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Traffic Signal Control with Routing Protocols in VANETS

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Abstract: **Vehicular Ad Hoc Network (VANET) is formed by applying the principles of Mobile Ad Hoc Networks (MANETs) the formation of a wireless network for data substitute to the realm of vehicles. It is appeared to be a new expertise to put together the openness of enormously employed wireless networks to vehicles. Vehicular networks aims to make the driving skill safer, well-organized and pleasant. Traffic Management is one of the most critical issues. Lots of research and managing techniques are used by government and city traffic scheming bodies to resolve Vehicle traffic congestion issue. As Vehicle traffic congestion is reflected as delays while nomadic. The idea is to attain the ubiquitous connectivity for vehicles either through well-organized vehicle-to-vehicle communication that enables the Traffic Signal control. In order to propose a suitable and capable routing protocol in VANET, a comprehensive study on popular obtainable VANET routing protocols must be considered as a substantial need. In this paper, AOMDV, AODV, DSDV are to be compared in terms of routing performance based on delay and packet delivery factor.**

Index Terms - **VANETS; OJF Algorithm; Platoon Algorithm; AOMDV; AODV; DSDV Protocols;**

I. INTRODUCTION

Vehicular transport has been one of the main means of transportation for hundreds of millions of people around the humankind. While mobility is one of the supreme achievements of our modern civilization, the number of vehicles in the roads has enlarged extensively, leading to high density in traffic and additional troubles like congestions, accidents and high levels of fuel utilization.

One of the most significant improvements in road safety and traffic competence was the deployment of the famous road traffic signs to serve the purpose of guiding, caution and helping to regulate traffic flow for drivers. There are different kinds of road signs and they are frequently placed above or beside highways and streets. In addition, traffic light systems are used (mostly at road intersections) to legalize and manage conflicts between differing vehicular traffic movements. Without the use of traffic lights at some sites, the major flow would lead the junction, making entries from the minor road impossible or very dangerous. While traffic lights can improve junction capacity and road safety, there are still some limitations. Improperly operated traffic lights cause extreme delays that give up productivity, waste fuel, pollute the air and increase the levels of stress. The effectiveness of this systems depends on the ability of signal operators to obtain real-time traffic patterns, thus, conventional signal control is obviously limited. Similar limitations exist in road traffic signs. For instance, they have a limit time period accessible for users to extort information, and even if road signals are mainly consistent, most of them use text to express meaning restricting. They have static in sequence and cannot be easily updated in order to be able to handle the frequent changes in the environment. Moreover, the exploitation and protection of such infrastructures has very high costs.

ALGORITHM 1: OJF Scheduling Algorithm.

Let a^{r}_{i} , $a^{r'}_{j}$, a^{l}_{k}, **and** $a^{l'}_{m}$ be the earliest arrival times on each of the vertices of **G′** ;
while r, r′ , l, l′ have jobs waiting, **do**
Let a^{s}_{t} be the earliest arrival time among a^{r}_{i} , $a^{r'}_{j}$, a^{l}_{k}, and $a^{l'}_{m}$
Let **S** be the side of **G′** on which vertex **s** lies:
For each vertex **s′** on side **S** in **G′**, **do**
Schedule the job with the earliest arrival $a^{s'}_{t}$ **;**

The spirit of the junction control is to decide these conflicts at the junction for the safe and well-organized movement of both vehicular traffic and walkers. Two methods of junction controls are there: time sharing and space sharing. The type of junction control that has to be adopted depends on the traffic level, road geometry, cost concerned, significance of the road etc.

Routing in VANET

VANETs are particular classes of ad hoc networks that are normally used ad hoc routing protocols are implemented for MANETs have been experienced and evaluated for use in a VANET environment. Use of these address-based and topology-based routing protocols require that each of the participating nodes be assigned exclusive address. This implies that we need a mechanism that can be used to assign inimitable addresses to vehicles. Thus, existing scattered addressing algorithms used in mobile ad-hoc networks in a VANET atmosphere.

II. PROACTIVE ROUTING PROTOCOLS

Proactive routing protocols utilize standard distance-vector routing approach (e.g., Destination-Sequenced Distance-Vector (DSDV) routing).Route updates are sometimes performed regardless of network load, bandwidth restriction, and network size. The main snag of such approaches is that the upholding of unused paths may occupy important part of the available bandwidth if the topology of the network changes regularly. Since a network connecting cars is extremely dynamic proactive routing algorithms are often inefficient.

