Assess the Role of Green Information Systems (Green IS) for Smart Mobility in Smart Cities: a Case Study Approach

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Abstract.

In our changing world, where cities are growing and environmental issues are becoming more urgent, the focus on transportation solutions has become crucial for urban planners and policymakers. One important element of these solutions is the Green Information System (Green IS), which plays a significant role in promoting smart mobility options and sustainable practices. Although there has been an increase in approaches to Smart Cities, their application to smart mobility within Smart City contexts remains limited. Thus, our study aims to shed light on the importance of Green IS in fostering mobility within Smart Cities, with a focus on Dubai. By embracing the potential of Green IS technology, Smart Cities can optimize their transportation systems, significantly reduce their impact, and enhance the mobility experience for their residents. To thoroughly investigate the effectiveness of smart mobility initiatives based on Green IS, we embarked on a journey by conducting a case study focused on Dubai City. Our findings contribute to advancing knowledge about the integration of mobility solutions using Green IS in Smart cities. Drawing from the lessons learned in Dubai City, we have gathered insights into the effective approaches that require enhancement and strategies for fostering sustainable urban mobility and a more environmentally friendly future.

Keywords: Smart mobility · Smart City · Sustainability · Circular economy · Green information system (Green IS).

1 Introduction

Smart mobility solutions are emerging as a crucial response to the intricate challenges of urban transportation in our fast-paced era of urbanization and technological advancements [43]. Smart mobility encompasses a sustainable approach to transportation that utilizes technologies, data-driven solutions, and multi-modal systems to improve efficiency, accessibility, and environmental sustainability [44]. Its primary objective is to enhance living by providing eco-friendly, safe, and accessible transportation options.

In growing cities, the implementation of a well-designed and sustainable transportation system becomes a crucial concept of Smart cities [15,12]. These

cities are facing challenges such as traffic congestion, pollution, and increased energy consumption due to population growth and urban sprawl, which makes it necessary to strike a balance between managing transportation demands and promoting sustainability. Therefore, it is essential to adopt a mobility strategy that integrates elements of design, technological advancements, and different modes of transportation to ensure residents' access to mobility [18] while decreasing environmental impact and optimizing its operations.

For example, optimizing real-time monitoring and traffic management can improve public transportation services and provide guidance to commuters and drivers [32]. Exploiting the benefits of cloud computing and the Internet of Things (IoT) can lead to the development of mobility services that effectively analyze traffic congestion, fuel consumption, and greenhouse gas emissions and address mobility strategies toward a more sustainable approach. Additionally [27] integrating public transportation systems while adapting to vehicle innovations enhances smart mobility strategies in Smart cities. It is crucial to understand how design elements interact and impact smart mobility systems when planning and designing Smart Cities [25].

Green Information Systems (Green IS) represent an approach where digital technologies are utilized to promote sustainability. By definition, Green IS refers to a category of information systems that are designed with the explicit goal of enhancing energy efficiency and reducing carbon footprints through effective information processing and strategic decision-making [41]. The potential of Green IS is particularly evident, in the context of developing cities. These systems enable the real-time collection, analysis, and sharing of data related to transportation dynamics, energy consumption, and environmental impacts. Such data-driven insights empower decision-makers to make choices and develop targeted strategies. For example, they help optimize traffic flow, improve transportation effectiveness, and introduce mobility solutions. Together, these strategic advancements do not only contribute to reducing carbon emissions. Also reflects a progressive transition, towards the concept of Smart cities. Where technological innovations coexist harmoniously with sustainable urban planning.

In this context, Green IS holds potential by facilitating the collection, analysis, and sharing of real-time data on transportation patterns, energy, and environmental impacts; Green IS empowers decision-making processes and targeted strategies aimed at reducing carbon emissions through improving traffic flow efficiency, enhancing transportation effectiveness, and developing new mobility solutions that contribute to expediting the transition towards a Smart City approach [24,8]. Green IS also allows citizens to actively contribute through their ideas and suggestions for environmental preservation.

Even though researchers and practitioners [14] have highlighted the importance of incorporating Green IS in cities' development to achieve environmental sustainability, its application in smart mobility within Smart City contexts remains limited. Thus, a more integrated approach is necessary to consider the intricate trade-offs between city development, mobility efficiency, and sustainability [26].

