving decisions. People frequently ask for advice from individuals around them before executing a potentially dangerous maneuverer like braking or switching lanes. Rapid and skilful action is of the utmost importance [37]. A quick method of data error checking is necessary for timely control action. When customers consider how essential safety features like collision avoidance systems are to ensuring their safety, they will understand why manufacturers are investing substantially in diagnostic technology. Improvements in computing power and data storage have made it easier to implement increasingly sophisticated cleaning tactics on computer or mobile devices, such as behavior-based and learning-based cleaning.

INTELLIGENT TRANSPORTATION SYSTEMS AND ENVIRONMENTAL SUSTAINABILITY

Nevertheless, intelligent business owners are beginning to see that they can distinguish themselves from rivals by going above and beyond to promote environmental sustainability. Organizations must pinpoint the most pressing ecological pressures and trends impacting their operations and devise a plan to counteract them [40]. The effects on the environment should factor into both short-term and long-term planning. Management accountants must draw on a wide range of expertise when making decisions about the company's environmental impact. Management accountants have strong numeracy and analytic skills, making them adept at tackling complex problems. Therefore, people may play a pivotal role in setting the agenda for environmental sustainability. Management accountants should always consider the environment when making strategies, creating budgets, collecting data, analyzing costs and investment returns, monitoring operations, and writing reports. The positive effects these organizations have on Earth are depicted in Figure 1.

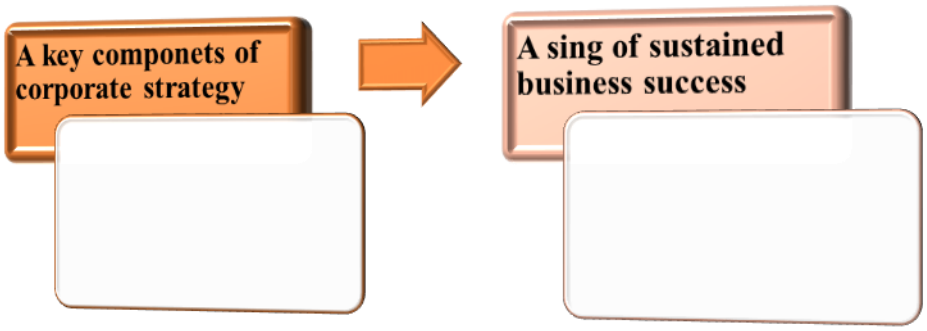

Figure:1 Environmental Sustainability for Organizations

The availability of new tools can aid businesses in streamlining their modernization processes. Companies can reduce their negative impacts on the environment and increase their positive contributions by adopting or modifying a few essential concepts from management accounting. Figure 2 depicts an occurrence that, at first glance, would not seem all that noteworthy. As we shall see, however, many businesses are just now starting to appreciate the significance of this trend.

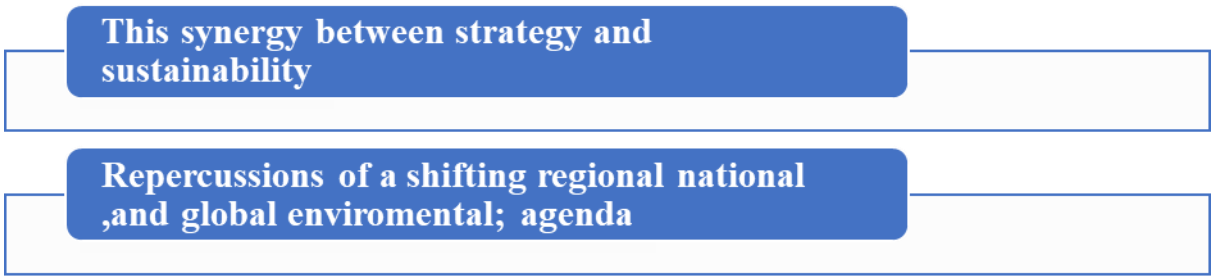

Figure:2 Environmental Sustainability for Organizations' Importance

If a company doesn't consider reducing its environmental impact, its future growth and prosperity could be at risk. Companies will not be able to profit fully from environmental sustainability if they only comply with legislation. To aid their consumers in achieving a wide range of long-term goals, firms must prioritize ecological sustainability, as shown in Figure:3.

