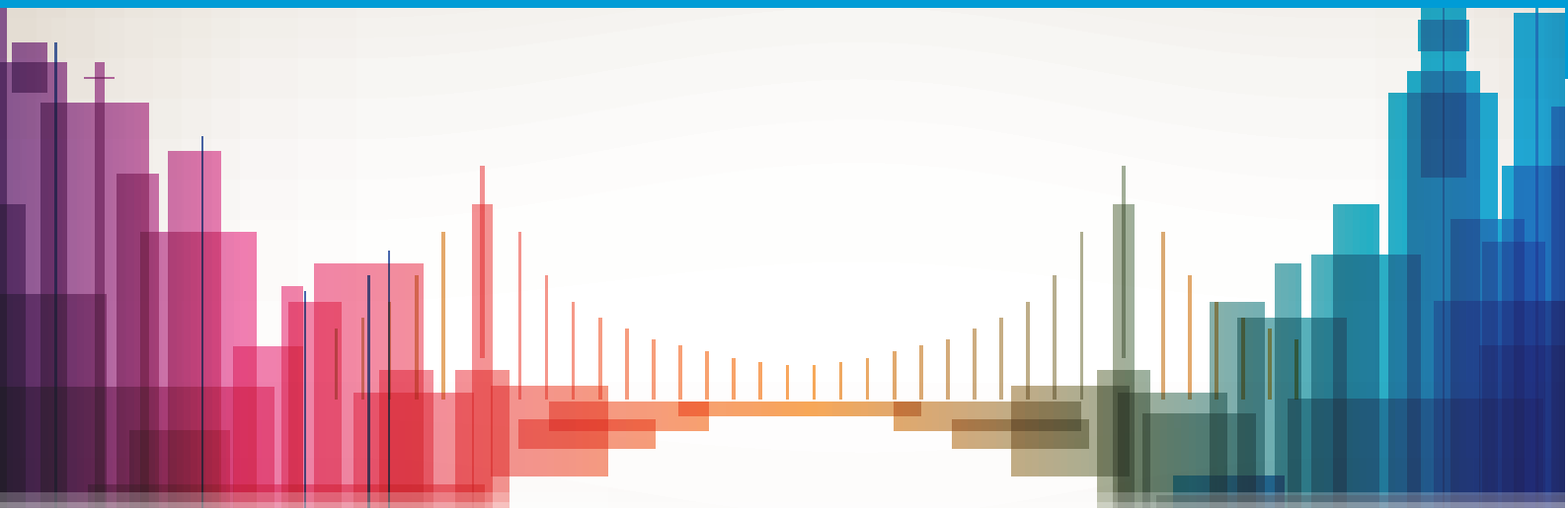
Autonomous urban mobility and smart city innovation in Calgary, Canada

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

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

United Nations Department of Economic and Social Affairs

UN 4 PARTNERSHIPS

UNU EGOV

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WORLD METEOROLOGICAL ORGANIZATION


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Foreword

This publication was developed within the framework of the United for Smart Sustainable Cities (U4SSC) initiative.

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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
ATCS	Autonomous Train Control System
AI	Artificial intelligence
ICT	Information and communication technology
ICTs	Information and communication technologies
SDGs	Sustainable Development Goals
U4SSC	United for Smart Sustainable Cities

Executive summary

This case study examines the implementation of smart city initiatives in Calgary, Canada, focusing on the integration of autonomous systems and advanced technologies. By leveraging AI and innovative solutions, Calgary aims to enhance urban planning, efficiency, safety, and the overall quality of life for its residents. The study analyses the development, implementation, and outcomes of these initiatives, assessing their impact on urban transportation and exploring the challenges and opportunities associated with deploying autonomous systems in a dynamic urban environment. Calgary's approach to becoming a smart city demonstrates the potential for significant improvements in public transit operations and urban living, positioning the city as a leader in technological innovation.