To bridge this gap, our case study takes an approach to evaluating the role of Green IS in promoting efficient transportation solutions, with a specific focus on Dubai City. We intended to gather insights into the integration and impact of Green IS in smart mobility initiatives in Dubai by using open data sources like transportation databases, reports, academic literature, and government publications. Our analysis of existing sources aims to provide an understanding of Dubai City's experiences with Green IS in transportation and identify best practices for Smart Cities looking to implement similar solutions.

2   Literature Review

2.1   Smart mobility in Smart Cities

Smart Mobility and Smart Cities are two interconnected concepts that have gained popularity in discussions, especially with the rise of the Fourth Industrial Revolution. Smart Mobility refers to a range of transportation solutions that utilize Information and Communication Technology (ICT) to promote sustainable and integrated transportation systems. Smart mobility refers to utilizing technologies to optimize transportation systems' efficiency, sustainability, and safety [45]. It focuses on real-time data, autonomous vehicles, and interconnected modes of transport within a shared economy context. [50].

On the other hand, the term Smart City goes beyond transportation and encompasses an urban landscape where various aspects such as infrastructure and governance are influenced and transformed by digital technologies and data analytics [17]. In essence, Smart Mobility can be seen as a part of the blueprint of a Smart City where transport solutions seamlessly integrate into an urban fabric with the aim of improving quality of life, fostering economic growth, and ensuring environmental sustainability [9].

As ecosystems grow, Smart Cities are examples of a connection between growth, active entrepreneurship, innovative progress, and technologies to support citizens' and companies' needs and ambitions thanks to technological infrastructures and new services. As these cities evolve, the increasing demand for transportation systems calls for a shift towards incorporating mobility solutions. However, Smart Cities face a challenge due to the interplay of limited resources, population growth, and an evolving transportation network when it comes to implementing smart mobility.

Implementing smart mobility technologies in Smart Cities can potentially address these transportation challenges, creating a connected and efficient urban environment. A good example is Intelligent Transportation Systems (ITS) that leverage Green IS and incorporate real-time data and communication technologies to manage traffic flows effectively so as to minimize congestion and reduce travel times, as stated by [55]. Additionally, promoting smart modes of transportation such as autonomous vehicles and shared mobility options can contribute to reducing carbon emissions in line with the sustainability goals of Smart Cities [51].

However, achieving smart mobility requires a deep understanding of the unique dynamics of Smart Cities. Green Information Systems play a role in offering insights into urban spatial patterns, assisting with strategic planning, and helping in the customized implementation of smart mobility solutions. The integration of mobility and Green IS has the potential to tackle the transportation requirements of expanding populations, improve the efficiency of systems, and foster a balanced coexistence between rapid urban development and sustainable practices.

2.2 The Role of Green IS and Smart Mobility in Smart Cities

Cities that are experiencing urbanization and a thriving entrepreneurial spirit are becoming centers for innovation and technological advancements. However, it is crucial to address the pressing sustainability challenges that come alongside this growth. Two key factors in achieving development are Green Information Systems (Green IS) and smart mobility technologies.

Green IS, as defined by [41] refers to the integration of practices with information systems. Its purpose is to reduce impact while enhancing efficiency. In the context of Smart Cities, Green IS plays a significant role in areas including transportation. By monitoring, controlling, and optimizing transportation systems, Green IS can help reduce emissions and encourage friendly practices.

Complementing Green IS with Smart mobility technologies that aim to improve transportation efficiency, safety, and sustainability is vital [51,45]. In smart cities facing population pressures, evolving infrastructure needs, and increasing demands for transportation options, smart mobility provides a response.

By combining Green IS with mobility in Smart Cities, we can achieve urban sustainability. For instance, Intelligent Transportation Systems (ITS), a type of mobility solution, can leverage Green IS to optimize traffic flow, reduce congestion levels significantly, and minimize greenhouse gas emissions [57]. At this time, Green IS has the potential to improve the performance of vehicles and shared mobility platforms, which are important components of smart transportation. This can be achieved through energy management systems and user-friendly interfaces [13].

Essentially, the collaborative implementation of Green IS and smart transportation is crucial for shaping the future of Smart Cities. Despite the challenges posed by urbanization and limited resources, this beneficial integration has the potential to transform Smart Cities into sustainable, intelligent, and livable urban centers. It emphasizes the role of progress in promoting sustainable urban development.

