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Congestion Control in MAC Layer of Vehicular Adhoc Network using Gradient Decent Algorithm

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***Abstract*— The self-sorting based MAC protocol in VANET network improves the performance but it is not able to reduce the resources. The proposed work defines an access mechanism which enhances the self-sorting protocols with resource optimization using the Gradient descent algorithm. The proposed algorithm reduces the error rate (drop packet rate) and enhances the Packet delivery ratio. The proposed algorithm improves the usage for safety applications and uses the mechanism for service application transmission. The results of the proposed work are compared with enhanced self-sorting protocols with other existing protocol.**

Keywords*— *VANET, MAC, TDMA, RSU, PDR

I. INTRODUCTION

Now a day transportation systems is biggest point of problem between policy makers, researchers and automobile manufacturer. It is biggest public health and injury prevention problem because of the increment in traffic congestion, injuries and death due to road accidents. To overcome this type of issues VANET define two different types of application in which one is related to safety and other is related to service. The safety application gives the detail of safety on road and depends on the two factors that are packet delivery ration and delay. Service application demands more on throughput.

In the proposed work is based on these considerations in which it considers the vehicle coverage ratio, Number of accident, Channel busy ratio and Packet delivery ratio. On the basis or this performance evaluation is also done. The rest part of the paper gives detail about the related approaches used to solve the problem like this.

II. RELATED STUDY

Ngo, et al. [1]: In this paper to improve the performance of safety application in high density VANET a self-sorting based MAC protocol is introduced. There is also an introduction of access mechanism which helps in enhancement of self-sorting protocol for the purpose of appropriate time utilization to incorporate the mechanism. With the comparison of proposed protocol with self -sorting protocol and other network scenarios we investigate the performance of introduced protocol. The result shows that introduced protocol gives better performance in dense network and there performance in terms of output of the protocol is acceptable. Shen, et al. [2]: In this paper for high density scenario a MAC protocol is proposed in VANET which depends upon the dissemination of safety-related messages. Here this protocol permits the vehicles to sort with another vehicle in a collision-tolerance manner before data transmission. A logic queue is developed by vehicles automatically. In this paper a queue makes the self-sorting process in the MAC protocol. Here queue compete for accessing the channel. In contrast with completely random access, the slot a queue selects to access the channel depends on the completion time of the self-sorting process. The performance of the given protocol is determined by comparison process with other introduced protocols. The result shows that this introduced protocol has better utilization in high density.

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Dang, Duc Ngoc Minh, et al. [3] in this paper, the author proposed a multichannel MAC directional protocol for VANET's. It provides the security to the data during the transmission of message on vehicles. This protocol is also known as DMV protocol which provides the reliability and supports the TDMS and CSMA Access schemes. The simulation result of the proposed approach enhanced the packet delivery ratio and throughput of the network. Nguyen, VanDung, et al. [4] in this paper, the author proposed the Hybrid multichannel MAC protocol for the vehicular network. This protocol enhanced the throughput and reduces the collision on the network. The co-ordination between the nodes is nontrivial and it supports TDMA and CSMA to improve the reliability in broadcasting messages. This protocol controls the undesired messages and eliminates them. It works on the approach of time slot division and provides faster services.

Kawakami et al. [5] in this article, the author introduces a new modified approach which is based on TDMA in vehicular network. In this approach additional bits are added to the header of each time slot called as collision flag. This flag is used to identify the collision in time slot and without changing the ID of the sent packets. If the collision flag in packet is high then it indicates that collision is occurred. The result of the proposed method shows that this method reduces collision level and enhanced the throughput of the network. Mao, Yiwei et al. [6] the author proposed the phase based slot allocation scheme called as Semi- Greedy approach for vehicular network. In this approach two phase of a node get only one time slot and in third phase the node shows the greedy behavior and occupy more time slots. This approach provides the proper utilization of channel and reduces the delay in broadcast. The performance of this approach is effective and efficient.