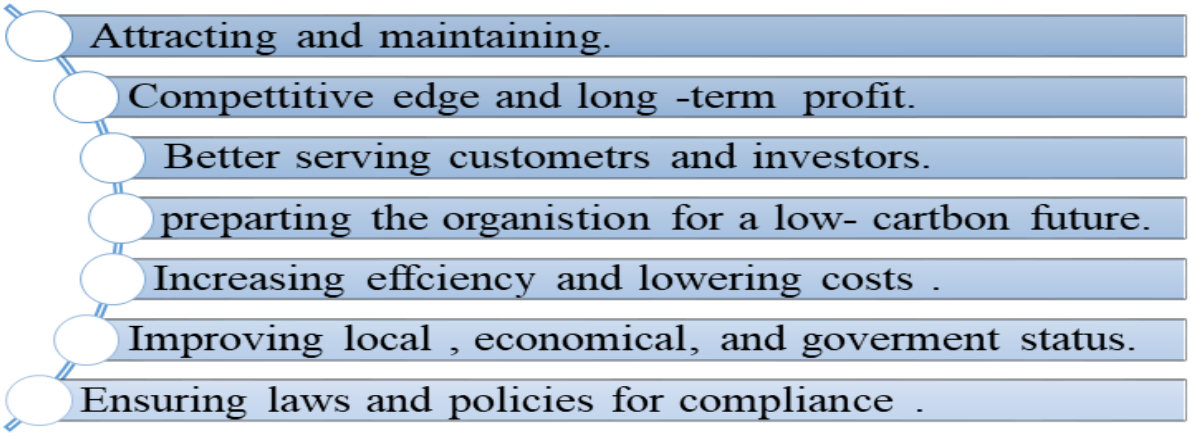

Figure:3 Environment Management Strategic Objectives

ENVIRONMENT SUSTAINABILITY CHALLENGES IN TNTELLIGENT TRANSPORT SYSTEMS

However, most people's efforts to save the planet are understated. The industry, strategy, and future goals of a company are all important factors that investors and competitors should consider. There may be everyday struggles faced by new business owners [46]. Still, every sector has its problems. Utility managers will pay closer attention to air pollution levels as the number of cars on the road, and thermal power plants grow.

For this reason, convenience stores that service a limited geographic area may be more likely to implement green initiatives like paperless ordering and biodegradable packaging. For businesses to make strides toward environmental sustainability, it is crucial for leaders first to acknowledge the value of employees' connections to that goal. Most people are willing to cause severe financial sacrifices to protect the environment [47]. Their ambition is to reach a position of influence in which they can substantially contribute to environmental protection in their professional capacities.

Cost Reduction

Trash minimization has significant monetary and environmental benefits. Extraordinary acts of kindness should be recognized handsomely. Many obvious uses can be found, contributing to cost reductions. Numerous real-world examples demonstrate how simple; low-cost cleaning solutions may reduce business expenses.

Reacting to Influences from Stakeholders

Companies in the modern day must consider the views of numerous stakeholders. Lenders and insurers are starting to feel a company's environmental policies when deciding whether to do business with them. The corporation could look into less risky alternatives if it can do so. A company may feel pressure from customers and suppliers to improve its environmental practices.

Gaining a Competitive Edge

There is a growing expectation for top-level management to reduce their organizations' environmental impact. Adopting ethical business practices is essential not because of their financial benefits but because it is the right thing to do. Sustainability in the environment is becoming more mainstream as its beneficial ecological and

economic consequences are recognized. Public support increased for transportation companies that took steps to lessen their carbon footprint.

Strategic placement

Several ideas have been proposed to look into a company's future and predict its success. It's vital to remember that the priorities of businesses in this sector are subject to change. Time is an influential factor that can change many outcomes. The company's practices may be harmful to animals. Only two environmental challenges, rising sea levels and a lack of freshwater could negatively influence the company.

Evaluation of the environment's impact

Companies with integrity will first undertake an internal audit to establish the environmental concerns that have the most and most minor noticeable effects on their business. These considerations will form the basis of the company's overall strategy. That's why this information needs to be available to the public. Companies with ethics will find methods to help the planet without making radical adjustments.

Priorities and Policies

Businesses that are concerned about their impact on the environment can choose from a wide variety of approaches. It is essential to list the people in such order if the problems are significant and challenging for the organization to handle. Focusing on the near and far future is vital to making the most of opportunities. This list should be based on findings from a thorough analysis of the organization's systems, practices, and assets. The company may need to bring in new employees to solve complicated challenges as they develop.

Finances

Employees and co-workers who participate in budgeting better understand the organization's goals and values. Financial experts could emphasize the necessity to reduce emissions and energy use. The importance of water and its conservation are two examples. An organization's budget can be utilized for both short-term and long-term planning.

Legal Challenges

The regulatory barriers may exist regarding the intelligent transportation system in terms of policy, government involvement through regulation, procurement and environmental safety standards and strategic alliance in terms of public private partnership.

