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Congestion Control using Cross Layer Model in VANETs -A Review

Sania Gupta
M.Tech ResearchScholar
Deptt. of CSE
PTU Regional Centre
ACET, Amritsar

Tanupreet Singh,
Ph.D. H.O.D of E.C.E
Deptt. of E.C.E
PTU Regional Centre
ACET, Amritsar

***Abstract-* Congestion control in vehicular ad hoc networks is challenging due to limited bandwidth or dynamic topology. VANETS is the promising solution to overcome the future needs of increasing traffic safety and efficiency. To achieve the aim of the cooperative vehicular system will be based on wireless communication between vehicles and other nodes. This paper presents a cross layer congestion control model which consists of two modules. In first module, the event driven messages are prioritized when an abnormal situation is created on the road. The second module is based on beaconing load. As a result it solves congestion problems and improves bandwidth usage in VANETS. This idea will reduce the load on traffic. With the help of TCP model layers the congestion problem has been solved.**

Keywords- Congestion control, vehicular networks, cross layer model.

I INTRODUCTION

Vehicular ad hoc network (VANETS) is the type of MANETS which is used for communication among the vehicles between the vehicles and road side equipment. In addition to the challenging facts of MANETS like lack of established infrastructure, wireless links and multi-hop broadcast communications, VANET brings the new challenges the to realize safe communication architecture within the environment. Within VANET networks, the nodes are characterized by the high dynamic and mobility, In addition to the growing rate of topology challenges and density variability to evaluate the neighboring nodes. In addition the 50% of all reoccurrences and the maximum potential communication time duration is only 1 second; now in 90% of the occurrences, the upper boundary for the communication time is 5 s. Another important constraint in the multi-hop inter-vehicular communications is the limited bandwidth within the environment. Undoubetedly , the wireless channel can occupied by the competitive nodes for many reasons (the collisions, or interferences or insufficient the signal strength, time duration of the transmission sequence, etc.). To handle these environment constraints, and in the order to assure safe and optimized the communication method, now setting the quality of all service policies that is now mandatory, which inspires a congestion control approach within VANET. We suggest in this context that a cooperative or fully spreaded congestion control approach, now dedicated to operate within vehicular networks, integrated within the 802.11p underway standard, and based on dynamically scheduling packets according to their preferences and the available bandwidth is now shared among the neighbours so that the vehicles sending higher priorities packets are favored. Taking the high real-time and the reliability level needed by the inter-vehicular safety communications, we take a complete model which is based on the validation approach of our congestion control algorithms, lets taking into account reliability and temporal and operational aspects. Congestion avoidance techniques monitors the network traffic loads in an effort to count on and avoid congestion at the familiar network bottlenecks. Congestion avoidance has been now get via the packet dropping. Which is surrounded by the familiarily used congestion avoidance mechanism has now Random Early Detection (RED), which is now suitable for that high-speed transit networks. The Cisco IOS QoS which adds an implementation of RED that, when build, controls and when finally the router drops the packets.when you do not analysis the WRED, the router has used the cheap default packet drop mechanism is called tail.

Fig 1:VANET[1]

Vehicular Ad Hoc Network (VANET) is a self-organized network composed of mobile nodes connected with wireless links (Al-Sultan et al., 2014). In 2003, the Federal Communication Commission (FCC) established the Dedicated Short Range Communications (DSRC) service, a communication service for private and public safety operating at a frequency range from 5.850 3) Low tolerance for error: Some protocols have been designed on the basis of the probability. VANET has used life critical information on which action has performed in very short duration of time and a small bug in probabilistic algorithm might cause harm.

