REAL TIME INTELLIGENT TRAFFIC CONTROL OPTIMIZATION

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Declaration

I declare that this dissertation does not incorporate, without acknowledgment, any material previously submitted for a degree or a diploma in any university and to the best of my knowledge and belief, it does not contain any material previously published or written by another person or myself except where due reference is made in the text. I also hereby give consent for my dissertation, if accepted, to be made available for photocopying and for interlibrary loans, and for the title and summary to be made available to outside organization.

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Abstract

Transportation has been a crucial aspect of human life for decades. Road traffic congestion is a critical socio-economic issue as it causes high fuel consumption, waste of time, increased environmental pollution, frustration and safety issues. Major cause for increased road traffic congestion is the sub-optimal use of available resources such as time and road space due to the fixed traffic signal plan. Traffic density at multiple adjacent intersections is not considered in current traffic signal plans.

The said problem is formulated as a distributed constraint optimization problem in this research. Optimized road traffic control mechanism, based on dynamic traffic conditions in multiple adjacent intersections is proposed. The goal is to attain the emerging effect of minimizing the passenger time loss due to traffic congestion of a selected area over time. This is achieved by permitting the optimal green time eligibility for each controlled link in a given intersection during traffic signal phase and cycle length design in a conflict free manner. Multi agent technologies are used to facilitate the communication and coordination between multiple adjacent intersections. Two types of agents namely CCTV agents who monitor the traffic density and traffic signal light agents who control the traffic flow are introduced. Two multi agent based algorithms namely individual lane based traffic signal control and cumulative intersection based traffic signal control are proposed to determine the optimal green time eligibility for a given intersection considering the traffic density of the incoming and outgoing lanes of multiple adjacent intersections. Convolutional Neural Networks (CNNs) is applied on video surveillance data to recognize the traffic density of adjacent intersections.

Real world video surveillance data in Sri Lankan roads are used to evaluate traffic density recognition. Simulation of Urban Mobility (SUMO) traffic simulation suite is used to assess the proposed dynamic traffic control optimization mechanism. Experimental results show that the proposed traffic signal plan effectively reduces the time loss due to traffic congestion for a given area by 34% compared to the fixed traffic signal plan. Accuracy of the traffic density recognition is 72%.

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