A GENERAL REVIEW OF MATSIM APPLICATIONS: IMPLEMENTATIONS AND FUTURE SCOPE

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Abstract

Agent based simulation that provides comprehensive insights into travel behaviour, modal shifts, and possible effects on energy demand and grid infrastructure, has become as an integral component in urban mobility and infrastructure planning. The development of EV charging and infrastructure planning applications is facilitated by the open-source multi-agent transport simulation framework MATSIM, and its evolution is ongoing (e.g., for high-performance large-scale simulation). [1] With an emphasis on applications in urban mobility planning, EV charging infrastructure, freight and commercial traffic, and multimodal transport systems, research articles and scientific works presented between 2020 and 2025 that uses the open-source multi-agent transport simulation framework MATSIM, are systematically analysed in this review paper.

The potential of MATSIM to assist with infrastructure deployment and grid impact assessments has been demonstrated by recent research that combines mobility simulation with EV charging demand modelling, charging locations optimization, and forecasting of spatial and temporal charging demand. [2, 3] Long-distance transportation, heavy-duty freight, passenger cars, and logistics are currently included in applications, demonstrating the adaptability of MATSIM across mobility industries. [4] Nevertheless, difficulties with data requirements, validation, and model realism against computing expense are still encountered, particularly when mobility simulations are integrated with energy and charging infrastructure. [5]

Hybrid simulation frameworks that combine mesoscopic demand modelling with microscopic traffic simulation have been included in recent MATSIM-based research to increase computational performance and realistic accuracy, along with synthetic demand generation models that uses open data. [6] Simulated traffic flows and mobility patterns have been validated against measured traffic data, and MATSIM has been extended to simulate EV charging demand and charging-station development scenarios in urban settings. [7] However, a lack of publicly accessible peer-reviewed studies on comprehensive integration of mobility simulation with full energy-system or grid-impact modelling (that incorporates charging demand, load profiles, and grid constraints) is still present.

This review summarizes recent MATSIM applications for EV charging, fleet electrification, and grid-impact modelling. Methodological and data-related gaps are identified, and future directions such as real-time data integration, energy-model coupling, multi-modal logistics and simulations, and scalable simulation frameworks to support energy-system planning during the e-mobility transition are outlined in this paper. The key question driving this study is- What are the existing applications, methods, and limitations of MATSIM, and what future research areas can be identified to improve its integration with mobility and energy-system planning?

Keywords - MATSIM, Agent-based simulation, EV charging infrastructure, Mobility–energy systems, Urban mobility, Freight and logistics

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