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A Two-level Traffic Light Control Strategy for Preventing Incident-Based Urban Traffic Congestion

This work designs a two-level strategy at signalized intersections for preventing incident-based urban traffic congestion by adopting additional traffic warning lights. The first-level one is a ban signal strategy that is used to stop the traffic flow driving toward some directions, and the second-level one is a warning signal strategy that gives traffic flow a recommendation of not driving to some directions. As a visual and mathematical formalism for modelling discrete-event dynamic systems, timed Petri nets are utilized to describe the cooperation between traffic lights and warning lights, and then verify their correctness. A two-way rectangular grid network is modelled via a cell transmission model. The effectiveness of the proposed two-level strategy is evaluated through simulations in the grid network. The results reveal the influences of some major parameters, such as the route-changing rates of vehicles, operation time interval of the proposed strategy, and traffic density of the traffic network on a congestion dissipation process. The results can be used to improve the state of the art in preventing urban road traffic congestion caused by incidents.

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