5.225 GHz to 5.925 GHz. IEEE has developed a Wireless Access in the Vehicular Environments (WAVE) standard, or IEEE 802.11p to provide DSRC for VANET communication. A multi-channel spectrum system is developed in DSRC which encompasses seven channels and provides 10 MHz of bandwidth per channel wherein six are Service Channels (SCH) and one is identified as the Control Channel (CCH).SCH are utilized for non-safety and WAVE-mode messages or services, while CCH is used for safety messages (Mak et al., 2009; Amadeo et al., 2009; Kakkasageri and Manvi, 2014). To ensure the safety of drivers and passengers, a single 10 MHz wide channel is used to exchange safety messages and IEEE802.11-Working-Group (2010)offers a data rate ranging from 3 Mb/sto 27 Mb/s. Lower data rates have better resistance against interference and noises**.**

II CHARACTERSTICS OF VANETS

1. High Mobility
2. Rapidly changing the network topology
3. An Unbounded network side
4. Potential support from the infrastructure
5. The time sensitive data exchange
6. The Crucial effect of security
7. High Privacy
8. And Safety oriented

III CHALLENGES IN VANETS

1) Network Management: overdue to the high mobility, the network topology and the channel condition change quickly. overdue to this, we should not use the structures like tree because these structures could set up and maintained as quickly as the topology has changed. generally occurs while in the rush hours the traffic load is very high and at last network is congested and the collision occurs in the network.

2) Congestion and collision Control: The unbounded network size also creates a challenge. It is always analysis that the traffic load is low in rural areas and night in even urban areas. so,the congestion and collision control is another challenge in vanets.

IV CONGESTION CONTROL IN VANETS

The main target of the congestion control is to feat the given network resources while preventing from the constant overloads of the network nodes and the links. Relevant congestion control mechanisms are very important to give able operation of the network. Assure the congestion control now inward the vehicular ad hoc networks which is going to faces the special challenges and with the specificities of the environment. In this text, we represent in this paper a coefficient and fully scattered congestion control approach, which is based on the changing scheduling and transportation of these priority-based messages, to assure decent and safe communication architectonics within the VANET. Messages preferences have been dynamically evaluated according to the types and the network content, and the neighboring nodes structure. Take the content of high reliability and the real-time response which is required for the inter vehicular communications (include the compulsion crumbling notice like), we propose a entire validation form of our congestion control conclusion, lets take into the account accuracy, mortal, and practical aspects.

To deal with the environment constraints, and in the order to assure the safe and suitable communication architecture setting up kind of service policies grows in important, which influence a congestion control path within VANET. We suggest in this content a coefficient and fully shattered congestion control approach, which is devoted to operate inward vehicular networks ,unified within the 802.11p ongoing standard, and based on changing scheduling packets according to their preference. Furthermore, the acessible bandwidth is shared among neighbors so that vehicles sending higher preference packets are floured. Lets take the high real-time accuracy level neccessity by the inter-vehicular safety communications, we initiate a communication The basic idea of our application-layer congestion control approach is to explain policies, in order to changing and cooefficiently manage the some messages transmission in the network. Messages scheduling has achieved according to the preferences, evaluated as a activity of the service of the concerned messages, the sender function and the neighborhood content. The messages transportation in the vehicular network has achieved in an good and cooperative manner, by favoring vehicles property the highest-priority messages to send. accordingly, our path has divided into three steps that we present after that: dynamic priority assignment, message scheduling and cooefficient message transportation.

V CONGESTION CONTROL TECHNIQUES IN VANET

A cross-layer congestion control has suggested to solve the wastage problems in VANETs. Figure 1 shows the model, where each layer of the communication model has its own duties to reduce the congestion in VANETs, which is described as below

1. The application layer used to decrease the number of packets and also lessen the congestion under many conditions by means of various path, like condition-based and application-based limited message re-sending.

2. In the transport layer, end-to-end communication services, such as the TCP and UDP, can be provided for network applications by using the protocols on this layer.s

3. The network layer is responsible to lessen the congestion and channel load by using the technique smart routing and broadcasting algorithms. Artificial Intelligence (AI) algorithms, like genetic algorithm, ant colony optimization,

and fuzzy logic, can be used in the place of current routing algorithms in VANETs.