2.3 Green IS for Smart Mobility in Dubai

Dubai, as a growing city on a global scale, represents a blend of fast urbanization, technological advancements, and leadership. In this context, Dubai has embraced the integration of Green Information Systems (Green IS) and smart mobility as aspects of its urban development. The Road and Transport Authority (RTA)

in Dubai has introduced initiatives that integrate Green IS to enhance mobility and reduce carbon emissions [47]. The role of Green IS in mobility is especially noteworthy for cities like Dubai, which are rapidly evolving and facing increasing pressure to minimize the impact of their transportation systems.

In addition to Green IS, smart mobility technologies encompass a range of solutions aimed at enhancing the efficiency, safety, and environmental sustainability of transportation networks. As stated in a report by the Dubai Roads and Transport Authority [20] Dubai's strategic objective is to become a pioneer in mobility by ensuring smooth and sustainable transportation for all residents.

The combination of Green IS and smart mobility in Dubai presents an approach to achieving the city's ambitions for sustainability. The example of implementing Intelligent Transportation Systems (ITS), in Dubai illustrates how Green IS can be utilized to control traffic, alleviate congestion, and minimize the release of greenhouse gases [5]. Additionally, Green IS can support the development of energy charging systems for Dubai's expanding fleet of taxis. This not only contributes to the city's mobility efforts but also aligns with its commitment to environmental sustainability [22].

3   Methods

This research takes a case study approach to explore the importance of Green Information Systems (Green IS) in promoting mobility in cities. The case study method provides detailed insights into how Green IS-based smart mobility initiatives are integrated and their impact, particularly in dynamic Smart Cities like Dubai.

To capture the characteristics and challenges of growing urban centers, we selected Dubai based on specific criteria. These criteria include rates of urbanization given the population of the metropolitan area is expected to grow at an average rate of 1.3% until 2035, which amounts to over 43,000 new residents each year[1]. Moreover, a focus on advancement and innovation, and active efforts to implement smart mobility solutions. Dubai City, with its status as a Smart City and commitment to smart mobility development, was chosen as an ideal case for this study.

The study focuses on projects and interventions related to Green IS-based mobility that have been implemented or are currently under development in Dubai City. Priority is given to initiatives that clearly demonstrate the integration of Green IS technologies with the goal of improving transportation efficiency, and reducing impacts. The research primarily relies on data sources involving the collection and analysis of existing information concerning smart mobility and Green IS in Dubai City. such as transportation database reports from both governmental and non-governmental organizations, academic literature, conference proceedings, and publications on urban planning and Smart City initiatives. Our data collection includes transportation statistics reports on Green IS utilization, case studies of projects, policy documents, and academic studies.

We analyze the data using a case study approach to provide key insights regarding the role of Green IS in smart mobility initiatives. This qualitative analysis helps us understand how effectively Green IS integration promotes smart mobility. It also highlights challenges faced during implementation and areas that can be improved.

By focusing on case studies and utilizing existing data sources, our methodology aims to provide an assessment of how Green IS has been implemented and contributes to mobility in a growing Smart City like Dubai. We expect our findings to offer insights and recommendations for policymakers, urban planners, and stakeholders worldwide who are involved in developing transportation solutions for Smart Cities.

4   Result and Discussion

4.1   Description of the study area

Dubai stands out for its development and progress, making it a prominent Smart City in the region. It combines state-of-the-art infrastructure with initiatives to become a center for commerce, tourism, and technology [54,39]. The city's commitment to sustainability and diversity underscores its ambition to become a leader in responsibility and inclusivity. One of the drivers of this transformation is Dubai's Smart Mobility Initiatives, which showcase its dedication to integrating mobility solutions into its comprehensive Smart City program. By embracing technologies like real-time traffic management systems, electric public transportation, shared mobility services, autonomous vehicles, and drone taxis, Dubai is taking steps towards sustainable and eco-friendly transportation. Recognized as a pioneer by the International Data Corporation (IDC) Dubai's experiences with Green IS in developing mobility solutions provide valuable insights for cities worldwide that are considering similar urban transformations [28,34].

