Enhancement in ECODE Protocol to improve Network Life Using Single Hop Communication

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Abstract –VANET (Vehicular Adhoc Network) communication is one of the most widespread topic in the field of research in wireless networking. The most prominent goal of VANET is to provide road safety and ease to the passengers. For this, VANET uses two types of safety messages – beacons and event driven messages. But as the numbers of vehicles are increasing, traffic also increases which results in congestion in the network. So to overcome these problems different methodologies should be used to avoid the traffic congestion. The Efficient Traffic Congestion Detection Algorithm (ECODE) has been improved by reducing the congestion in the network. This technique will provide better outcomes in terms congestion control and end to end delay.

Keywords- VANET, CONGESTION, ECODE, DSRC, ITS, RSU, TMR.

I. INTRODUCTION

VANET is one of the influencing areas for the development of the Intelligent Transportation System in order to provide comfort and safety to the road users. VANET is a self organising network. VANET is subclass of MANET. The only difference is, in MANET, mobile nodes are there and in VANET vehicles are there but there are few stationary nodes known as roadside units (RSU) to support the vehicular networks for serving geographical data. In VANET, vehicles move on predefined roads. The vehicles have to follow the traffic signs and obey traffic rules. In Figure 1, VANET architecture is shown in which vehicles communicate with each other using vehicle to vehicle communication (V2V) and with roadside infrastructure using (V2I) communication. V2V communication is suitable for short range vehicular network. It does not need any roadside infrastructure. V2I uses pre existing network infrastructure such as wireless access points. In V2I warning messages are first send to roadside units and then from that roadside unit these warning messages send to the vehicles.

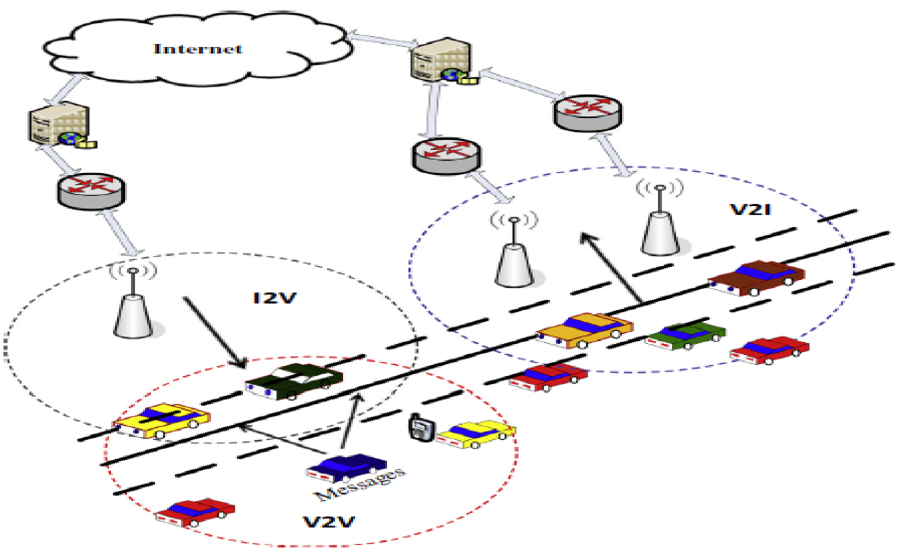


Fig. 1. Vanet Architecture

A.STANDARDS

Various types of technologies have been introduced in VANET to provide radio communication between the vehicles and roadside units. The most widely used technologies are cellular networks (2G/3G/4G), Wireless LAN/Wi-Fi, WiMAX and DSRC/WAVE. Vehicular networks usually use dedicated short range communication (DSRC) which is the enhanced version of Wi-Fi. DSRC is basically used where the topology changes extremely quickly. DSRC uses 5.9 GHz band and provides data transfer between vehicles and roadside units. DSRC provides high data rates and quick responses in vehicular networks so that critical situations like road accidents can be avoided. As shown in Fig. 2, DSRC is protocol stack which includes MAC and PHY layers provided by IEEE 802.11p. DSRC is made up of seven channels; it starts at 172 and ends at the 184 channel number. Each channel has specified a frequency i.e. 10MHz.channel number 178 is used to control the channel, for safety and secure communication. Likewise channel number 172 and channel 184 is used for safety application, some other services provides safety and non safety uses.