DSDV

DSDV protocol is a proactive routing protocol. In this protocol each nodes maintains direction-finding table. This routing information must be updated from time to time. With the assist of routing information nodes data can transmit to other node in a network. The parameters of routing table are as following: destination, next, metric, sequence number, installs time, stable data etc. Sequence information is basically originated from target itself. Install time are used to remove false entries from table. Stable data is basically indicator to a table holding information on how stable path and also used to damp fluctuations in network.

III. REACTIVE ROUTING PROTOCOLS

Ad hoc On-demand Multiple Distance Vector (AOMDV) and Ad-hoc on-demand distance vector (AODV) are Reactive routing protocols. The routing includes implementing route determination on a demand or needing basis and maintaining only the routes that are currently in use, thereby reducing the trouble on the network when only a subset of vacant routes is in use at any time. Data transfer among vehicles will only use a very limited number of routes, and therefore reactive routing is predominantly accurate for this application circumstances.

AODV

One of the important routing protocols used in VANET system is Ad hoc On-demand Distance Vector (AODV) routing related to topology routing protocol. This AODV routing algorithm enables active, self starting, multi-hop routing between participating mobile nodes to create and sustain an ad-hoc network.

Extreme mobile nodes are allowed to create a route very fast to find new destination, and it is not necessary to maintain the route for the nodes which are not connected as it was dynamic routing algorithm. In this the nodes are allowed to break a linkage from one network and can join to node of another network. But in during transmitting the packets AODV does not allows closed path only shortest path is measured by counting to infinity problem message and forms multiple paths from destination to source. Therefore, efficient multipath routing with less overhead is obtained.

AOMDV

Ad-hoc on demand Multipath Distance Vector AOMDV, the path recovery process is divided in two cases as follows. First, when a link is broken down due to modification of the network topology, intermediate nodes report to the route unreachability by sending a message to the source node. Second, each node has a rest field in its routing table in AOMDV. That is, AOMDV uses soft-state paths. Each node checks its routing table every so often and it find again a route when the route is expired. The value of the break is in relation of trade-off. Too small timeout causes unnecessary route finding processes and too large timeout causes superseded routes. Additionally, each node sends hello messages periodically in order to check the strength of the route.

Only disjoint nodes are considered in all the paths of AOMDV, thereby attaining path disjointness. Route request packets are propagated throughout the network to discover the route thereby it recognizes the multiple paths at destination node and at the intermediate nodes. Multiples Loop-Free paths can be found by using the advertised hop count method at every node. The advertised hop count is necessary to be maintained at every node in the path table entry. The path entry table at every node contains a list of next hop along with the resultant hop counts. Every node enables an advertised hop count for the destination. Advertised hop count can be described as the “maximum hop count for all the paths”. Route vacancies of the destination are sent using this hop count. Another path to the destination is accepted by a node if the hop count is below the vacant hop count for the destination.

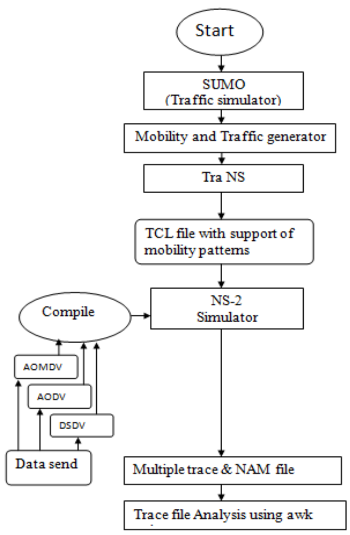

Figure1: Flow Methodology in NS-2

IV. PERFORMANCE EVALUATION

Proposed Method

The oldest arrival first (OAF) algorithm, formulates each vehicles real time location and speed information to do vehicular traffic scheduling at a remote traffic intersection with the intention of minimizing delays at the intersection. This simple algorithm leads to the finest (delay minimizing) schedule that we examine by falling the traffic scheduling problem to a job scheduling problem, with intersections, on processors. The scheduling algorithm captures the conflicts among differing vehicular traffic with a conflict graph, and the objective of the algorithm is to decrease the latency values of the jobs. If the condition is that all jobs need equal processing time is imposed, we can show that the OAF algorithm be converted into the oldest job first (OJF) algorithm in the job scheduling realm with conflicts between jobs and the idea of minimizing job latency values. We use a 2-competitive (with respect to job latencies) online algorithm that does non-empathic scheduling with conflicts of the jobs on the processors and then confirm a stronger result that the best possible non empathic scheduling with conflicts algorithm is 2-competitive.We influence a VANET to execute the OJF algorithm. An important necessity for the OJF algorithm is that all jobs have need of equal dispensation time.