4. In the MAC layer, scheduling and queuing algorithms has used to give various preferences for different packets to reduce congestion. At last, packets with low priority can dropped to reduce channel load in congested conditions.

5. In the physical layer, congestion has detected by sensing and assigning a profaned threshold for channel load in this. layer, which is the first step of congestion control in all networks.

This model consists of two modules to identify congestion in the congestion detection center. The first module is event-driven message detection, which monitors emergency situations and activates the control center whenever a new event-driven safety message is delivered. Higher priority is given to these messages and they are sent to the emergency management whenever a vehicle is in emergency mode. The traffic management receives the message and communicates with the congestion detection center. The second module is channel load sensing based on dynamic threshold values. Congestion is detected whenever the measured channel load exceeds the predefined threshold value. A dynamic threshold issued instead of a fixed one to utilize the bandwidth optimally. A Dynamic Distributed Fair Transmit Power Adjustment for VANETs (DD-FPAV) algorithm which adjusts the transmit power and packet generation rate is proposed to achieve our three main goals, namely, congestion control, prioritization and efficient bandwidth usage. This algorithm serves as a congestion control algorithm in the control center. The following sections present the proposed DD-FPAV algorithm.

CROSS LAYER CONGESTION CONTROL MODEL

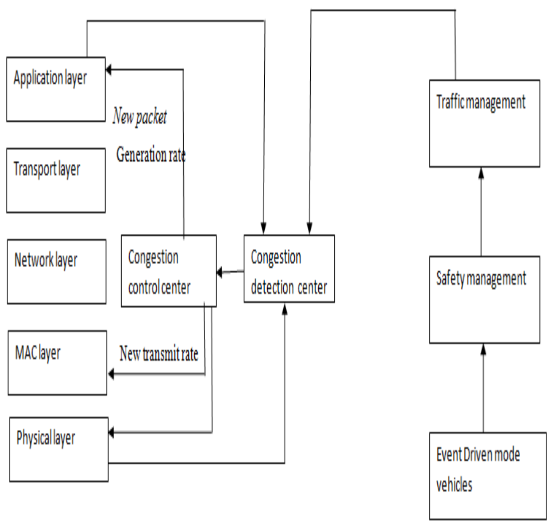

Fig 2:cross layer model

ALGORITHM DD FPAV

The channel load threshold value is the dynamically calculated in DDFPAV which is based on different road conditions, like high and low traffic conditions, and the take event-driven messages in the place of predefined and fixed values. The network model and beaconing problem has definitions for DD-FPAV are outlined as follows:

Suppose group of nodes $N=\{n_1 \ldots . n_n\}$are moving on the road which is similar to a line with unit length and Each node has generates a beacon message with a predefined frequency F and also broadcasts this message via specific transmit power TPE{TPmin;TPmax}, where TPmin and TPmax has indicated the minimum and maximum values of the transmit power,

Power assignment (Pa) definition: Suppose the group of nodes $N=\{n_1 \ldots . n_n\}$, Pa is a value between 0 and 1 which is assigned to each node n. Pa TPmax will be used by nodes as transmit power for sending beacon messages.

Carrier-Sense (CS) range definition: suppose Pa and any node nEN, the CS range of n with the Pa, $CS(P_a,n_i)$, has defined by the meeting points between deployment region R and CS range of the node n with power of Pa *TPmax. CSMAX (i) is defined as the carrier sense range of node n with maximum power.

Beacon messages load with Pa definition: Take a group of nodes N and Pa, the load of beacon messages at any specific node n with transmit power of Pa is defined as: BML (p_a,n_i)=|nEN,j=I : nECS (pa,j)| means the carrier sense range of node n with transmit power of Pa.