Dang, Duc Ngoc Minh, et al. [7] in this article, the author introduced a new multichannel MAC protocol for TDMA and CSMA schemes in VANET. It provides the smooth channel for communication between the nodes without any collision on the nodes with reserved time slots. The simulation result of the proposed method shows that this method reduces collision level and enhanced the throughput of the network.

Nguyen, VanDung, et al. [8] in this paper, the author proposed the enhanced MAC protocol for vehicular networks. This protocol assigns the time slots to the moving vehicle in opposite direction to avoid the collision. It solves the exposed terminal problem and provides efficient and reliable data transmission. Parallel transmission of data provides the effective communication between the vehicles. Sharef et al. [9] A Vehicular Ad hoc Network or VANET is a novel way to deal with intelligent transportation framework innovation which has gotten noteworthy consideration as of late. The model of the directing conventions utilized as a part of VANETs is exceptionally essential for upgrading the wellbeing of the drivers, managing movement and enhancing the entire driving background. VANET is a sort of mobile ad hoc networks (MANETs). The key qualification amongst VANET and MANET is the high versatility design, quick evolving topology, and ability of portability expectation. Be that as it may, it isn't powerful to apply the predominant directing conventions of MANETs into VANETs.

Xiang, Yong, et al. [10] In this paper, the author proposed the geographic stateless routing which is combined with digital map and mode location. It solves the problem like sparse connectivity and local maximum to enhance the forwarding path. The issue related to unreliable wireless channel solved by using forwarding algorithms. The simulation results show the efficiency in result by providing high packet delivery ratio as compared to other existing schemes.

III. **PROPOSED STUDY**

This section describes the proposed work with the algorithm and flow chart of the methodology in detail. Here we describe the algorithm gradient descent which is used in VENET.

Gradient Descent: Gradient descent is an optimization algorithm which is used to find the values of parameters of a function which minimize the cost function. This algorithm provides the continuous optimization for a long time. Basically it is an iterative algorithm which is based on the value of cost function which decreases fast in the direction of negative gradient.

Algorithm Used

Input : Y, θ, X, α, tolerance, Max iteration
Here, Y← Number of Queues
θ← Queue length
X← Vehicles
α← Variance in queue Length
Output: θ
Step 1: $for\ i = 0; i < \max iteration; i++\ do$
Current cost= Cost(Y,X, θ) {Current cost← Number of drop Packet}
If current cost < tolerance of variance then
else
gradient = Gradient (Y,X, θ)
$\theta_j \leftarrow \theta_j - \alpha.gradient$ {Update the variance on the basis of variance change the queue length}
Here α is learning rate.

