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# Optimising Charging Station Placement for Electric Motorcycle Taxis in Kigali: A Survey Integrating Driver GPS Data and Grid Capacity Constraints

**A, m, i, n, a, t, a, D, i, o, p, ,, M, a, m, a, d, o, u, N, d, i, a, y, e, ,, F, a, t, o, u, S, a, r, r**

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# Abstract

The shift towards electric motorcycle taxis in African cities offers a pathway to more sustainable urban transport. Kigali, Rwanda, exemplifies this transition. Strategically locating charging infrastructure remains a key engineering problem, necessitating a balance between driver demand patterns and the capacity of the local electrical grid. This survey aims to synthesise and evaluate existing methodologies for optimising electric vehicle charging station placement. It focuses on algorithms that integrate two datasets critical for Kigali: historical driver GPS data to model demand and grid capacity constraints to ensure technical feasibility. A systematic literature review was undertaken. Peer-reviewed articles, conference proceedings, and technical reports on charging station placement algorithms were identified and analysed. The review assessed the integration of spatial-temporal demand modelling (using GPS data) and electrical grid constraints within optimisation frameworks applicable to electric motorcycle taxis. The survey identified a predominant focus on private car data in existing models, revealing a gap in algorithms tailored for high-frequency, short-range taxi operations. A key theme was the frequent omission of medium-voltage grid capacity as a hard constraint, with a minority of reviewed models incorporating it effectively. Solutions integrating both factors typically employed a multi-objective optimisation approach. Current charging station placement algorithms require

substantial adaptation to suit the operational patterns of electric motorcycle taxis and the grid realities of cities like Kigali. An effective model must prioritise the unique demand density of taxi hubs and incorporate grid constraints from the initial planning phase. Future research should develop and validate integrated optimisation models using real-world GPS data from motorcycle taxis and detailed grid topology data from Kigali. Collaboration between transport and power systems engineers is essential. Pilot projects are needed to test model predictions against operational outcomes. electric motorcycle taxis, charging infrastructure, optimisation, GPS data, grid capacity, Kigali, survey. This survey clarifies the specific adaptations required for charging station placement algorithms to support electric motorcycle taxi fleets in African urban contexts, highlighting the critical integration of mobility patterns and grid constraints.