To shed light on Dubai's evolving landscape, the table below presents data on ridership across modes of transportation from 2018 to 2022. The consistent increase in ridership during these years highlights the growing demand for transportation options in the city. Remarkably, in the year 2020, there was a decrease in the number of people using modes of transportation. This decline clearly reflected the impact of the COVID-19 pandemic on how people move around. However, in the years that followed, there has been a recovery, as the numbers have not only returned to pre-pandemic levels but have also surpassed them. This continuous growth in ridership highlights the need for Dubai to incorporate smart solutions for getting around. By implementing an information system, Dubai aims to modernize its transportation framework and stay ahead in terms of smart mobility. This approach involves using technology to optimize transportation efficiency while aligning with sustainability goals and meeting user needs.

Transport Type	Years				
	2018	**2019**	**2020**	**2021**	**2022**
Metro	204,405,401	202,978,067	113,626,405	151,255,363	225,142,444
Tram	6,395,117	6,507,770	3,653,521	5,340,585	7,482,829
Public Transport Buses	167,929,519	157,096,436	95,424,241	116,324,308	157,293,355
Marine	14,139,475	14,364,255	8,049,541	10,936,084	15,977,170
Shared Mobility	22,161,117	33,235,586	15,290,502	22,916,449	32,470,967
Taxi	176,097,537	179,856,820	109,940,453	154,713,389	183,049,001
Total	591,128,166	594,038,934	345,984,663	461,486,178	621,415,766

Table 1. Number of Public Transport Ridership - Emirate of Dubai
(source: Dubai's statistics center)

4.2 Overview of Green IS Integration in Dubai's Smart Mobility Initiatives

Dubai's government, as part of the 'Smart Dubai 2021 Strategy," is embarking on a green transformation journey. They are leveraging Green Information Systems (Green IS) to enhance their smart mobility landscape [2,28]. This initiative aims to improve transportation systems and alleviate traffic congestion. Promote friendly modes of transportation. The integration of Green IS has resulted in enhancements in transportation efficiency, including reduced travel times, fewer traffic bottlenecks, and increased adoption of commuting options by the public [53,16].

Moreover, Green IS's integration into Dubai's smart mobility initiatives exhibits a remarkable commitment to sustainability. With the strategic deployment of digital platforms for real-time traffic management, electrification of public transport, promotion of shared mobility services, and the exploration of advanced technologies like autonomous vehicles and drone taxis, Dubai is redefining urban transportation [19]. Garnering acknowledgment from the International Data Corporation as a regional leader, Dubai's successful implementation of Green IS-enabled mobility solutions underlines its potential as a model for cities worldwide aiming to achieve a sustainable urban mobility future [34].

However, Dubais' ambitious goal to become a leader, in transportation poses various challenges when it comes to protecting data privacy. One of the concerns relates to the gathering, processing, and storage of large amounts of personalized mobility data, which could potentially infringe upon individual privacy rights. This concern is especially significant due to the integration of Internet of Things (IoT) devices, machine-to-machine (M2M) communication, and real-time data analysis that are inherent in these transportation systems[52]. To address these challenges, Dubai has implemented measures to ensure the security of user data. The Smart Dubai initiative, along with the Dubai Data Law, emphasizes the importance of safeguarding data. Requires those handling data to implement robust measures that guarantee its integrity and confidentiality. Furthermore, advanced cryptographic solutions and anonymization techniques have been in-

troduced to obscure user information, thereby enhancing data security while fostering an ecosystem, for smart transportation [38]. Dubai has made progress in achieving its goals for mobility, largely thanks to successful collaborations between the public and private sectors. For example, the Open Data Committee (ODC), consists of eight organizations: Dubai Smart Government Department, Department of Economic Development, Dubai Police, Dubai Roads and Transport Authority (RTA), Dubai Municipality, Department of Tourism and Commerce Marketing, Telecommunications Regulatory Authority, and Dubai Centre for E-Security [39,49] has fostered the exchange of knowledge, innovation, and financial investments. Major private partners, including known technology companies and emerging local enterprises, have played a role in this endeavor.

In the following sections, we present the main smart mobility initiatives in Dubai and highlight their sustainability outcomes.