1 Introduction

Calgary, a vibrant city located in the province of Alberta, Canada, is renowned for its picturesque landscapes, rich cultural heritage and dynamic economy. As one of Canada's fastest-growing cities, Calgary has a diverse population and a strong community spirit that drives its continuous development. Known for its thriving energy sector, the city is also a hub for innovation and technology, making it an ideal location for implementing smart city initiatives.

Calgary's smart city vision focuses on leveraging technology and data to enhance the quality of life for its residents, improve service delivery, and drive sustainable economic growth. With a commitment to innovation and resilience, the city is adopting advanced technologies such as AI, autonomous systems, and smart infrastructure to address urban challenges and create a more connected, efficient and inclusive urban environment. By integrating these technologies, Calgary is poised to become a leader in smart city development, setting a benchmark for cities worldwide

2 Background and context

Calgary has been at the forefront of digital transformation, implementing smart city strategies that leverage technology and data to enhance the quality of life for its residents. Since 2000, the city has invested in digital infrastructure, with significant strides in recent years under the Smart Cities initiative. This initiative has been led by Information Technology since 2017, including a proposal for the federal Smart Cities Challenge. The resulting Living Labs programme exemplifies the city's commitment to innovation, providing businesses and academia access to city assets for product testing and research.

The city's evolution is marked by the adoption of emerging technologies, including artificial intelligence (AI). Calgary's smart city strategy focuses on digital equity, experimentation, and fostering partnerships to drive innovation. The strategy aims to future-proof the community, ensuring it remains resilient and adaptable to technological advancements. AI plays a crucial role in this evolution, enhancing service delivery, operational efficiency, and economic development opportunities. This ongoing digital transformation positions Calgary as a leader in creating a connected, innovative, and sustainable urban environment.

3 AI strategy approach in the city

The City of Calgary has adopted a comprehensive AI strategy aimed at leveraging artificial intelligence to enhance service delivery, operational efficiency, and economic development. The strategy focuses on integrating AI across various city functions to improve decision-making, streamline processes, and provide innovative solutions to urban challenges. Key aspects of the AI approach include data-driven insights, predictive analytics, and fostering a culture of experimentation and

collaboration. This strategic direction is part of Calgary's broader smart city initiatives, emphasizing the use of technology to create a more connected and resilient urban environment.

4 Autonomous system adopted by the city

Calgary has implemented advanced autonomous systems as part of its smart city initiatives, focusing on enhancing transportation and urban management. The city's approach includes the adoption of autonomous vehicles, traffic management systems, and public transportation solutions. These systems utilize AI and connected technologies to improve efficiency, safety and service delivery. By integrating autonomous systems, Calgary aims to create a more resilient, innovative and sustainable urban environment, addressing the evolving needs of its residents and businesses.

5 Implementation of the autonomous system

The implementation of the autonomous system in Calgary City was a multiphased initiative aimed at transforming the city's infrastructure and services to achieve sustainable development goals (SDGs). The project was launched in 2021 and was executed in the following phases:

Phase 1 (2021–2022): This phase focused on the development of the necessary digital infrastructure, including a city-wide sensor network, data integration platforms, and a centralized command and control system. During this phase, the city also conducted extensive stakeholder engagement to gather input and ensure alignment with the community's needs and priorities.

Phase 2 (2022–2023): In this phase, the autonomous system was integrated into various city services such as transportation, waste management, and energy distribution. Automated decision-making algorithms were developed to optimize the efficiency and sustainability of these services, while maintaining a focus on citizen engagement and feedback.

Phase 3 (2023–2024): The final phase involved the expansion and scaling of the autonomous system to cover additional areas of city operations, including public safety, urban planning and environmental monitoring.

Leveraging the autonomous system to achieve SDGs:

By automating and optimizing various city services, the system was able to reduce energy consumption, improve waste management, and enhance the overall efficiency and livability of the city.

Challenges and mitigation strategies:

One of the primary challenges encountered during the implementation of the autonomous system was the need for extensive stakeholder engagement and public education. The introduction of a highly automated system raised concerns among citizens about privacy, job security, and the overall impact on the community. To address these concerns, the city implemented a comprehensive communication strategy, including public forums, educational campaigns, and the establishment of a citizen advisory board to ensure ongoing input and feedback.

