A Review for Signal Coordination at Congested Intersection

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ABSTRACT

The urban traffic congestion has become a global phenomenon. Rapid urbanization and industrialization have caused drastically growth of vehicles all over the world. But the problems like congestion, delay, energy consumption, environmental pollution, etc. still remain in question if the traffic signals are not coordinated. Coordination of signals is achieved when the flow of traffic on a given phase of movement at one intersection is accommodated by a go" phase on its arrival at the next signalized intersection. It enhances progressive movement of traffic streams at some specific speed without enforced halts and reduced overall delay. It reduces the speed variations and provides smooth traffic operation, which increases capacity, decreases energy consumption and reduces air and noise pollution. Goal of signal coordination is to get the greatest number of vehicles through the system with the fewest stops in a comfortable manner. At present, traffic volumes are higher during peak hours in all the approaches of the signalized intersections, i.e. on the major and minor streets. Therefore, it is necessary to coordinate the signals of the network in all the directions, rather than to coordinate on a single corridor. Considering this fact, a methodology has been developed for the pre-timed signal coordination at network level.

Keywords : Traffic, signal co-ordination, traffic flow, time delay, congested traffic

I. INTRODUCTION

Increase in traffic volumes due to growth of population and vehicles ownership creates problems in traffic operation. Its impacts are congestion, delay, accidents and environmental pollution. As the vehicular traffic increases day-by-day in the cities, it becomes necessary to signalize the intersections of arterial/sub-arterial streets to control and regulate the traffic. It is just not enough to install the signals on intersections to satisfy one or more warrants. By installing the signals and applying proper phase plans, there is considerable reduction in conflicting points, which ensures reasonable safety. Therefore, the main consideration should be given to reduce the delay to vehicles on the legs of intersection. The operation of traffic signal installation will be optimum when the delay to vehicles on each approach of intersection becomes minimum. There will be considerable reduction in delay to vehicles on the approaches of a road by coordinating the signal installations of a road.

II. LITERATURE REVIEW

1. Andreas (2008) have carried out survey to cover the research in the area of adaptive traffic control with emphasis on the applied optimization methods. Method uses Bi-level formulation, and dynamic for the online. There are several models for trace networks, which are not based on the periodic behavior of online systems to perform coordination. Instead they assign green time to phases in some order, which is optimal given the detected and predicted trace.

2. Liu. (2002) introduced an adaptive signal control system utilizing an on-line signal performance measure. Unlike conventional signal control systems, the proposed method employs real-time delay estimation and an on-line signal timing update algorithm. They have used the method of algorithm and conclusion was that the proposed adaptive controller was sought in terms of maximizing the combined performance of all of the controllers. As addressed in the paper, the performance of the system can be improved by employing more complicated control logics.

3. Sen. and Head (1997) shows optimization of a variety of performance indices such as delay, stops and queue lengths. Based on dynamic programming and the simulation study, they produced very promising results that indicate that the COP (Controlled Optimization of Phases) algorithm is capable of significantly reducing vehicle delays.

4. Taale (2003) set up the integrated traffic control and traffic assignment problem to create theoretical formulation leads to several different control strategies. He has taken into account the choice of route, departure time or even mode. The problem solved using genetic algorithms and the result obtained. On average, for the examples studied, anticipatory control showed improvements of 20% in comparison with optimized fixed-time control, whereas local control strategies show improvements of 13%-17%. From these traditional control strategies, Webster control appeared to be the best, with an average improvement of 17%.

5. Smadi (2001) has suggested a simplified methodology to achieve better traffic signal control through the use of a knowledge-based system that suggests an appropriate optimized signal plan to deal with large traffic changes. The knowledge-based system serves as a simplified adaptive signal control system. The results of the simulation testing show that this knowledge-based application is an efficient method for reducing travel time and delay on the 14 arterial of the case study. The savings in travel time and delay are in line with the savings achieved by existing sophisticated adaptive signal control systems.

6. Chong (2003) shows application of ATCS on the existing ATMS and infrastructure to provide a fully adaptive system capable of running totally unattended; and the method uses cycle length, signal phase, and split. He concluded that the adaptive control module was almost ready for alpha testing. The plans and specifications for modifications to the detection at the critical intersections have been completed and approved.

7. Three types of region—isolated intersection, corridor, and grid road network area were evaluated by Jansuwan, 2005. The results obtained from comparison between the existing controls and the optimal fixed time controls method using SCOOT (With SCOOT) and police control (Without SCOOT). The purpose of this study was to assess the effectiveness of adaptive control: With SCOOT and Without SCOOT control by various measure of effectiveness (MOE). The main purpose of this method was to compare the result to the theoretical optimized fixed time plan for each area type. Paramics software was used to determine the effectiveness of signal timing plan and to assess the network wide performance

8. Nacional (2005) shows Urban traffic networks, split control, distributed agents, model predictive control using the multi-agent mpc system and compared its speed with that of an ideal, centralized agent that solves the problem single handed. Simulation study reveals that a control algorithm that handles constraints explicitly can outperform strategies that treat constraints in an ad hoc manner.

III. CONCLUSION

Now a days, for the congested urban road network with signalized intersections having heavy traffic flow in all approaches, coordination in two way directions is not sufficient, but coordination in four way direction shall be considered. For the traffic signal coordination, equal cycle time shall be selected on every intersection to minimize the overall delay. The cycle time can be adopted as an average of designed cycle time of the intersections on the network level.

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