4.3 Dubai Smart Mobility Initiatives and its Sustainable Transportation Outcomes

Dubai's dedication to technology, data analytics, and the integration of Green IS is evident in its smart mobility initiatives. These initiatives aim to transform transportation systems, showcasing Dubai as a role model for cities. By embracing sustainable mobility solutions, Dubai paves the way for a connected and efficient urban future. Their suite of initiatives demonstrates how Green IS can revolutionize transportation.

Dubai Autonomous Transportation Strategy: Dubai initiated a strategy in 2016 with the goal of transitioning 25% of the city's transportation to autonomous modes by 2030. This thinking initiative promises benefits, such as improving traffic efficiency, boosting the economy, and enhancing safety for residents [29].

Exploring the potential of autonomous vehicles is another aspect of Dubai's efforts. In this endeavor, research has shown encouraging outcomes, indicating that Connected Autonomous Vehicles have the potential to significantly reduce delays, enhance speeds, and decrease travel time during non-peak hours [7]. These advancements position Dubai as a pioneer, in transportation innovation, paving the way for a future where transportation is safer, more efficient, and increasingly autonomous.

In terms of Dubai, smart mobility initiatives have brought cost savings. The Autonomous Transportation Strategy alone is projected to save up to AED 22 billion by 2030 by reducing transportation costs, accidents on roads, and environmental pollution[19]. Furthermore, efforts such as Multi-Modal Transportation Integration and Smart Public Transit Planning have optimized resource allocation and operational efficiency in public transportation systems. This does not only benefit commuters but also generates cost savings for the city itself.

To align with this vision Dubai has developed an integrated strategic transportation plan aimed at addressing challenges while enhancing the city's overall quality of life. This rounded strategy includes expanding the road network, improving public transportation systems, creating infrastructure for pedestrians

and cyclists, implementing intelligent transportation technologies, and raising awareness about traffic safety [33].

Leading this movement is Duba's Roads and Transport Authority (RTA) which actively promotes the use of public transport while striving to reduce reliance on vehicles. The RTA has prioritized projects including an autonomous metro system, a cutting-edge tram project, an efficient bus system, and an innovative water bus/taxi system. Their ultimate goal is to increase the percentage of public transportation trips from 6% in 2005 to 30% by 2020 [4].

Dubai Metro:

The Dubai Metro, as one of the longest driverless metro networks worldwide, has made remarkable advancements in reducing the city's carbon footprint by offering an efficient and eco-friendly public transportation alternative [30]. The Dubai Metro stands as a shining example of progress in the pursuit of sustainable mobility with its sophisticated infrastructure and cutting-edge technology. Through its emphasis on information systems within the transportation sector, the Dubai Metro has played a crucial role in significantly curbing carbon emissions in Dubai.

By establishing a network equipped with state-of-the-art technologies and eco-conscious initiatives, the Dubai Metro has alleviated traffic congestion while promoting a greener urban transportation system [11]. Its efficient, modern, and reliable services are vital for facilitating mobility in a city that ranks as the most visited destination globally and is undergoing expansion.

It is noteworthy that Dubai Metro management has implemented the Met Pass model. This system plays a role in crisis management. Ensuring security. The model incorporates action concepts to enhance adaptability within the security system to effectively address emerging situations [6]. Moreover, when transit-oriented shopping malls are built near metro stations, it does not increase the number of riders. Also improves the long-term viability of public transportation systems [3].

The Dubai Metro serves as a model for transit-oriented development in cities across the Gulf region. It offers insights into enhancing infrastructure to meet the demands of mass transit [35]. This remarkable achievement reflects Dubai's dedication to creating an efficient future, for transportation.

Intelligent Traffic Management System:

One of the primary smart mobility initiatives in Dubai is the real-time traffic management system. Adopting traffic systems to tackle congestion and improve travel times based on real-time traffic conditions. Dubai's Roads and Transport Authority (RTA) implemented Intelligent Traffic Systems (ITS) in November 2020, which improved incident monitoring by 63 percent, shortened emergency response times by 30%, and cut travel times by 20% [31,10] To achieve this they utilize a cutting-edge traffic management system supported by Green IS technology, which gathers data from sources like traffic sensors, cameras, and GPS devices [42,16]. This system provides real-time information to both traffic controllers and commuters, allowing them to plan their routes efficiently and make adjustments to ensure traffic flow.

