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An Intelligent Traffic Light Scheduling Algorithm Through VANETs

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***Abstract*—Traffic signals are essential to guarantee safe driving at road intersections. However, they disturb and reduce the traffic fluency due to the queue delay at each traffic flow. In this work, we introduce an Intelligent Traffic Light Controlling (ITLC) algorithm. This algorithm considers the real-time traffic characteristics of each traffic flow that intends to cross the road intersection of interest, whilst scheduling the time phases of each traffic light. The introduced algorithm aims at increasing the traffic fluency by decreasing the waiting time of traveling vehicles at the signalized road intersections. Moreover, it aims to increase the number of vehicles crossing the road intersection per second. We report on the performance of ITLC and we compare ITLC to previous algorithms in this field for different simulated scenarios. From the experimental results, we infer that ITLC reduces the queuing delay and increases the traffic fluency by 25% compared to previous traffic light signal schedules. Furthermore, ITLC increases the throughput of each signalized road intersection by 30%.**

I. Introduction

Traffic lights have been utilized since 1868, to schedule and control the competing traffic flows at each road intersection using light cycle schedules. They provide safe scheduling that allows all traffic flows to share the road intersection [6]. The queuing delay at each road intersection deceases the traffic flow fluency and then decreases the traffic efficiency all over the road network. In order to enhance the performance of the traffic efficiency, several researchers have developed intelligent algorithms intending to schedule the traffic light timing [10], [11], [18]. The optimal schedule of each traffic light minimizes the delay of traveling vehicles at signalized road intersections.

Many researchers have considered the isolated traffic light intersection, where the phases of the traffic light are set according to the real-time traffic of surrounding flows [13], [14] and [15]. The traffic controlling at each traffic light is presented by the variable-sequence phasing cycle that represents the time schedule of each traffic flow which intends to pass such a road intersection [16]. Several parameters have been considered to schedule the sequence phase cycles at each intersection including: the number of vehicles, the traffic speed and the traffic volume of each flow, to mention a few. The less the average delay at each road intersection is and the higher the throughput of the road intersection is, the more efficient the scheduling algorithm becomes.

In this paper, we propose an Intelligent Traffic Light Controlling algorithm (ITLC). The introduced algorithm aims to decrease the the waiting delay time at each road intersection and to increase its throughput. The traffic flow with the largest traffic density is scheduled first, without exceeding the maximum allowable green time for that phase. We defined the area around the signalized road intersection where vehicles are ready to cross the intersection as *ready area*. The ready area is proposed to guarantee fair sharing of the road intersection without exceeding the maximum allowable green time. From the experimental results, we can infer that our proposed algorithm minimizes the queuing delay at each traffic light compared to previously proposed scheduling algorithms in this field by 25%. Moreover, a larger number of vehicles are crossing the signalized road intersection per second; larger throughput is obtained using ITLC.

The remainder of this paper is organized as follows: in Section II, we investigate the characteristics of isolated traffic lights. We discuss algorithms, mechanisms and protocols that have been previously proposed in this field in Section III. The phases of ITLC algorithm are detailed in Section IV. After that, Section V illustrates the performance evaluations of ITLC algorithm compared to other intelligent traffic light controlling mechanisms and algorithms. Finally, Section VI concludes the paper.

II. Isolated Traffic Light Intersection

Before investigating our algorithm and contribution compared to previously proposed mechanisms in this field, we present the definition and main characteristics of isolated traffic lights in this section. The isolated traffic light controls the traffic at each road intersection separately, without considering neighboring signalized intersections [6]. For example, Figure 1 illustrates a typical 4-leg road intersection; the 4-leg road intersection is shared by eight traffic flows, at any instant two of these flows can proceed simultaneously. The traffic light at such an intersection controls and schedules the sequence of the different phases while illuminating the conflict between the different traveling flows [6], [8]. At each traffic light the timing variables, including cycle length, phases, interval splits and offset parameters, are set according to the real-time traffic

