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Optimizing a public transport network with a temporal Dijkstra algorithm: A geospatial model and plugin for the GAMA platform

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Abstract

Urban public transport is crucial for addressing increasing travel demand and mitigating the economic and environmental impacts of private car usage. In many developing countries, such as Morocco, public transport is not yet playing its expected role as the backbone of sustainable urban mobility, as seen in more developed countries. This issue arises from several challenges, such as inadequate road infrastructure, poorly maintained and uncomfortable buses, lack of integration between different transport modes, and unoptimized routes and schedules. As a consequence, the efficiency of public transport is very low, making it an unattractive option that fails to dissuade the population from using private cars.

In this work, we present MarraSIM (Marrakech SIMulator) [2], a geospatial agent-based model that simulates the multimodal public transport network in the city of Marrakesh (Fig. 1). This network includes standard buses, BRT (Bus Rapid Transit), and most notably, Grand Taxis, which play a crucial role in the city's urban mobility, including in areas served by buses. The model is built using the GAMA platform and incorporates a custom plugin that implements a temporal Dijkstra algorithm [1] to optimize the schedules of buses and BRTs. The main purpose of the model is to explore how to efficiently integrate these two bus systems with Grand Taxis, which, despite being managed differently, cannot be overlooked due to their crucial role in Marrakesh's urban mobility.

References

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- [2] Ahmed Laatabi et al. "Assessing Public Transport Strategies in Marrakesh using ABMS". In: *Procedia Computer Science* 238 (2024), pp. 566–571.

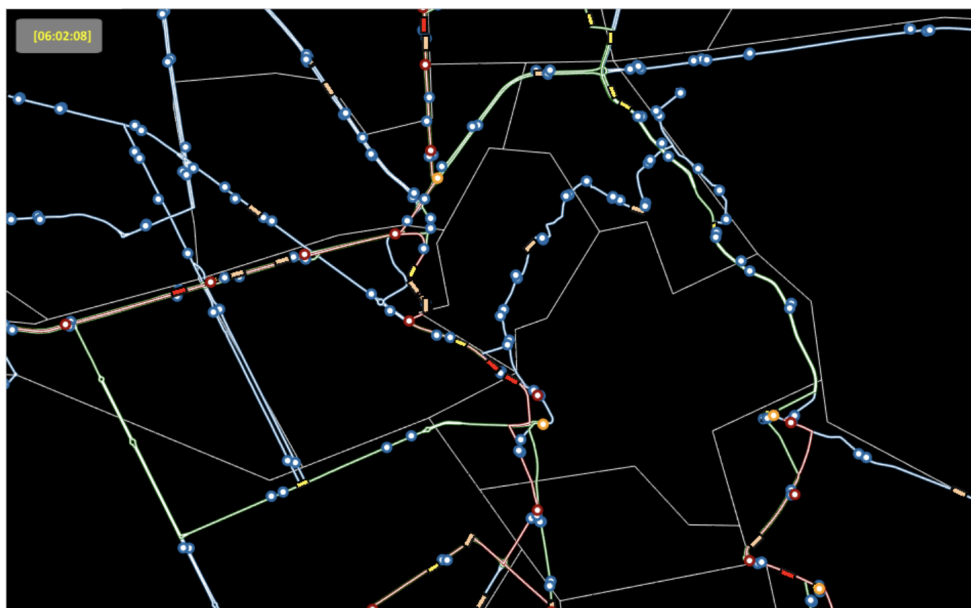


Figure 1: The multimodal geospatial model of the public transport network in Marrakesh