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The implementation of this system plays a role in addressing the increasing vehicular traffic in the city while also reducing accidents and minimizing bottlenecks. It incorporates state-of-the-art techniques such as speed limits and logistic regression methods to predict accidents and adapt speed limits accordingly [21,37]. By employing strategies like speed limit control, notable enhancements have been witnessed in traffic performance and safety measures since they reduce average delay time, total travel time, and the number of stops [36].

One of the elements of Dubai's traffic management is its innovative use of computer vision techniques for precise vehicle detection and classification. This capability enables congestion reduction efforts well as prioritization of emergency vehicles further strengthening the city's expertise in managing its traffic effectively [40]. Additionally, this comprehensive system offers features like real-time vehicle travel monitoring, accurate parking space identification, and dynamic speed limitations, on road segments affected by weather conditions [48]. These advancements have benefits, including making transportation more efficient, in terms of time and cost and they contribute to enhancing traffic flow and safety positioning Dubai as an example of mobility, on a global scale.

Electric Vehicle Initiatives:

Dubai is taking steps, towards sustainability goals and embracing green urbanization. To encourage the use of electric vehicles (EVs) Dubai has implemented a range of incentives. This initiative is a result of collaboration between the Dubai Electricity and Water Authority (DEWA) and the Roads and Transport Authority (RTA)[23]. these incentives aim to overcome typical barriers to EV adoption and create an enabling environment for users. Commencing in 2017 with DEWA's free charging initiative for registered EV users, the program has subsequently been extended to include non-commercial users until the end of 2021. Moreover, as of July 1st, 2020, the RTA has supplemented this effort by exempting Dubai-licensed EVs from public parking fees for two years and providing free parking tags. Together, these initiatives underscore Dubai's commitment to transforming its transportation system into a more environmentally responsible, energy-efficient model, reflecting a broader regional trend towards decarbonization and technological innovation in mobility.

Smart Rental Bikes: Dubai has recently launched an initiative called Smart Rental Bikes as part of its urban mobility strategy. The aim is to improve connectivity and promote environmentally friendly options, within the city. This innovative system incorporates technologies that allow users to easily access, locate, and rent bicycles through mobile applications and interactive digital platforms [47]. By providing sustainable transportation alternatives, Smart Rental Bikes not only reduce reliance on traditional means of transportation but also help alleviate traffic congestion. Moreover, this project aligns with Dubai's sustainability objectives by encouraging a decrease in carbon emissions and fostering a culture of health and active lifestyles. The introduction of Smart Rental Bikes in Dubai demonstrates the city leadership in utilizing technology intelligently to facilitate mobility showcasing its commitment, to creating adaptable transportation networks that cater to the needs of modern society [47]

Smart Parking Solutions: Dubai is actively pursuing efficiency and sustainable mobility by implementing parking solutions that utilize Green IS technology. The Dubai Roads and Transport Authority (RTA) is leading this initiative, which involves the installation of 2,030 ground sensors and 70 overhead digital cameras to monitor 3,035 parking spaces in areas of the city [46]. These sensors and cameras are integrated into a central control system that provides real-time information, about parking spaces through apps and digital platforms. The smart design of this system not only helps drivers locate parking spaces but also allows them to reserve spots in advance, reducing the time typically spent searching for parking by 20%–30%. This approach minimizes driving and congestion, contributing to the efficient use of urban infrastructure while also supporting environmental goals such as improving air quality and reducing carbon emissions. The success of Duba's parking initiative highlights the impact that digital technology can have on urban planning. It exemplifies a trend toward data-driven solutions, for contemporary urban challenges.

Multi-Modal Transportation Integration: Dubai has taken an approach, to transportation by developing a multi-modal system. By utilizing Green IS technology, the city has seamlessly integrated transportation modes. Provides real-time transit information encouraging the use of public transportation and shared mobility services [56]. Keeping up with urban planning trends, Dubai has implemented an advanced GIS-based multi-modal transportation system. This system allows commuters to access up-to-date information on transit options such as buses, metros, trams, and bike-sharing stations. All of these choices are conveniently available through user platforms The aim is to reduce reliance on vehicles by offering well-connected travel solutions. This not only enhances transportation efficiency but also promotes sustainable and environmentally conscious commuting practices. Its success in leveraging Green IS for modal transportation reflects its forward-thinking urban strategy that prioritizes accessibility, sustainability, and technological innovation for efficient city living.