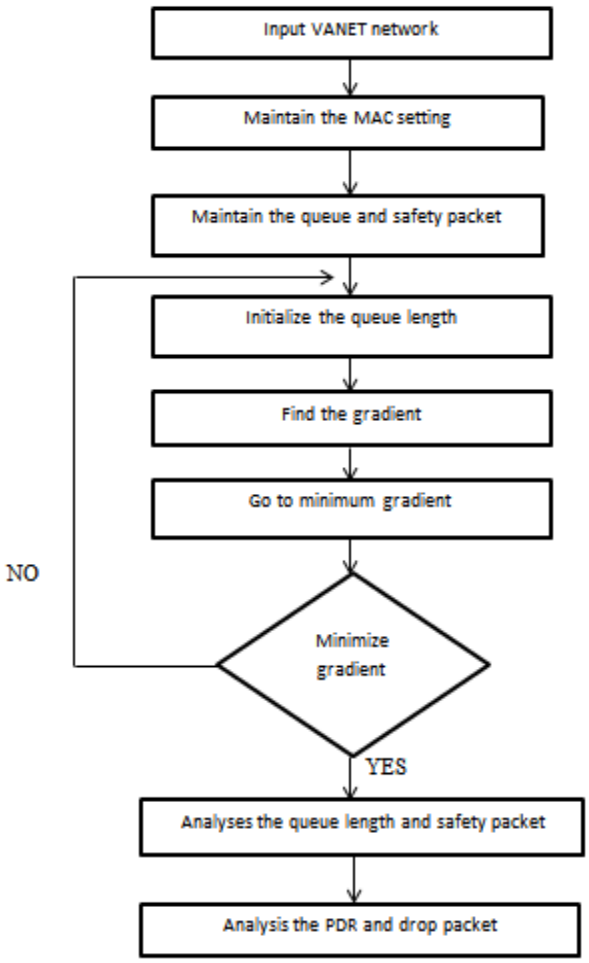

Figure 1.1 Flow Chart of the Methodology

Methodology Steps

Step1 Input VANET Network.
Step2 Maintain the Media Access Control settings (MAC).
Step3 Maintain the queue and safety packet.
Step4 Initialize the queue length.
Step5 Find the gradient descent on the basis of queue length.
Step6 Select the minimum gradient among all.
Step7 Check the Gradient is minimum or not if yes the analysis the length and safety packet otherwise initialize the queue length again.
Step8 Analyze the performance evaluation parameters Packet drop rate and Drop Packets

IV. RESULTS ANALYSIS

This section gives a detail on performance evaluation process by the obtained results on different number of vehicles. The parameters for the performance are also discussed in this chapter. The graphs shown in the chapter represents the performance of the existing and proposed approach.

Parameters Used

The parameters used in this work represent the efficiency of the proposed work in the vehicular network. Following are the parameters that are used for analysis process in the next section:-

Vehicle Coverage Ratio: It is defined as the vehicles in the particular range. The generalize formula for this is following:

$$\frac{Area}{No\ of\ vehicles} \times Range\ of\ network$$

No. of Accident Occur: it is the ratio between the total packet transferred from a nodes and their delivery rate. If the packet delivery is successful then network is working properly if the nodes does not receive message due to failure is case of accident.

Channel Busy Ratio: This parameter defines the network ratio when the data packet delivered on the network is more than its efficiency and data transmission between vehicle goes slow.

Packet Delivery Ratio (PDR): It is defined as the ratio of total number of packets delivered successfully and the total number of packets sent from source to destination. Higher PDR signifies more efficiency in the network.

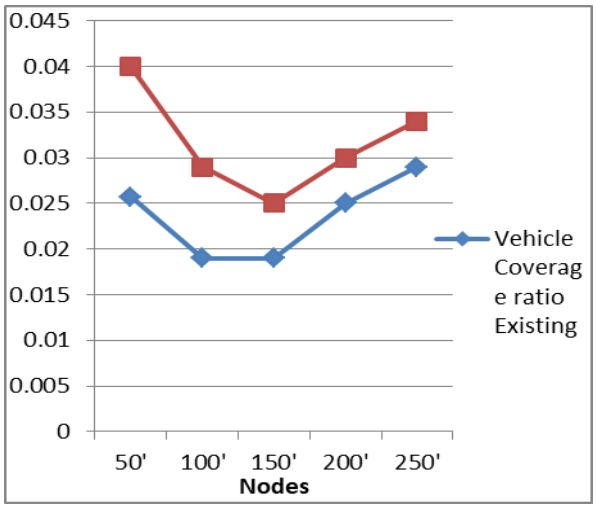

Figure 1.2 Vehicle Coverage ratio In existng and proposed approach

In the above given figure 1.2 vehicle coverage ratio in existing and proposed approach is shown graphically. The X-axis shows the number of nodes and Y-axis represents the valuse of the approaches. The red line depicts the value of proposed approach and blue line depicts the value of existing approach. The coverage of vehicles in the proposed approach is maximum then existing approach which shows the better network coverage in VANET.

