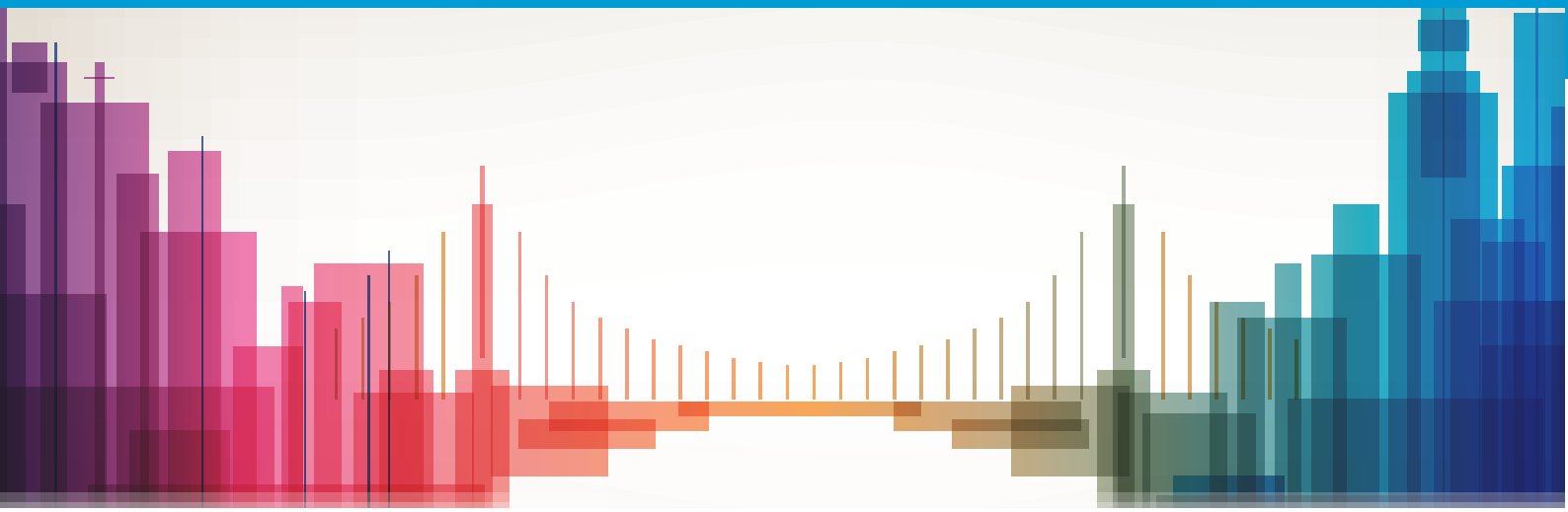
Dubai's self-driving transport strategy

Case study of the U4SSC Guide to autonomous cities and AI: The next frontier of urban transformation



Convention on Biological Diversity

United Nations ECLAC

Food and Agriculture Organization of the United Nations

UNIDO

ITU

UNDP

United Nations Economic Commission for Africa

UNECE

UNESCO United Nations Educational, Scientific and Cultural Organization

UN environment programme

UNEP FINANCE INITIATIVE

United Nations Framework Convention on Climate Change

unitar United Nations Institute for Training and Research

UN HABITAT FOR A BETTER URBAN FUTURE

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UN 4 PARTNERSHIPS

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Foreword

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Disclaimer

The opinions expressed in this publication are those of the authors and do not necessarily represent the views of their respective organizations or U4SSC members. In line with the U4SSC principles, this report does not promote the adoption and use of Smart City technology. It advocates for policies encouraging responsible use of information and communications technologies (ICTs) that contribute to the economic, environmental and social sustainability as well as the advancement of the 2030 Agenda for Sustainable Development and the Pact for the Future and its Global Digital Compact.

