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## **A Unified Framework for Vehicle Rerouting and Traffic Light Control to Reduce Traffic Congestion**

As the number of vehicles grows rapidly each year, more and more traffic congestion occurs, becoming a big issue for civil engineers in almost all metropolitan cities. In this paper, we propose a novel pheromone-based traffic management framework for reducing traffic congestion, which unifies the strategies of both dynamic vehicle rerouting and traffic light control. Specifically, each vehicle, represented as an agent, deposits digital pheromones over its route, while roadside infrastructure agents collect the pheromones and fuse them to evaluate real-time traffic conditions as well as to predict expected road congestion levels in near future. Once road congestion is predicted, a proactive vehicle rerouting strategy based on global distance and local pheromone is employed to assign alternative routes to selected vehicles before they enter congested roads. In the meanwhile, traffic light control agents take online strategies to further alleviate traffic congestion levels. We propose and evaluate two traffic light control strategies, depending on whether or not to consider downstream traffic conditions. The unified pheromone-based traffic management framework is compared with seven other approaches in simulation environments. Experimental results show that the proposed framework outperforms other approaches in terms of traffic congestion levels and several other transportation metrics, such as air pollution and fuel consumption. Moreover, experiments over various compliance and penetration rates show the robustness of the proposed framework.