Laws regarding intellectual property rights, environment laws, consumer protection laws in terms of unfair practice and unfair competition should be considered to protect the interest of society and organization. Necessary laws and policies should be enacted further for the intelligent transportation system for traffic management in the smart cities by central province and local government through proper coordination. There should be consistent in laws among tiers of government. ITS policies, public policy, voluntary industry standards, electronic data recorders, private laws, protecting consumer privacy law should be considered while implementing this system.

INTELLIGENT TRANSPORTATION SYSTEM FUTURE DEVELOPMENT

Congestion and waiting times will reduce as more and more communication, and transportation networks become integrated. International dynamics may be profoundly affected by the widespread adoption of IVS [49]. Also, efficient and sophisticated autos contribute to cleaner air and a lower social standing for their drivers. There has never been a better time to buy a fuel-efficient car because so many are on the market. Tourists who invest in global positioning system (GPS) equipment will have a much simpler and quicker experience moving about. However, "smart mobility" entails more than merely updating our cars to the latest technological standards. Building roads that lead directly to significant thoroughfares is vital to service vehicles and trucks better. The various modes of transportation accessible today can be categorized in several ways. Many of these ideas are only getting started, so they have plenty of space to develop. Congestion in urban transportation systems can be reduced with more research and pilot testing of such programs. Every technique for easing traffic congestion, from the simplest to the most complex, has a rich and varied background [50].

Data Aggregation in Wireless Communication

Due to their reliance on inherently unreliable and unpredictable information, modern GPS systems cannot ease congestion brought on by these accidents. We have not yet reached the end of our potential as a species. Each car provides information as a node in a more extensive network. Even while pedestrians can't buy drivers any

extra time by reacting swiftly, their actions still matter. If there is a significant disturbance, they could help reroute people. People can use this data to determine if they should take the bus or the train on a given day. Transportation experts might use information regarding commute times, traffic patterns, and accidents to make the roads safer for drivers.

Low-Tech Alternatives

Given the minimal likelihood of a completely functional transportation communications network being created in the area anytime soon, it may be sensible to make only modest modifications to the local highways using low-tech means. More intersections may start using dynamic signal timing in the not-too-distant future. Drivers can take advantage of less congested routes at more convenient times thanks to variable speed limits. Recognizing this possibility, despite its increased complexity, is helpful.

INTELLIGENT TRANSPORTATION SYSTEM TO ENVIRONMENTAL SUSTAINABILITY

The goal of environmental sustainability in smart cities can be enhanced by the adoption of an Intelligent Transportation System (ITS) for efficient traffic management. This approach provides a sophisticated and comprehensive strategy aimed at integrating urban mobility with the environment. As the course of industrialisation increases, cities are confronted with a growing array of complex obstacles, including but not limited to issues such as air pollution, traffic jams, and shortages of resources. The concept of Intelligent Transportation Systems (ITS) presents a prospective solution that integrates cutting-edge technology, real-time data analysis, and creative infrastructure to address these difficulties and cultivate a balanced coexistence between urban development and ecological welfare.

The foundation of Intelligent Transportation Systems (ITS) is predicated on the interdependent fusion of several components, encompassing sensors, communication networks, data analytics, and artificial intelligence. The interaction between various elements allows cities to effectively coordinate a well-balanced transport system that not only enhances the efficiency of vehicle movement but also substantially mitigates the negative environmental impacts commonly associated with conventional traffic management strategies.

The ability of Intelligent Transportation Systems (ITS) to collect real-time data from many sources, such as traffic cameras, GPS devices, interconnected vehicles, and infrastructure, plays a crucial role in enhancing its overall efficiency. This information is subsequently examined in order to derive valuable observations regarding traffic patterns, areas of high congestion, and rates of flow. With the utilisation of this up-to-date information, urban planners and traffic management authorities have the ability to proactively apply dynamic policies aimed at improving traffic flow, redirecting vehicles away from congested regions, and minimising idle hours. The primary outcome is a significant decrease in the emissions of greenhouse gases, air pollutants, and noise levels, all of which contribute collectively to the enhancement of the urban environment in terms of health and acceptability.

One notable characteristic of Intelligent Transportation Systems (ITS) is its ability to facilitate a transition towards more sustainable modes of transportation. The provision of timely information about public transport timetables, shared mobility choices, bicycle routes, and pedestrian pathways via Intelligent Transportation Systems (ITS) serves as a catalyst for a shift away from private vehicles among commuters. This not only mitigates the issue of traffic congestion but also fits with wider international efforts to reduce carbon emissions and address the challenges caused by climate change.