The load of the beacon messages has measured which is based on the number of nodes which hold node n in their CS range. Almost Similar-sized messages and a fixed frequency are assumed for all nodes. Now The function of the number of the near nodes is the channel load which is under observation. This definition of the beaconing nodes are generally has used in many beaconing messages with the variety of sizes and frequencies in these network. In the fully distributed environment, DD-FPAV has aim to solve this problem:

Beaconing Max-Min Tx Power Problem (BMMTxP) definition: suppose a group of nodes N={n1…nn}in R=[0,1] or a value for Max Beaconing Load (MBL), has decided a Pa, such that the smallest range of transmit power has employed by the nodes for beaconing reaches the peak and the threshold level of the network load experienced at nodes will not extend:

Maximum Pa E Pa(min By considering BML (P_a,i)=<MBL,iE{1….n}

One of the main goals, like congestion control, has achieved by solving BMMTxP. MBL has employed to control cause of the congestion via the beaconing activity. Simulation results has showed that prioritization can be achieved by sending the beacons that use the transmit power, which has calculated by DD-FPAV, as well as via sending the event-driven safety messages with the maximum power. The DDFPAV algorithm has based on the FPAV algorithm. FPAV algorithm is centralized and now assumed global knowledge (node positions) to resolve the BMMTxP. FPAV has its roots in the "water-filling" approach. The power levels of nodes have increased in a repetitive pattern by the specific amount, α*TPmax. This algorithm has initially used from minimum level until it has reached the point of satisfying the MBL condition. All nodes have raised to a similar power level when the process stops. DD-FPAV has the following principles:

1. Recognize high traffic from low traffic condition by using the information carried by beacon messages.

2. Now Recognizing the existence of the event-driven message by checking its related flag in the received messages.

3. Select the proper MBL and BGR values.

4. Execute the FPAV algorithm in each vehicle by using the received data from beacon messages.

5. Calculate the local transmit power for each vehicle and the MBL threshold should no exceeded at any node and other surrounding vehicles.

6. Take the minimum transmit power value surrounded by the ones locally calculated and those computed by the surrounding vehicles.

In the first principle, number of neighboring vehicles and their speed have used as the metrics for recognize high traffic from low traffic condition. When 80% of the neighboring vehicles have speed that do not exceeded 30 km/h, and also, if number of neighboring vehicles in the communication range has exceeded 150, this has been implies high traffic condition in the streets. We have now selected 150 vehicles as high traffic criteria since we have assumed that the number of street lanes, and the length of vehicles and communication range as 2, 5 m and 400 m, respectively.

The principles have been transformed into the following DD-FPAV algorithm:

Algorithm 1. DD-FPAV Algorithm: (algorithm for the node ni);

INPUT: all the nodes information in CSMAX(i);

OUTPUT: to assigning a power, Pa(i), Beacon Generation Rate, BGR (i) for the node n, in a way that lowest level of congestion occurs;

BMMTxP solution;

1. Using the nodes' information in CSMAX(i);

1.1. Procedure: find the Traffic (for node ni); According to t status of the nodes which is in CSMAX(i) and the Neighbor table of ni; also Calculate the number of neighbor vehicles and find their speed;;

if 80% of the neighbor vehicles' speed <=30 km/h and the number of neighbor vehicle >=150 then there is the high traffic in street and return true;

else j return false;

end

1.2. Procedure:The Event-driven-Existence (for node ni); Accordingly to the event-driven flag of sent message by ni;

if the event-driven flag=1 then

there is event-driven message and return true;

else

return false;

end

1.3. Procedure: dynamic MBL (for the node ni);

if findTraffic=true and Event-driven-Existence=true

then

BGR(i)= send 5 messages per second;

Then Return MBL=Bandwidth/3;

end

if findTraffic=false and Event-driven-Existence=false

then

BGR(i)= Send 10 messages per second;

Then Return MBL=Bandwidth;

end

if find Traffic=false and the Event-driven-Existence=true

then

BGR(i)=Send 10 messages per second;

Then Return MBL=(2*Bandwidth)/3;

end

2.The maximum transmit power value Pa(i) is calculated in a way that the MBL threshold is not exceeded at any node in CSMAX(i)