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Contents

Abbreviations and acronyms

Abbreviation	Full form
AI	Artificial Intelligence
AV	Autonomous Vehicle
CBTC	Communication-Based Train Control
DSOA	Dubai Silicon Oasis Authority
HD	High-Definition
LiDAR	Light Detecting and Ranging
MoU	Memorandum of Understanding
RTA	Roads and Transport Authority
SDT	Self-Driving Transport
UAE	United Arab Emirates
USA	United States of America
V2I	Vehicle-to-Infrastructure

Executive summary

Dubai's Self-Driving Transport Strategy is a forward-looking initiative that positions the emirate as a global leader in autonomous and smart urban mobility, with the goal of converting 25 per cent of all transport trips into smart and driverless journeys by 2030. Anchored in Dubai's broader smart city vision, the strategy combines advanced technologies such as artificial intelligence, machine learning, LiDAR, high-definition mapping, vehicle-to-infrastructure communication and automated rail systems to improve safety, reduce transport costs, lower emissions and enhance the efficiency of the city's mobility network. The case study highlights Dubai's phased implementation approach, including pilot projects, infrastructure upgrades, regulatory frameworks, public awareness efforts and international partnerships with technology leaders and research institutions. It also underscores the strategic role of the Dubai Metro as an established driverless transport system and model for scalable autonomous mobility. While challenges remain in areas such as infrastructure readiness, cybersecurity, data privacy, public acceptance and regulatory alignment, Dubai's integrated governance, collaborative approach and commitment to innovation demonstrate how autonomous transport can support more connected, sustainable and resilient urban transformation.

1 Introduction

Dubai has consistently positioned itself at the forefront of technological innovation, particularly in the realm of transportation. The emirate's commitment to becoming a global leader in smart mobility is exemplified by its ambitious Self-Driving Transport (SDT) Strategy. This comprehensive plan aims to transform 25% of all transportation trips in Dubai into smart and driverless journeys by 2030. This case study delves into the multifaceted aspects of Dubai's SDT Strategy, exploring its vision, strategic objectives, technological foundations, implementation roadmap, international collaborations, regulatory frameworks, and anticipated challenges.

2 Vision and strategic objectives

The SDT Strategy is an integral component of Dubai's broader Smart City initiative. Announced by His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice-President and Prime Minister of the UAE and Ruler of Dubai, the vision is to ensure that by 2030, a quarter of all transportation trips in Dubai are smart and driverless. This initiative is projected to yield AED 22 billion annual economic benefits, stemming from various advantages such as enhanced safety, reduced transportation costs, environmental sustainability, and improved productivity.

The primary objectives of the SDT Strategy encompass:

1) **Safety enhancement**: Mitigating human errors, which are a leading cause of traffic accidents, through the deployment of autonomous technologies.
2) **Cost efficiency**: Lowering transportation expenses for residents and visitors by reducing operational and maintenance costs associated with human-driven vehicles.
3) **Environmental sustainability**: Decreasing carbon emissions by promoting the use of electric and autonomous vehicles, thereby contributing to a greener urban environment.
4) **Economic impact**: Stimulating economic growth by fostering innovation, creating new job opportunities in the tech sector, and enhancing the overall efficiency of the transportation network.

3 Technological foundations

Dubai's approach to autonomous transportation is underpinned by several key technological components:

1) **Artificial intelligence (AI) and machine learning**: These technologies enable vehicles to interpret complex traffic scenarios, make informed decisions, and learn from real-time experiences to improve performance.

2) **Advanced sensor systems**: Utilizing LiDAR, radar, and camera systems, autonomous vehicles can achieve a comprehensive 360-degree awareness of their surroundings, facilitating safe navigation through urban landscapes.

3) **High-definition mapping**: Developing precise and up-to-date maps is crucial for autonomous navigation, allowing vehicles to understand and predict road layouts, traffic patterns, and potential obstacles.

4) **Vehicle-to-infrastructure (V2I) communication**: This technology enables vehicles to interact with traffic signals, road signs, and other infrastructure elements, ensuring seamless integration into the existing transportation ecosystem.

4 Implementation roadmap

The SDT Strategy outlines a phased approach to achieving its ambitious goals:

1) **Research and development**: Collaborating with academic institutions, technology companies and research centers to advance autonomous vehicle technologies and address region-specific challenges such as extreme weather conditions and diverse driving behaviours.

2) **Pilot projects**: Conducting controlled trials of autonomous vehicles in designated areas to assess performance, safety and public acceptance. Notably, the Roads and Transport Authority (RTA) has initiated data collection and testing of autonomous vehicles in the Jumeirah 1 area, utilizing Chevrolet Bolt-based vehicles equipped with advanced sensors.

3) **Infrastructure development**: Upgrading urban infrastructure to support autonomous vehicles, including the installation of smart traffic signals, dedicated lanes, and charging stations for electric autonomous vehicles.