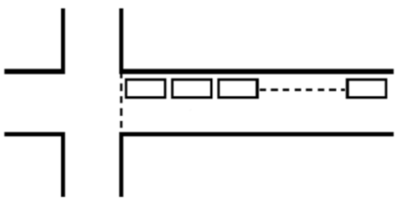

Fig2: Group of vehicles at a signalized intersection waiting for green signal

We provide an algorithm that uses the VANET to split up the future vehicular traffic into platoons that can be considered as jobs in the job scheduling with intersection. The traffic signal regulator can then use the conflict-free program from the OJF algorithm to plan platoons of vehicles in a safe conflict-free comportment. This two-phase method, where we first use the platooning algorithm to separate up the traffic into platoons and then treat each platoon as an same-sized job and then apply the OJF algorithm on the jobs to generate a conflict-free schedule, leads to what we call the OAF algorithm.

Algorithm 2: Platooning Algorithm:

For each approach k do
Configuration = Integer_Partitions(n)
for each platoon configuration i in Configuration do
for each platoon j in i do
Platoon_Green_Time[j] =
Estimate_Green_Time(j);
Add Platoon_Green_Time[j] to the list
Config_Green_Time[i, k];
Min Diff =
miniϵk,k={1,...,4}{max{Config _Green_Time[i, k]}-
min{Config_Green_Time[i, k]} ;
Final_Platoon_Configuration=
argminiϵk,k={1,...,4}{max {Config_Green_Time[i, k]}-
min{Config_Green_Time[i, k]}};

Platooning:

Grouping of vehicles into subgroups is called as platoons. This is a method of increasing the capacity of roads. It is automated highway system to reduce the traffic. Platoons decrease the distances between vehicle to vehicle using electronic coupling. This capability would allocate many cars or trucks to accelerate or brake simultaneously. This system also allows for earlier headway between vehicles by eliminating reacting distance needed for human reaction. It has capability might require buying new vehicles, or it may be something that can be retrofitted. Drivers would probably need a special license approval on account of the new skills required and the added liability when driving in the lead. Smart cars with non-natural intelligence could automatically join and leave platoons. The automated highway system is a proposal for one such system, where cars put in order themselves into platoons of eight to twenty-five.

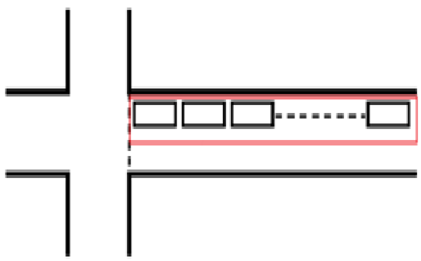

Fig3: Vehicles represented in platoons

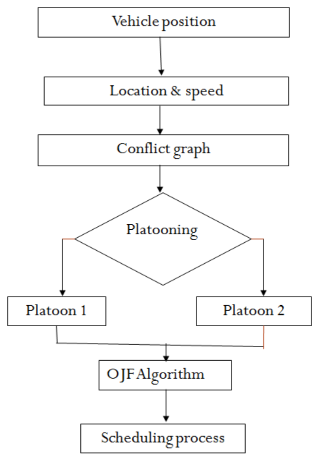

Fig 4: Data flow

V. SIMULATION RESULTS

Packet Delivery Fraction (PDF)

Packet delivery fraction and average delay are calculated for AOMDV, AODV and DSDV. The results are in brief below with their corresponding values. We note that AOMDV has a better PDF value when compared to AODV and DSDV for each set of connections. This is because in the time wait at a node, AOMDV can find an alternate route if the present link has broken whereas AODV is cause to be useless at that point and DSDV doesn't support Multi path Routing so efficiency is will be decreased.