3.Broadcast Pa(i) to all surrounding vehicles in CSMAX(i)

4.Take the transmit power value from neighboring nodes like nj, where niACSMAX(j) and save it as Pa(j)

5.Calculate the final transmit power value by following expression:$P_a(i)$=minimum $P_a(i)$,$min_{j:niE}$ CS $_{max}$(j) Pa(j)

Figure 2 shows the procedure to calculate the dynamic MBL value. In that process, the real-time traffic conditions have determined from neighbor's table, which is then established based on the beacon message information like the node speed, direction, and the position. The existence of the event-driven messages is now discovered based on the specific flag in messages. If the node wants to send a event-driven message, then the event-driven flag status is changed from zero to one. accordingly, four different conditions has arrived, which are high traffic and the event-driven (eg now there is at least one event-driven message to send) (condition 1), high traffic and the nonevent-driven (eg there is no event-driven message to send) (condition 2),there is low traffic and event-driven (condition 3), low traffic and non-event-driven (condition 4). However, the second condition would not be occur due to the fact that these event-driven messages are issued in that case of abnormal conditions like the existence of high traffic or accidents. With the result, diverse values have assigned to the MBL threshold based on these different conditions. This MBL value has set for the cluster of vehicles which have ;located in a specific region. Vehicles in a cluster are in a similar situation from the traffic.

In figure 2 the diagram has the explanation which is:

1.Let us take 150 vehicles then the first point is if 80% of vehicle’s speed less than 30 km/h and number of vehicles greater than 150 then there is high traffic in street and it return true else false

2.if the event driven flag is 1 then there is event driven messages and return true else false

3.if traffic is true and existence of event driven messages is true then 5 messages per second has sent

4.if traffic is false and existence of event driven messages is false then 10 messages per second