4) **Public awareness campaigns**: Educating residents and visitors about the benefits and safety aspects of autonomous transportation to build trust and encourage adoption.

5) **Regulatory frameworks**: Establishing comprehensive policies and legislation to govern the testing, deployment, and operation of autonomous vehicles, thereby ensuring safety and compliance with international standards.

5 International collaborations

Dubai recognizes the importance of global partnerships in achieving its autonomous transportation objectives:

1) **Cruise collaboration**: In a landmark agreement, the RTA partnered with Cruise, a leading self-driving technology company, to deploy autonomous vehicles for taxi and e-hailing services.

This initiative positions Dubai as the first city outside the USA to operate Cruise's self-driving cars, with plans to introduce up to 4 000 autonomous vehicles by 2030.

2) **Dubai Silicon Oasis Authority (DSOA)**: An MoU was signed with DSOA to facilitate the testing of autonomous vehicles within the technology park, providing a controlled environment to evaluate performance and integration with smart city infrastructure.

6 Regulatory framework

To ensure the safe and effective deployment of autonomous vehicles, Dubai has implemented a robust regulatory framework:

1) **Testing permits**: The RTA has issued permits for the supervised testing of autonomous vehicles on public roads, marking a significant milestone in the strategy's implementation.
2) **Operational guidelines**: Comprehensive guidelines have been developed to standardize the operation of autonomous vehicles, covering aspects such as safety protocols, data privacy, and interaction with traditional vehicles and pedestrians.
3) **Insurance and liability**: Collaborations with insurance providers aim to establish frameworks for liability and coverage specific to autonomous vehicles, addressing concerns related to accidents and malfunctions.

7 Challenges and considerations

While the SDT Strategy is ambitious, several challenges must be addressed:

1) **Technological limitations**: Ensuring that autonomous vehicles can operate safely in Dubai's unique environmental conditions such as high temperatures and sandstorms requires ongoing research and development.
2) **Infrastructure readiness**: Significant investments are needed to upgrade existing infrastructure to support autonomous vehicles, including the deployment of smart traffic management systems and dedicated lanes.
3) **Public acceptance**: Building trust among residents and visitors is crucial for widespread adoption. Transparent communication and demonstrable safety records are essential to alleviate concerns.
4) **Regulatory Alignment**: One of the major hurdles in the successful implementation of autonomous transport systems is ensuring that regulatory frameworks are aligned with international standards. As self-driving vehicles evolve rapidly, so regulations must adapt to new technologies and potential risks, which require ongoing updates. Dubai's effort to collaborate with global partners, including tech companies and regulatory bodies, helps in crafting future-

proof policies that ensure safety, fairness, and global alignment in autonomous transport practices. There is a strong need for a regulatory ecosystem that can balance innovation with public safety and consumer protection.

5) **Security and Data Privacy**: Autonomous vehicles heavily rely on data collection, including real-time traffic information, vehicle performance data, and potentially sensitive user data. As autonomous systems become more integrated with smart city infrastructure, so ensuring robust cybersecurity measures will be crucial to protect both public and private data. Furthermore, adhering to data privacy regulations and maintaining the trust of users will be a priority in Dubai's SDT Strategy.

8 Economic and environmental impact

The SDT Strategy is poised to have far-reaching economic and environmental implications for Dubai. The successful deployment of autonomous vehicles can lead to significant savings and economic growth:

1) **Cost reduction**: Transitioning to autonomous transport is expected to reduce transportation costs across multiple sectors, including taxis, logistics and personal transportation. Autonomous vehicles can operate with fewer human resources, optimize fuel consumption, and lower maintenance costs. This reduction in operational overheads can make transportation more affordable for businesses and consumers.
2) **Economic growth**: By promoting the growth of autonomous vehicle-related technologies, Dubai aims to create new industries and job opportunities, particularly in the tech, innovation and regulatory sectors. Moreover, the city's position as a global leader in autonomous mobility could attract international investments and partnerships, bolstering its economic standing.
3) **Environmental sustainability**: One of the key objectives of the SDT Strategy is to create a more sustainable transportation system. Self-driving vehicles, especially electric ones, can significantly reduce the overall carbon footprint of the city's transportation network. Moreover, the introduction of autonomous fleets can enhance the efficiency of public transport, reducing the number of vehicles on the road and lowering congestion-related emissions.

