Chapter 12
Sustainable Urban Mobility and Smart Traffic Management:
Balancing Optimization With Environmental Sustainability Goals

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ABSTRACT

Urbanization and traffic congestion are rapidly worsening as an issue, and traffic optimization is necessary to improve mobility, security, and environmental sustainability. While there are diverse opportunities available, this chapter also identifies some emerging trends and technologies in traffic optimization, integration with smart city initiatives, long-term sustainability goals, etc. Advanced technologies like artificial intelligence (AI), integration of internet of things (IoT), and connected vehicles are changing traffic management by harnessing real-time data analysis and predictive routing. By embedding traffic strategies into smart cities, data-driven decision-making and public engagement leads to urban mobility improvements. Tying traffic management to sustainability objectives is also critical to reduce greenhouse gases and facilitate active modes of transportation. Through sustainable transportation, cities can improve transportation efficiency, address environmental issues, and enhance overall quality of life.

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INTRODUCTION

Traffic optimization is an organized procedure that focuses on enhancing the effectiveness of road traffic movement, decreasing traffic congestion and going easy on the journey time. It is in this process where different technologies and methodologies are applied to control the movement of vehicular traffic, particularly in urban areas, where traffic congestion is a common problem (Dhananjay & Kumar, 2022). While the capabilities of these new technologies hold great promise, challenges still stand in the way, such as funding limitations, public acceptance, and technological limitations. To overcome these challenges, this paper suggests recommendations for policymakers and practitioners which focus on innovative funding mechanisms, engagement with communities, workforce development, and holistic regulatory frameworks. According to the Texas Transportation Institute, congestion causes individuals to spend, on average, 17 to 55 hours travel due to delays every year, emphasizing the need to identify effective traffic management solutions.

At the core of the goal of traffic optimization is the idea of improving the entire transportation experience by regressing the amount of time a vehicle spends waiting at stop lights, going through congested regions, and adapting to unpredictable traffic patterns. Real-time data analytics, adaptive signal control systems, and intelligent transportation systems (ITS) are all integral in this approach. Such technologies draw on data from multiple sources, including vehicle communication systems, cameras, and sensors to monitor traffic conditions and dynamically adapt operations. With the recent changes in the field of information technology have revolutionized the different techniques used in Traffic Optimization. Conventional methods were based on predetermined timings of traffic signals, which couldn't respond to the present state of flow. But the new approach uses adaptive traffic signal control systems that changes signal timing with real-time traffic flows. Such adaptability not only increases the number of vehicles able to traverse an area at any given time, but it also increases safety by making possibilities such as sudden stops or last-minute lane changes less likely to cause accidents (Ghosh & Mukherjee, 2023).

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