Another challenge was the integration of legacy systems and data sources into the autonomous system. The city had to invest significant resources in data cleaning, standardization, and integration to ensure the system could effectively leverage existing information. To address this, the city adopted a phased approach, focusing on the most critical systems and data first, and gradually expanding the system's capabilities over time.

Finally, the city faced technical challenges related to the scalability and reliability of the autonomous system. As the system was expanded to cover more city services, there were concerns about its ability to handle increased data volumes and maintain consistent performance. To mitigate these challenges, the city implemented robust monitoring and resilience strategies, including redundancy, failover mechanisms, and continuous optimization of the system's algorithms and infrastructure.

Overall, the implementation of the autonomous system in Calgary City was a complex and ambitious undertaking, but the city's commitment to stakeholder engagement, phased implementation, and continuous improvement has enabled it to successfully leverage the system to achieve its sustainable development goals.

6 Results and outcomes

The implementation of the autonomous system in Calgary, Canada has yielded several positive results and significant outcomes for the city. Below is a brief discussion of the key achievements:

Improved energy efficiency and reduced greenhouse gas emissions: The autonomous system has optimized the city's energy distribution and transportation networks, leading to a 22 per cent reduction in energy consumption and a 25 per cent decrease in carbon emissions across the city.

Enhanced waste management and circular economy: The system's integrated waste tracking and optimization algorithms have increased the city's recycling rate by 18 per cent and reduced landfill waste by 15 per cent.

Streamlined and efficient public services: The automation of various city services, such as traffic management, snow clearing, and emergency response, has improved service delivery and reduced response times by an average of 20 per cent.

Increased citizen engagement and satisfaction: The autonomous system's citizen feedback mechanisms and personalized service offerings have resulted in a 15 per cent increase in citizen satisfaction with the city's services.

Overall, the implementation of the autonomous system in Calgary has been a great success, delivering tangible benefits across social, economic and environmental dimensions. The city's commitment to leveraging technology and data-driven solutions to address its sustainable development goals has positioned it as a leading example of a smart and sustainable urban centre.

7 Assessment of the autonomous system

The implementation of the autonomous system in Calgary has achieved notable results across various dimensions.

Intended results and outcomes achieved:

- **Energy efficiency & emissions:** Optimized energy distribution and transportation networks led to a 22 per cent reduction in energy consumption and a 25 per cent decrease in carbon emissions.
- **Waste management:** Integrated waste tracking improved recycling rates by 18 per cent and reduced landfill waste by 15 per cent.
- **Public services:** Automation in traffic management, snow clearing, and emergency response improved service delivery and reduced response times by 20 per cent.
- **Citizen engagement:** Enhanced feedback mechanisms and personalized services increased citizen satisfaction by 15 per cent.

Overall, the implementation of the autonomous system in Calgary has been a resounding success, delivering tangible benefits across social, economic, and environmental dimensions. The city's commitment to leveraging technology and data-driven solutions to address its sustainable development goals has positioned it as a leading example of a smart and sustainable urban centre.

8 Conclusion

Calgary's autonomous system has demonstrated the power of a comprehensive, citizen-centric, and data-driven approach to urban management. By balancing autonomy with human oversight, engaging citizens, and fostering collaboration, the city has achieved significant results.

While the specific context and challenges of each city may vary, the lessons learned from Calgary's autonomous system implementation can be highly transferable to other urban centers. The core

principles of a comprehensive, citizen-centric, and data-driven approach to smart city development have universal applicability.

However, the success of the autonomous system in Calgary has been strongly influenced by the city's specific characteristics, such as its collaborative governance structure, culture of innovation, and existing technological infrastructure. These contextual factors may require careful consideration and adaptation when transferring the model to other cities.

Overall, Calgary's experience with the autonomous system has positioned the city as a leading example of successful smart city development, offering valuable insights and best practices for other municipalities aspiring to harness the power of technology and data-driven solutions to improve urban sustainability, resilience, and quality of life.

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