9 Public transport integration

The integration of autonomous vehicles into the broader public transport network is central to the SDT Strategy's success. Dubai's transportation network will become more interconnected, with

autonomous vehicles complementing existing modes of transport, such as the metro, buses, and taxis. The plan includes:

1) **Multimodal transport integration**: Autonomous vehicles will work seamlessly with other modes of transport to create a more efficient and accessible mobility ecosystem. This approach allows users to choose the most efficient, cost-effective, or environmentally friendly transport option based on their needs.
2) **Shared and on-demand services**: By incorporating autonomous vehicles into shared mobility services, such as self-driving taxis or shuttle services, the city can reduce the total number of vehicles on the road. This approach could alleviate congestion and make transport more affordable and flexible for residents and visitors alike.
3) **Efficient traffic management**: The deployment of autonomous vehicles, combined with smart traffic management systems, could lead to smoother traffic flow and more effective use of infrastructure. The real-time data generated by autonomous vehicles could be leveraged to improve traffic prediction models and optimize routes, leading to reduced congestion and more reliable travel times.

10 Strategic collaborations and global leadership

Dubai's SDT Strategy is not being developed in isolation. The city is actively engaging with international stakeholders to ensure the global competitiveness of its autonomous transport ecosystem:

1) **Partnerships with technology leaders**: Collaborating with companies like Cruise, Waymo, and local innovators in Dubai has been a key factor in accelerating the development and deployment of autonomous transport technologies. These partnerships bring valuable expertise, technologies, and research capabilities, further cementing Dubai's role as a leader in smart mobility.
2) **Global smart city alignment**: Dubai has long been a key player in the global smart city movement, and the SDT Strategy is a continuation of this trend. The city is committed to fostering international collaborations with other cities and nations involved in autonomous mobility. By aligning with global best practices and standards, Dubai aims to ensure that its strategy not only meets local needs but is also compatible with global trends in autonomous transport.
3) **Research and development initiatives**: Dubai is home to a number of research and development initiatives focused on autonomous transport. The RTA's collaborations with academic institutions and technology firms support the continuous refinement and innovation of autonomous vehicle technologies. These efforts help identify potential challenges and develop solutions that enhance the effectiveness and safety of autonomous transport systems.

11 Future of the SDT strategy

Looking ahead, the SDT Strategy remains flexible to accommodate emerging trends and technological breakthroughs. In the coming years, the following areas are expected to play a pivotal role in the success of Dubai's autonomous transport ecosystem:

1) **Artificial intelligence and machine learning**: As AI technologies continue to advance, the capabilities of autonomous vehicles will improve, particularly in their ability to process complex scenarios and interact with humans and other vehicles. AI will also be essential in optimizing traffic management and vehicle routing, thereby further enhancing the efficiency of Dubai's transport system.
2) **Autonomous logistics and freight transport**: While the initial focus has been on passenger transport, Dubai is also exploring the potential of autonomous vehicles in logistics and freight delivery. The rise of autonomous trucks and drones could revolutionize the supply chain industry, making it more efficient and sustainable.
3) **Integration with other smart city services**: As Dubai's smart city initiatives evolve, there will be opportunities to integrate autonomous transport with other city services. This could include everything from smart parking systems to real-time information sharing with other public services, creating an interconnected ecosystem that provides greater convenience and efficiency for residents and visitors.

12 Dubai Metro – Leading the shift toward autonomous urban mobility and contributing to SDT strategy

Overview

Launched in 2009, the Dubai Metro stands as a hallmark of innovation in urban transportation. Operated by Dubai's Roads and Transport Authority (RTA), it is one of the world's longest fully automated, driverless metro systems. A cornerstone of Dubai's smart mobility vision, the metro integrates cutting-edge technology to deliver safe, efficient, and sustainable transit solutions aligned with the city's broader Self-Driving Transport Strategy.

Autonomous innovation

The Dubai Metro operates without human drivers, leveraging a sophisticated Communication-Based Train Control (CBTC) system. This automation ensures real-time train coordination, precision in scheduling, and optimized energy use. Every aspect from station arrivals to door operations and speed regulation is managed autonomously through a central control system, reducing human error and improving safety.