Moreover, the inherent adaptability of Intelligent Transportation Systems (ITS) enables traffic signals and control systems to dynamically react to real-time conditions. Through employing predictive algorithms and enabling vehicle-to-infrastructure communication, these systems effectively modify signal timings to optimise the movement of cars, hence reducing the occurrence of stop-and-go patterns that contribute to heightened fuel consumption and emissions. The optimisation of traffic flow not only yields financial benefits for individual commuters but also leads to a substantial reduction in the carbon emissions associated with urban transportation networks.

The positive effects of Intelligent Transportation Systems (ITS) extend beyond immediate benefits. The data that is collected and analysed by ITS serves as a useful resource for the purposes of long-term urban planning and the formation of policies. Through the analysis of trends and patterns over a period of time, urban areas are able to make well-informed judgements about the development of infrastructure, urban design, and zoning regulations. The acquisition of this knowledge enables the development of urban designs that prioritise pedestrian-friendly environments, the incorporation of green spaces, and the strategic placement of public transit hubs. As a result, this promotes sustainable transportation options and reduces the environmental impact of urban areas.

In essence, the notion of attaining environmental sustainability via the implementation of an Intelligent Transportation System for the purpose of traffic management inside smart urban areas is very transformational. By integrating technology, real-time data, and predictive analytics, Intelligent Transportation Systems (ITS) not only improves the efficiency of traffic flow and mitigates congestion but also serves as a catalyst for the development of environmentally sustainable and resilient urban environments. This statement highlights how innovation has the capacity to propel cities towards a future in which transport effortlessly integrates with the requirements of residents and the demands of a sustainable environment.

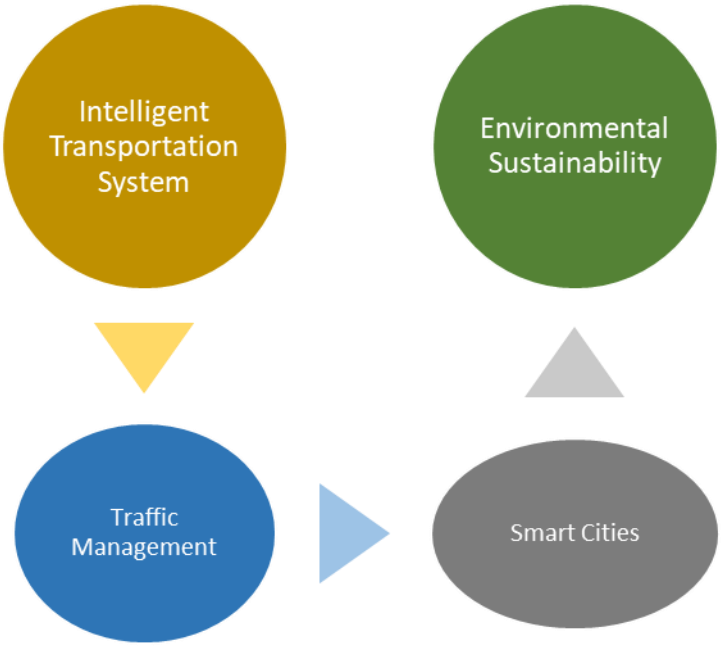

Figure: 4 Intelligent Transportation Systems to Environmental Sustainability

CONCLUSION

Though this theory was developed with public transportation's betterment in mind, its applications are significantly more far-reaching than that. Intelligent transportation systems enhance people's daily lives by making it more straightforward to achieve goals like avoiding traffic and arriving on time. Information will be sent to a remote data center for storage. The limits of cloud-based transportation systems are being tested as traffic is monitored more attentively. The location has traditionally not been a significant factor in how businesses operate or make money. International corporations and people should implement a more nuanced environmental policy that gives local communities a higher priority. Today's business environment is incredibly competitive, and only the most dogged and self-aware entrepreneurs will be able to build successful companies that can survive and thrive. Business operations, including R&D, raw material procurement, production, marketing, sales, law, and finance, could be negatively impacted. Financial institutions (like banks) that wish to maintain their competitive edge must increase the quantity and quality of the information they make available to the general public. Many of the techniques and methods outlined here will be evident to anyone with some background in management accounting.

Conversely, management accountants can assist businesses with short-term and long-term financial and operational planning. The ability to network with C-suite executives is crucial for a career in management accounting. Today's managerial accountants are expected to consider the business landscape at large. For a considerable time, their sole responsibility was guaranteeing the company's smooth operation and financial success. That is what we'd call "green business," anyway. Financial advisors cannot help their clients without this data. Thus, management accountants must have access to it. Traditional traffic lights do not work as well as they used to because of growing populations and other things. Getting rid of these old ways of doing things is all about combining the latest AI technologies with traffic control.

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