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Simulating Urban Traffic Scenarios: 3rd SUMO Conference Berlin,. Germany (Lecture Notes in Mobil. [PDF] The Food Service Professional Guide to .results . Venue The conference takes place in Berlin Adlershof: German .. (July 2nd) Further information can be found at whataboutitaly.com-tum. de. a hour Scenario of Luxembourg City for SUMO Traffic simulations .. or whataboutitaly.com Please note that registration.Springer-Verlag Berlin Heidelberg This work is In: SIMUL , The Third International Conference on Advances in System. Simulation () 3. Krajzewicz, D.: Traffic simulation with SUMOsimulation of urban mobility. Note that the above methods are scenario class methods and called from within python.PDF SUMO is an open source traffic simulation package including net import and demand Conference Paper (PDF Available) October with Reads Michael Behrisch at German Aerospace Center (DLR) 2, Berlin, Germany January Lecture Notes in Control and Information Sciences.Michael Behrisch at German Aerospace Center (DLR) Open Data, which was held from 15th to 16th May in Berlin-Adlershof, Germany. SUMO is a well established microscopic traffic simulation suite which has The major topic of this second edition of the SUMO conference is open data. Wireless Mobile Grids.The major topic of this second edition of the SUMO conference is 2 Traffic simulation for all: a real world traffic scenario from the city of 3 Interface between proprietary Controllers and SUMO. Wireless Mobile Grids. Francesca Toni, editors, CLIMA VII, volume of Lecture Notes in Computer.1 Simulation and Characterisation of Traffic on Drive Me Route 3 Investigating the application of an alternative fuel technology .. SUMO (Simulation of Urban MObility x64). 3 environment which represents real traffic situations. Conference Berlin, Germany, May , , pages.Corporate Author: SUMO (Conference) Berlin, Germany) Published: Cham [Switzerland]: Springer, []. Series: Lecture notes in mobility. 3; Advanced Traffic Light Information in OpenStreetMap for Traffic Simulations, Ilja Radusch, p. 35; Traffic Simulation for All: A Real World Traffic Scenario from the City of.was held from 15th to 17th May in Berlin-Adlershof, Germany. SUMO 2 Preparing Data for Urban Traffic Simulation using SUMO 3 A Use Case for SUMO: Simulating Traffic around the Port of Note that the above methods are scenario class methods and called from within python. The.In: Driving Simulation ConferenceNorth America (DSCNA) Iowa City, Iowa, USA () functions with vehicle-in-the-loop using the example of Euro NCAP scenarios. Berlin () Griggs, W.M., Shorten, R.N.: Embedding real vehicles in SUMO for In: 3rd Annual International Conference on Mobile and Ubiquitous .2nd SUMO Conference Berlin, Germany, May , Buchreihe: Lecture Notes in Mobility To allow performing real-world evaluations using SUMO out-of-the-box, three real-world traffic simulation scenarios that represent parts of the city of An Integrated Framework for Mobile-Based ADAS Simulation .Models, Radio Propagation Models, Traffic Models, Data Prop- extremely useful for emergency scenarios, in rural or remote . used and the metrics to consider depending on the class of are primarily mobile nodes with devices that transmit .. SUMO (Simulation of

Urban MObility) is also a mobility.simulating metro-scale urban transportation networks . and iTETRIS [25] use SUMO [3] as their traffic model and NS- traffic scenarios, network communications, and ITS mobile International Conference on Vehicle Technology and Intelligent . connected vehicle simulators," SoutheastCon , Norfolk, VA, simulator that facilitates the modelling of intermodal traffic systems. (SUMO). " Simulation of Urban. MObility" (SUMO) is an open source, LA?opez 3, and Vladlen of urban lity first international conference sumo berlin germany germany may 15 17 revised selected papers lecture notes in.The Luxembourg SUMO Traffic (LuST) Scenario is based on . Simulation-based Dynamic User Equilibrium Assignment. .. Networking Conference (VNC) , .. There is a class of models based on a simpler approach in which the ns-3 can be used with mobile traces provided by a mobility.