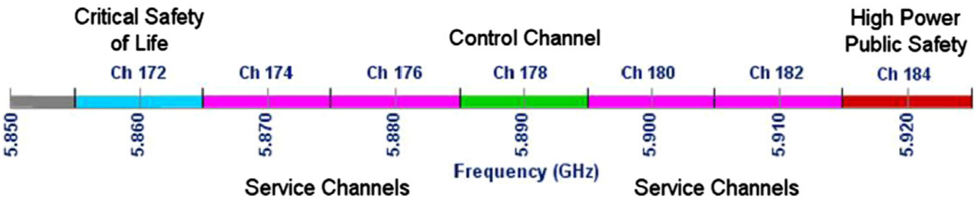


Fig. 2. 75MHz DSRC Spectrum

II. CONGESTION IN VANET

Congestion is one of the biggest problems in vehicular adhoc networks. Most of the researchers aim at decreasing the congestion level in the network but results is not obtained up to the mark. This is due to the increasing number of vehicles in the transportation system. We know that with increasing number of vehicles traffic also increases which may lead to congestion in the network. There can be various reasons for the congestion in the network like under-construction road, accidents, weather and rush hour. One of the main factors can be driver's behaviour. Communication channel congestion can lead to packet drops in the network which results in the channel degradation.

The main aim of VANET is to provide safety on road. So, it uses two types of messages. One is beacon messages and other is emergency messages. Beacons are used to exchange basic information like speed of vehicle or location of the vehicle and emergency messages are send in critical situations like accident warning. Beacon messages usually consume much bandwidth as compared to emergency messages. So, sometimes emergency messages are dropped which may result in accidents. There can be various ways by which congestion can be controlled. One is to reserve the bandwidth for emergency messages. Also there are various congestion control protocols which can be used to detect or avoid the congestion in the network, thus providing a smooth and safe travel.

III. REVIEW OF LITERATURE

This section intends to review several related solutions in the literature and are presented below. In [1], a congestion control technique is proposed which will guarantee that an adequate amount of bandwidth is assigned to beacons and emergency messages so that in dense environment the congestion can be avoided. In the proposed scheme, proper time slots are assigned to beacons and emergency messages. First we will partition the road into small segments or sectors of equal and unequal density. If the vehicle density is unequal then the local coordinator is selected will select the time slot for other vehicles. As we know that according to the DSRC, each vehicle will create beacons after 300ms, so if vehicle density is high the sector will get congested easily. So the congestion must be detected without delay and a dynamic time reservation slot must be assign to emergency messages. If the vehicles do not discover any time slot in the sector then intersegment slot transfer can be there. Thus, congestion can be controlled by the proposed method.

In [2], the traffic control and congestion avoidance system is presented to overcome traffic problems. This system is created over the cars in the traffic and their corresponding road infrastructure. To monitor traffic, sensors within road infrastructure are used and also in this system cars are acting as data collectors which will provide great help in congestion avoidance. The main advantage of this proposed system is that data is collected automatically by the cars (mobile devices) and wireless traffic lights and aggregated so that best path can be chosen to reach destinations.

In [3], the two types of safety messages has been described that are been used in VANET to provide safety on road. These are beacons (periodic safety messages) and event driven messages. The beacons are used to exchange status information like speed, position. Event driven messages broadcast messages in case of emergency situations for e.g. accidents. The authors make use of transmission rate or power control techniques to overcome the bandwidth problem that arises due to the use of same control channel for beacons and event driven messages. So, an efficient congestion control scheme has been designed to get optimal results. In the scheme, all the vehicles are informed regarding their channel level continuously. When the channel gets saturated, a vehicle can sense the congestion at that particular time. If this happens, the vehicle immediately starts congestion mitigation process. This step is performed until the channel load gets below congestion level.

In [4], authors put together the VANET and artificial intelligence to lessen traffic waves. Traffic waves are the travelling interferences in the dissemination of cars on a roadway. According to the researchers the main reason for this is human error. A VANET technology known as Zigbee Standard was developed when the research was ongoing. . Zigbee standard is a low- power, low-cost, wireless mesh networking standard. But Zigbee standard lacks in transmission of data at high speeds. Zigbee coordinator nodes are disseminated all over the map and record the number of vehicles in the cluster. This information will be send to all the nearby vehicles so that an efficient path must be followed by the driver.

In [5], ECODE protocol has been discussed which detects the road segments that are suffering from traffic congestion by means of cooperative vehicular communication. This protocol makes use of multihop communication and geocast ideology to collect and analyze general data of vehicles per road segment. This protocol handles the broadcast storm problem, limited bandwidth and reliability challenges. To solve the broadcast problem the author make use to relay vehicles to forward data. In this, each vehicle generate a traffic monitoring report which consists of traffic speed, traffic density and estimated travel time. This protocol is direction based that is it consider the direction in which vehicle is travelling.

