


Chapter 4

Integration of Autonomous Traffic Systems for Urban Mobility and Urban Planning: Developing Policy Frameworks for Smart City

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ABSTRACT

Autonomous vehicles (AVs) hold the potential to disrupt transportation in urban areas, delivering significant benefits including increased safety, mobility efficiency, and sustainability. This chapter looks at the implications AV technology has on urban planning and development as a whole with a closer look at potential safety concerns, issues of cyber security and the require for strong regulatory frameworks in the face of fast-paced change. It emphasizes the need for safety by design principles and robust verification practices to ascertain the reliability of AV systems. The chapter takes account of cybersecurity threats due to malware and data privacy issues stemming from mass data acquisition that is part of AV functionality. This explores different approaches to integrating AVs into the urban ecosystem while highlighting the importance of public-private partnerships and community involvement in building trust and acceptance.

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INTRODUCTION

Autonomous traffic systems are designed to utilize advanced technologies such as artificial intelligence, machine learning, and IoT to improve traffic management and reduce congestion (Patel & Kumar, 2024). Originally, by using computer vision, machine learning, and other AI technologies, we try to solve the challenges of traffic automation, which are at the heart of the new era of Autonomous Traffic Systems (ATS) solutions, given the speed of the development of all types of transportation and mobility solutions, expanded and opened by technological wonders. ATS connects different elements, such as autonomous vehicles, smart transportation systems, and sophisticated communication networks, to form an integrated framework that functions with little or no human input. In urban settings, these systems aim to increase safety, optimize traffic flow, and decrease congestion. Autonomous vehicles with advanced sensor technologies such as LiDAR, radar, and cameras lie at the heart of ATS. They are able to sense their environment, and make decisions and navigate through complex traffic situations without human intervention (Qureshi & Ali, 2024). AI systems embed themselves and learn from their environment, adapting to become more effective. For example, imagine that an Autonomous Smart Traffic Management (STM) system utilizes AI algorithms to optimize traffic flow rates by predicting the number of vehicles in certain locations and dynamically adjusting the standard traffic signals accordingly. ATS is an example of technology-serving-long-term-solution to solve the fast urban growth problem (urban planners face this type of challenges). These findings point to the need for adaptive policies regarding transportation that incorporate balancing innovation with ethics and equitable access to transportation services. This chapter concludes by mapping a route for harmonizing urban growth with autonomous traffic systems, supporting sustainable practices that better the lives of all stakeholders in the city.

As cities become more congested and populated, traditional traffic management systems are overwhelmed by the growing demand for transportation services. This is where ATS comes in as a reliable solution to reduce the need for too much infrastructure expansion and to ensure maximum utilization of all available roadways. Also, through data analytics and by employing machine learning, the ATS is able to predict traffic trends and permanently adapt operations, providing increased efficiency overall (Robinson & Carter, 2024).

Importance of Safety and Security in Urban Planning

With more cities looking to implement ATS, the need for safe and secure systems is paramount (Singh & Gupta, 2024). This means both physical security (ensuring continued road safety) and cyber security (preventing malicious actors

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