

Decentralized traffic signal control for grid traffic network using genetic algorithm

ABSTRACT

This work aims to explore the potential to minimize traffic congestion using a non-deterministic algorithm. Conventionally, the deterministic algorithm such as fuzzy logic was proposed as the computational algorithm to compute the optimum traffic signal timing for minimizing vehicles in queue and travel delay. However, it is very difficult to define the suitable number of fuzzy rules that are able to cover the all possibilities of traffic flow changes since the natural traffic flow behavior is dynamic. Besides, the inherent deterministic behavior limits the algorithm to explore the solution space in searching for the optimum traffic solution. In other words, the deterministic algorithm will not provide other solution with the same input. Therefore, genetic algorithm, a non-deterministic algorithm, is proposed to optimize the traffic signalization. A benchmarked 3×3 grid traffic network is developed as the testbed to examine the robustness of the proposed GA. Each intersection is integrated with a GA based signal controller or known as agent to form a multi-agent system. Each agent has the autonomy in controlling their own traffic intersection and they will share their local traffic information to their downstream intersections. The performance of the proposed GA is compared with the conventional fuzzy logic. The simulation results show the proposed GA improves the performance about 6.6 % in minimizing vehicles in queue and travel delay as compared to the conventional fuzzy logic.