These capabilities have positioned the metro as a critical component in Dubai's Self-Driving Transport Strategy, which aims to make 25 per cent of all transport in the city autonomous by 2030. As the earliest large-scale autonomous transit infrastructure in the UAE, the metro demonstrates both technical feasibility and public trust in driverless systems.

Impact and Efficiency

- **Ridership**: Recorded 275.4 million riders in 2024, reflecting a 6 per cent increase compared with 2023.
- **Network**: Spans 90 km with 53 stations in 2024.
- **Punctuality**: **Achieved 99.7 per cent punctuality** rate.
- **Environmental impact**: Reduced road congestion and supported Dubai's sustainability targets through energy-efficient operations and modal shift encouragement.

Strategic Relevance

The Dubai Metro not only serves as a practical transport solution but also as a symbol of urban digital transformation. It reinforces Dubai's position as a global testbed for smart city technologies, showcasing how autonomous transit can be seamlessly integrated into daily urban life. The metro also functions as a model for other megacities seeking to implement scalable, driverless public transport systems.

13 Lessons learned from Dubai's self-driving transport strategy: Implications for urban autonomous systems

1) Governance and policy must be agile and visionary

One of the core lessons from Dubai's self-driving transport journey is the necessity of flexible yet future-oriented governance frameworks. The rapid evolution of autonomous systems demands policies that are not only responsive but also anticipatory. Cities embarking on autonomous mobility must establish regulatory sandboxes and pilot zones to test, refine, and scale innovations safely. Dubai's proactive legislative stance, supporting AV testing and data exchange protocols, illustrates how adaptive policymaking can stimulate innovation while maintaining public trust and safety.

2) Human-centered design enhances adoption

While the technology behind autonomous transport is critical, its successful urban deployment hinges on user trust, inclusivity and accessibility. Dubai's emphasis on designing user-friendly interfaces, ensuring equitable access across demographic groups, and providing safety assurances highlights the importance of integrating social design principles into technological rollouts. Future

cities must not only build intelligent systems but also ensure that these systems serve the diverse needs of their populations, the elderly, the disabled, tourists and residents alike.

3) Infrastructure readiness is a prerequisite

A key insight is that autonomous vehicles do not operate in isolation, they rely on a well-prepared urban infrastructure. From digital twins and HD maps to 5G connectivity and integrated traffic signal systems, Dubai's investment in smart infrastructure has laid the groundwork for AVs to function safely and efficiently. For other cities, this underscores the importance of synchronizing urban planning with technological deployment, ensuring roads, data networks, and sensor systems evolve together.

4) Collaboration drives impact

Another pivotal takeaway is that public-private partnerships and global alliances are essential. Dubai's strategic collaborations with autonomous vehicle developers, AI firms, and academic institutions demonstrate the value of cross-sectoral engagement. For cities aspiring to introduce autonomous systems, establishing platforms that encourage innovation and joint ventures can accelerate progress and distribute risk more effectively.

5) Data ethics and cybersecurity are urban imperatives

Autonomous systems generate, transmit, and act upon vast streams of real-time data. A fundamental lesson from Dubai's strategy is the need to embed cybersecurity and data privacy mechanisms at every layer from vehicle software to citywide data platforms. Establishing transparent data governance structures not only ensures legal compliance but also fosters citizen confidence, which is vital for adoption.

14 Conclusion

Dubai's Self-Driving Transport Strategy is a bold, transformative initiative with the potential to reshape urban mobility. By leveraging cutting-edge technologies, fostering international partnerships, and focusing on public safety and environmental sustainability, Dubai is positioning itself as a global leader in autonomous transportation. Although the journey ahead is complex and filled with challenges, the long-term economic, environmental, and societal benefits make the strategy a key pillar in Dubai's vision to become the smartest and most sustainable city in the world.

The Dubai Metro (briefly explained in this case study) exemplifies how autonomous systems can reshape the future of urban mobility. Its contribution to the Self-Driving Transport Strategy reflects Dubai's commitment to being at the forefront of smart, connected, and sustainable cities. As cities worldwide navigate the challenges of growth and climate change, the Dubai Metro offers a replicable and visionary path forward.

Through its collaborative approach, regulatory foresight, and commitment to innovation, Dubai is laying the groundwork for a new era in mobility, one where autonomous vehicles contribute to a smarter, safer, and more sustainable urban landscape.

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