IV. PROBLEM DEFINITION AND OBJECTIVE

In VANETs, emergency messages (e.g. emergency stop of a vehicle, collision) should be sent with minimal delay, with a high priority and with a loss rate near to zero. If a large number of vehicles sends beacons at a high frequency, or event-driven messages are broadcasted multiple times then the communication channel will easily get exhausted which results in poor bandwidth usage. It is very important to keep the common control channel (CCH) free from bandwidth usage in order to ensure timely and reliable delivery of safety messages. In the work put forward by authors, they have attempted to reduce the congestion with the help of efficient road congestion detection protocol (ECODE). In their work, they have assumed RSU at each road intersection for monitoring the traffic of the surrounding segments. They have tried to reduce the congestion with a mechanism with the help of which every vehicle will broadcast an advertisement message to all the vehicles in its neighborhood community or in its range. RSU chooses the relay vehicles according to the information provided in the broadcasted message. The information includes ID, Speed, Location, Direction, Destination etc. However, in the dense city scenarios the numbers of vehicles are more and broadcasting the advertisement messages may result in congestion in the network. So there arises a need to design a mechanism to reduce this consumption which is quite minimal in these types of protocols which further results in better communication to make better congestion detection on various road segments. Single hop communication will take place only from vehicles to RSUs so in this case the no. of RSUs will be increased due to short range communication take place between the nodes to make better TMR.

V. RESEARCH METHODOLOGY

The vehicle moving on the roads must exchange useful information about the road conditions and vehicle density so as to monitor the traffic conditions and avoid accidents. However this requires periodic update of the information related to the vehicles such as vehicle speed, vehicle destination, vehicle direction etc so that vehicle moving ahead or those moving forward can access the conditions and decide their route accordingly. The periodic exchange of the information results in congestion in the network thus cause delay and further results poor packet delivery in the network. In the dense areas where the number of vehicles are much more the congestion is bound to occur. However, we aim to reduce bandwidth congestion in the network with the help of the road side units. Each vehicle must communicate with RSU which lies in the transmission range. The vehicle must send a message to the RSU, the message should contain information like vehicle id, its speed and location, direction and destination and time of message generation. The RSU must be placed in the last quarter of the road segment. The reason for this particular placement of the road side unit is accounted for the fact that the congestion is bound to occur at the intersection of the road segments. And if the road side unit is placed in the last quarter of the road segment, then after receiving all the information from the vehicles, the RSU can provide the vehicle with the proper directions and the driver of the vehicle will have all the directions before reaching the intersection itself. However, if the RSU is placed just at the intersection of the road, then the driver of the vehicle might not get enough of the time to assess the conditions. So after all the vehicles send their information to the RSU of one particular segment, it can communicate with the RSU of the other segment and inform it about the traffic conditions in its own segment. After assessing the traffic at the intersection, RSU will provide information to the vehicle to maintain the traffic by taking effective decision to follow a less congested route to the destination. In this way, we aim to reduce the congestion in the network.

V.I Algorithm Steps

1. Collect information about the vehicle like vehicle speed, destination, and direction.

2. Create traffic report for the destination given by the vehicle.
3. The traffic monitoring report gets the entries from the table and stores it in the table.
4. The RSU increment the number of nodes for the destination w.r.t vehicle.
5. Then RSU transfer the report updates to the next adjacent RSU unit.
6. Updates of transfer of traffic report will be executed till the corner RSU receives the updated report.
7. When the vehicle reaches at the corner segment, RSU updates the vehicle with current info and direction to follow for the destination.

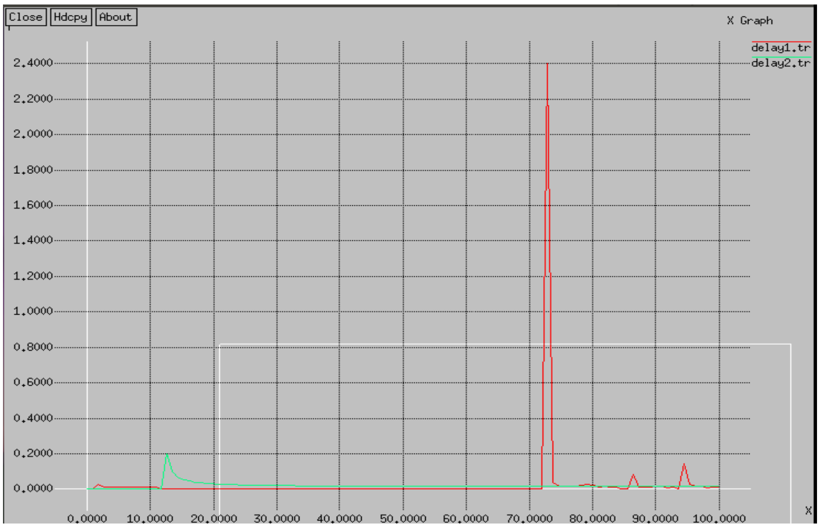
VI. PERFORMANCE EVALUATION

The simulation parameters that have been taken are listed below.