5.Send MBL value to D FPAV

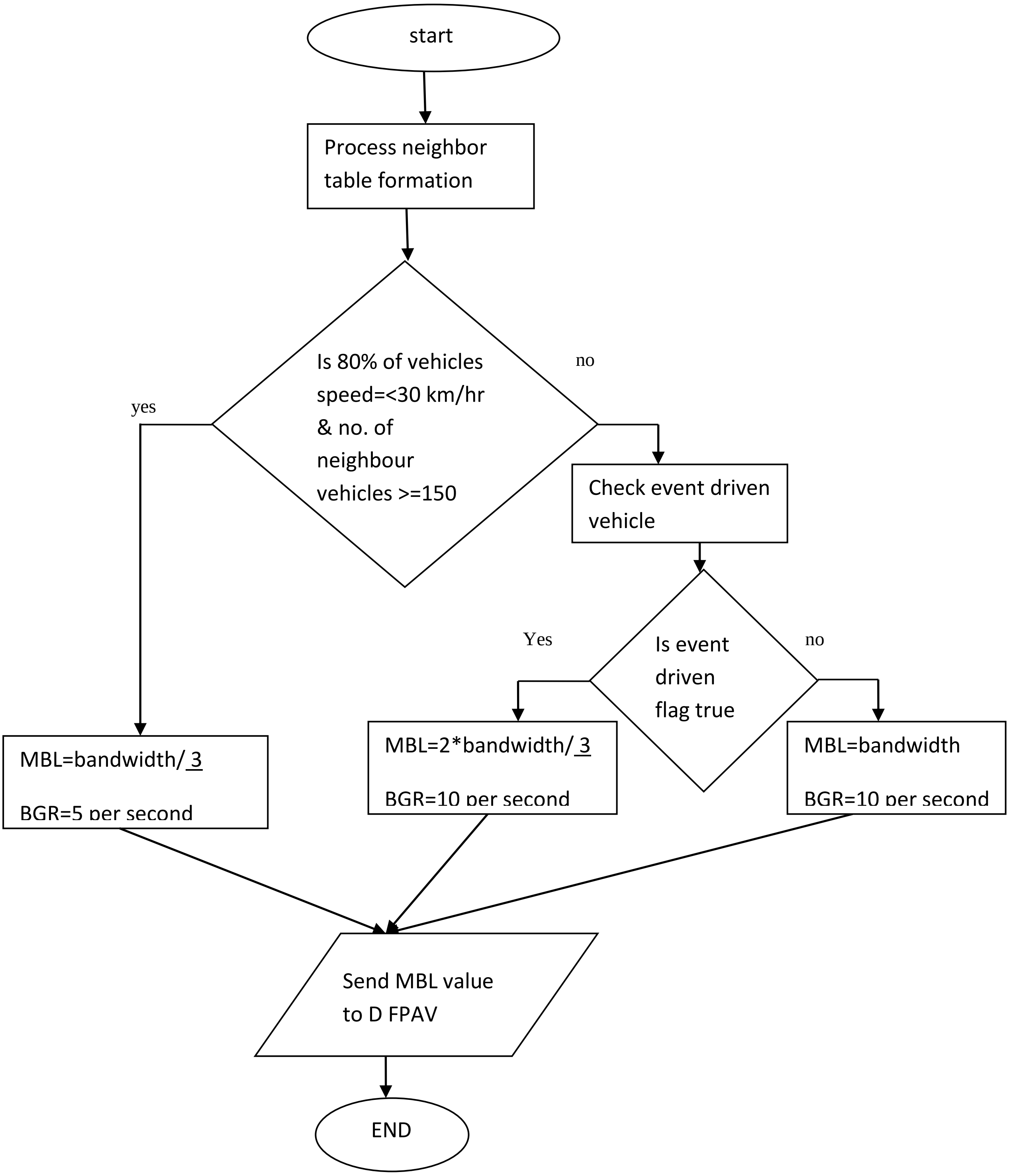

Fig3: Dynamic MBL procedure

CONCLUSION

This paper shows congestion, which is now the major challenges in VANETs. Congestion is now concerned by the limited bandwidth in the VANET standard, IEEE 802.11p. It is Based on the literature review, the packet generation rate or utility function, the transmit power control or access priority, carrier sense threshold, and smart rebroadcast are the main index used by the proposed algorithms to remove serious congestion. A cross-layer congestion control model had proposed to solve the congestion issue in VANETs. This paper has focused on the application, MAC and physical layers. The Safety related messages in this algorithm have classified into beacon and event-driven messages. These messages have transmitted based on a combination of the maximizing the minimum transmit power levels and the various packet generation ratio for all the nodes within the CS range in order to get congestion control among nodes until the beacon message load falls below dynamic threshold. This algorithm is based on a dynamic MBL assignment which is relative to urban conditions (high and low traffic). The effects of assigning dynamic MBL to this algorithm had investigated by using three scenarios (eg with different vehicle densities, with obstacles, and without obstacles). The results and evaluation metrics explains that the DD-FPAV algorithm produces much better reception probability for beacon and event-driven messages at the different vehicle densities. Besides, the DD-FPAV algorithm has performed the D-FPAV, D-FVAP-OFF and UV-CAST approaches in conditions of the average delivery ratio and average delay of the beacon and event driven messages under low and high traffic conditions, respectively, and anyway of whether any obstacles are present or not and Based on these given results, the given performance of these all algorithms debased in the scenarios with the obstacles (realistic scenario) which is now compared with the obstacle-free scenarios (unrealistic scenario) with the help of signal absorption and attenuation through obstacles like walls and buildings. Hence, more study can be focus on developing an accurate simulation model of the proposed approaches for urban vehicular environments. This model will help researchers to spread messages by using realistic parameters which are very necessary to ensure that proposed technique represents an sufficient behavior in a real-life environment and not only in the theory and the traffic congestion problem can be solved by developing a social-based model, whereas the behavior pattern of further global knowledge will allow us to make much better routing decisions to reduce traffic congestion. This social-based model can be play an important role to interconnect vehicles to support the new network applications.

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