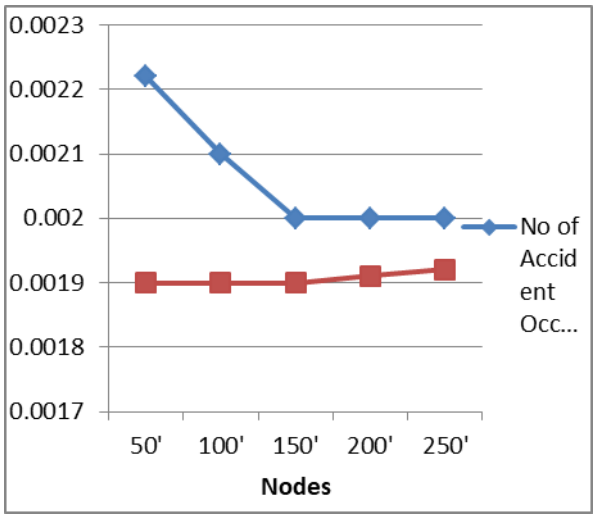

Figure 1.3 Number of Acciedent in exiting and proposed approach

In the above given figure 1.3 accident occur in existing and proposed approach is shown graphically. The X-axis shows the number of nodes and Y-axis represents the values of the approaches. The red line depicts the value of proposed approach and blue line depicts the value of existing approach. The accident occur in the existing approach is maximum then proposed approach which shows the better efficiency of network in VANET. The least number of accident shows the effectiveness of the VANET.

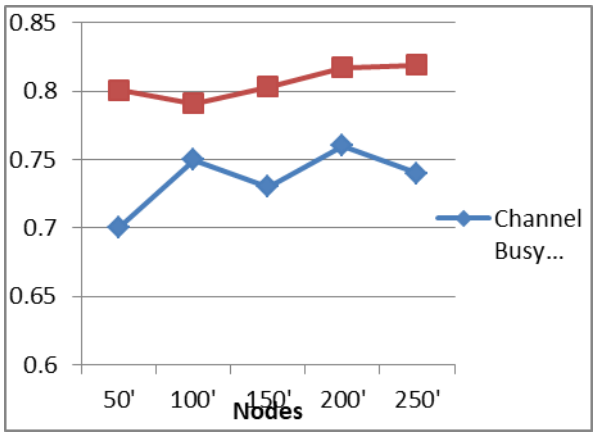

Figure 1.4 Channel Busy Ratio in existing and proposed approach

In the above given figure 1.4 Channel Busy Ratio in existing and proposed approach is shown graphically. The X-axis shows the number of nodes and Y-axis represents the values of the approaches. The red line depicts the value of proposed approach and blue line depicts the value of existing approach. The Channel Busy Ratio in the proposed approach is maximum and low in approach existing which shows the better efficiency of network in VANET. The channel busy ratio shows the communication process in the network which is maximum at proposed approach.

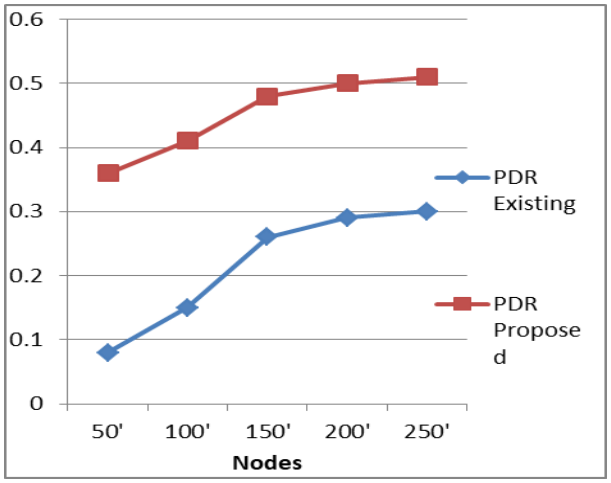

Figure 1.5 Packet deliveries Ratio in existing and proposed approach

In the above given figure 1.5 Channel Busy Ratio in existing and proposed approach is shown graphically. The X-axis shows the number of nodes and Y-axis represents the values of the approaches. The red line depicts the value of proposed approach and blue line depicts the value of existing approach. The Packet Delivery Ratio in the proposed approach is maximum and low in approach existing which shows the better efficiency of network in VANET. The Packet Delivery ratio shows the communication process in the network which is maximum at proposed approach.

V CONCLUSION

In this paper gradient descent algorithm is used for the optimized queue resources. The channel is contended by the queue heads and each queue is based on the channel based TDMA approach. During reserved slot of a queue handshakes for service application are also transmitted by the queue members. The performance evaluation of this work is done by enhancing the packet delivery ratio.

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