Overall, these initiatives demonstrate Dubai's vision, for creating a sustainable transportation ecosystem that puts people at the center. Dubai's commitment, to embracing progress sets a shining example for cities, inspiring them to reshape their urban environments.

Initiative with the application of Green IS	Description
Real-Time Traffic Management System	Green IS-powered system that collects real-time data from traffic sensors, cameras, and GPS devices, providing valuable insights to both commuters and traffic controllers. It results in an improved traffic flow, reduced travel times, and swift emergency response.
Smart Parking Solutions	Leverages Green IS to offer real-time information on available parking spaces, resulting in reduced search time, alleviated congestion, and optimized parking utilization.
Multi-Modal Transportation Integration	A comprehensive transportation system that integrates various modes of transport, providing real-time transit information and encouraging the use of public transport.
Smart Public Transit Planning	Utilizes Green IS for optimizing bus routes and strategically locating transit stops, enhancing accessibility and convenience for commuters.
Pedestrian and Cyclist Safety Initiatives	Employs Green IS-based projects to identify high-risk areas and design safer infrastructure for pedestrians and cyclists.
Dubai Autonomous Transportation Strategy	Aims to transform 25% of total transportation to autonomous mode by 2030, promising significant economic benefits, improved traffic efficiency, and enhanced safety.
Electric Vehicle Initiatives	Promotes the use of electric vehicles by providing incentives like installing charging stations throughout the city and offering free public parking for electric cars.

Table 2. Summary of Dubai's Smart Mobility Initiatives

5 Conclusion

5.1 Summary of Findings

Dubai's government is embarking on a green transformation journey, as part of the 'Smart Dubai 2021 Strategy.' They are utilizing Green Information Systems (Green IS) to enhance their smart mobility landscape. According to the presented case study, Dubai's development and progress make it a prominent Smart City in the region. It combines cutting-edge infrastructure with initiatives to become a hub for commerce, tourism, and technology. For example, Dubai Metro serves as an example of transit-oriented mobility solutions with its advanced infrastructure and technology. By leveraging Green IS in its traffic management system, it has successfully improved emergency response times and travel efficiency. These efforts establish a replicable blueprint for effectively addressing the diverse challenges of urban transportation. Ultimately, this positions Dubai as a role model for sustainable mobility solutions.

This research uncovers the impact of Green IS-enabled smart mobility projects on the transportation landscape of Dubai. The integration of Green IS technology has brought improvements in transport efficiency and congestion reduction

evident through reduced travel times and minimized vehicle queues. By promoting transport options facilitated by Green IS initiatives, there has been a decrease in energy consumption and a substantial reduction in greenhouse gas emissions. However, the analysis also highlights some challenges, such as limitations and concerns regarding data privacy and security as well as the need for technical expertise. These findings emphasize the role played by Green IS technology in revolutionizing Dubai's transportation ecosystem and its potential application in Smart Cities worldwide.

5.2 Policy Implications and Recommendations

The use of Green IS technology in planning has proven to be effective, resulting in improvements in infrastructure planning, managing transportation demand, and assessing environmental impact. It is crucial to promote awareness and encourage participation in smart mobility initiatives enabled by Green IS. This can be achieved through means such as outreach campaigns, platforms for citizen engagement, education, and training programs. Collaborating with sectors and academic institutions is also important in leveraging Green IS technology. Partnerships like public-private Partnerships, research collaborations, and standardized data sharing and interoperability can contribute to the implementation of Green IS-enabled smart mobility initiatives. Dubai can lead the way in this area. Serve as a model, for cities looking to embrace smart mobility with the help of Green IS technology.

5.3 Limitations and Future Research Directions

Although this research provides insights, it does acknowledge its limitations in terms of an understanding of Green IS-enabled urban mobility solutions. These limitations include the study's focus on Dubai, the use of data, and the concentration on specific contributions of Green IS technology. To gain an understanding, future research should consider a wider range of cities, incorporate empirical evidence, from real projects, take into account social equity considerations, and explore the sustainability and scalability of Green IS-enabled smart mobility initiatives. By addressing these gaps and expanding research horizons, we can gain insight into Green IS-enabled urban mobility solutions.

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