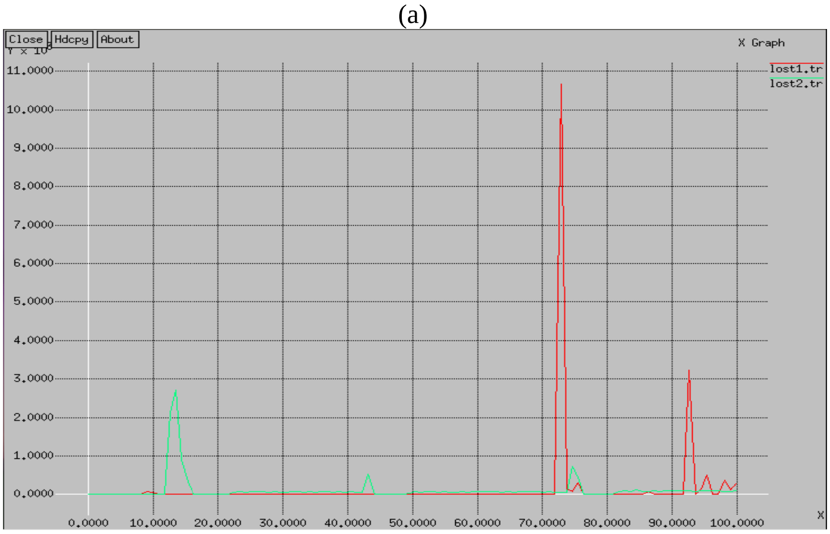
Table I

S.No	Parameter	Value
1	No of Lanes	4
2	Transmission Range	250m
3	Wireless medium	IEEE 802.11
4	Simulation Time	100s
5	Grid Size	4X4

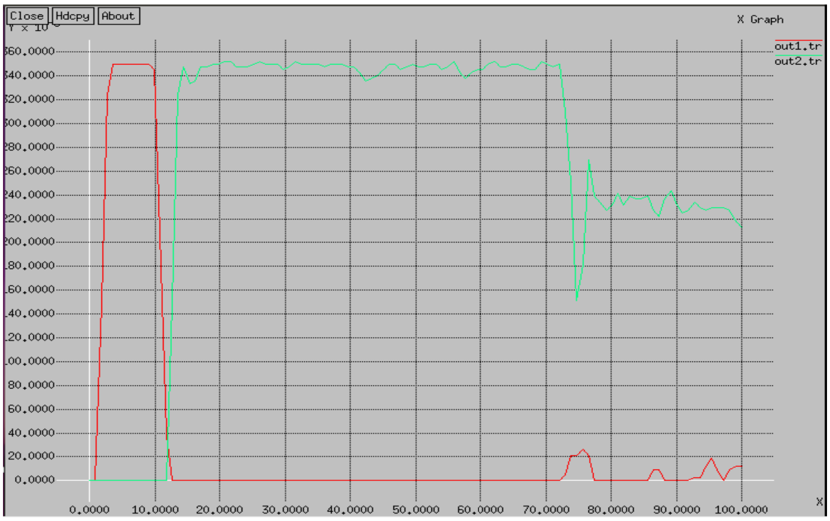
The Xgraph shows the performance of the enhanced protocol as compare to the previous one. Starting with the Figure3(a) the delay2 is negligible as compared to delay1 which was the delay in ECODE Protocol. Figure3(b) shows the packet loss1 is much less than packet loss2 which is again less because of single hop communication. Figure3(c) shows the overall throughput which is more in case of enhanced ECODE protocol(out1), thus making it better as compared to other protocols.



(a)



(b)



(c)

Figure 3. The Performance of enhanced ECODE compared to ECODE : a) end to end delay b) packet loss c) throughput

VII. CONCLUSION

The system is better in terms of performance measures as compared to the existing system. By using single hop communication, there will be direct communication between roadside units and vehicles which will reduce the bandwidth usage in the network. Also there will be decrease in end to end delay because communication will directly take place from RSU to RSU for generating traffic monitoring report. Roadside units will communicate with other and informs about the traffic conditions in its segment. RSU also acknowledges the vehicles by sending the information about the traffic conditions at the intersection. After assessing the traffic at the intersection, RSU will provide information to the vehicle to maintain the traffic by taking effective decision to follow a less congested route to the destination. In this way, system aim to reduce the congestion in the network.

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