Packet Delivery Fraction Calculation

The ratio of number of packets delivered to the total number of packets sent

PDR = no. of delivered packets / total no. of sent packets

Time Delay Of Data Packets

AOMDV and AODV have an average delay to DSDV's average delay. We note that AOMDV has a better average delay than AODV due to the fact if a linkage break occurs in the existing topology, AOMDV would try to find an alternate path from among the support routes between the source and the destination node pairs consequential in additional delay to the packet delivery time. In contrast, if a link break occurs in AODV, the does not packet reach the destination due to unavailability of an additional path from source to destination, since we presuppose in AODV only for singular paths exist between a source and destination node.

TABLE 1: Simulation Parameters

Variable	**Value**
Simulation type	NS 2
Routing protocols	AOMDV, AODV, DSDV
No. of vehicles	15
MAC	802.11p
Traffic type	UDP
Simulator time	80 s
No of nodes	16
Dimensions of the area	1000*1000
No of lanes	8
Antenna type	Omni directional

Overhead:
The amount of information needed to describe the changes in the dynamic topology.

Routing Overhead = (total no. of routing packets received / total no. of data packets received).

Delay= ∑ (End time-start time)

Table 2

PARAMETER	AOMDV	AODV	DSDV
Delay	0.028	0.028	4.156
PDR	0.98	0.76	0.67

Simulation in NS2

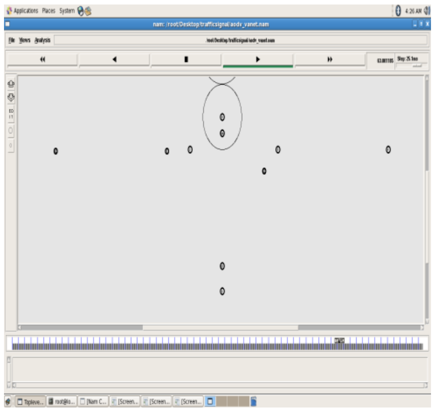

Fig5: Output of AODV protocol

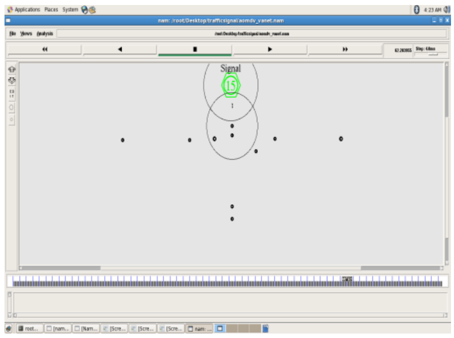

Fig6: Output of AOMDV protocol

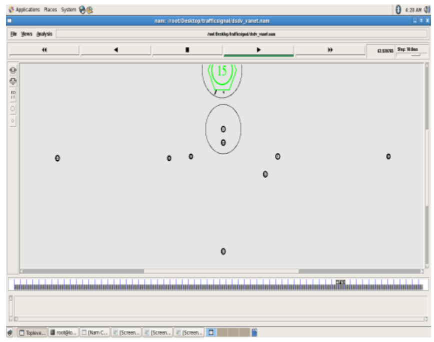

Fig7: Output of DSDV protocol

VI. CONCLUSION

This paper evaluated the performances of DSDV, AODV and AOMDV using NS-2. Comparison was based on of packet delivery fraction and average delay we conclude that AOMDV is better than AODV and DSDV. AOMDV outperforms AODV due its ability to search for alternate routes when a current link breaks down. Though AOMDV sustain more routing overheads although flooding the network and packet delays due to it's another route discovery procedure, it is much more efficient when it comes to packet delivery for the same reason. Hence, in conclusion we can say that when network load tolerance is of no consequence, AOMDV is a better on-demand routing protocol than AODV since it offers better statistics for packet delivery and routing overhead.

A new way to decrease the delay experienced by the vehicles in the traffic is dividing the vehicle density into platoons in respective directions to minimize the conflicts by conflict graph can be made. It can be achieved by the OJF algorithm by scheduling the platoons on the basis of first arrival of the vehicle in the platoon. By eliminating the buffer we can extensively increase the efficiency of adaptive traffic signal monitoring system.

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