REDUCE THE CONGESTION IN CONTROL CHANNEL OF MAC LAYER OF VANET USING MAC PROTOCOLS

[1]Abhishek Sharma, [2]Rajeev Bedi, [3]Dr. S.K Gupta

[1]M.Tech (CSE), [2]Assistant Professor, [3]Associate Professor
Department of Computer Science and Engineering,
Beant College of Engineering & Technology, Gurdaspur

***Abstract*: Vehicular ad-hoc network plays an important role in road safety and congestion of traffic on the road. To provide the reliable and efficient communication during data transmission various methods and algorithms are used with this application. In this paper the author review on the MAC (Media Access control) protocol which supports the adaptive broadcasting mechanism. This protocol affects the critical parameters of the VANET communication.**

Keywords: VANET, MAC, Vehicles RSU, TDMA, PDR

I. INTRODUCTION

VANET it stands for vehicular ad-hoc network. It is a special category of Mobile Ad-hoc Networks (MANET) which is consists of number of vehicles having ability to communicate with each other without any fix infrastructure. It is an important class because it is a key component of ITS (Intelligent Transportation system). IT'S helps to develop the infrastructure and communication among the vehicles and is a part of researches in smart cities. VANET is introduced under car to car communication and networking applications To provide safety, comfort and other road side services VANET co-exist with vehicle to vehicle and vehicle to roadside communication architecture. VANET is capable to communicate with other moving vehicles, fixed structure and road side unit (RSU) [1].

A. Architecture of VANET

The architecture of VANET is proposed by the number of the organization like IEEE, ISO, and European car industry (ECI) which varies from region to region. By using DSRC a unicast single hop communication is given by IEEE, where Continuous Air Interface for long to medium Range i.e. (CALM) is given by ISO and ECI gives the Car to Car Consortium (C2C-CC)which becomes the main driving force for vehicular Communication in 2007. This proposal gives its focus on the C2C-CC multi-hop and other W-LAN standards. The modes of communication of C2C-CC are unicast, broadcast, geo-cast and geo broad cast.

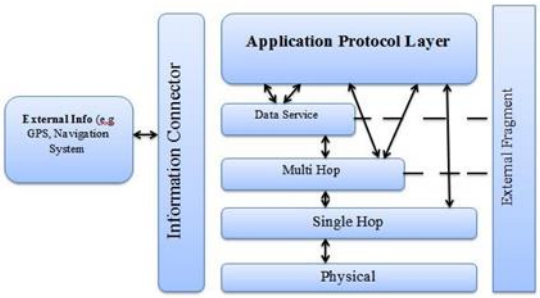

Figure 1.1: Architecture of VANET

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). Different types of protocols are used to enhance the performance of the VANET. These protocols also support the TDMA and CSMA approaches. Different protocols like DMV, MAC are used to increase the delivery ratio and throughput of the network [2, 3].

B. MAC Protocols for VANET

VANET also supports the vehicle to vehicle communication and inter-vehicle communication. In VANET the mobile nodes are vehicle going on the roads, and because of their speed and mobility its topology is frequently changed. Nodes in the VANET move

only in predetermined roads and they do not have the problem of resource limitation in terms of data storage and power. MAC protocols in VANET are mainly used to reduce the delay in information transfer.

MAC protocols for VANET

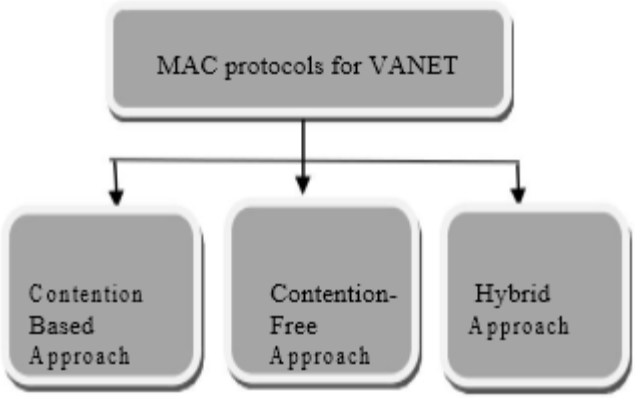

Figure 1.2: MAC Protocol Types

II. OVERVIEW OF VARIOUS MEDIUM ACCESS CONTROL PROTOCOLS

A. Self-sorting Based MAC Protocol:

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 their performance in terms of output of the protocol

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.. 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 [2].

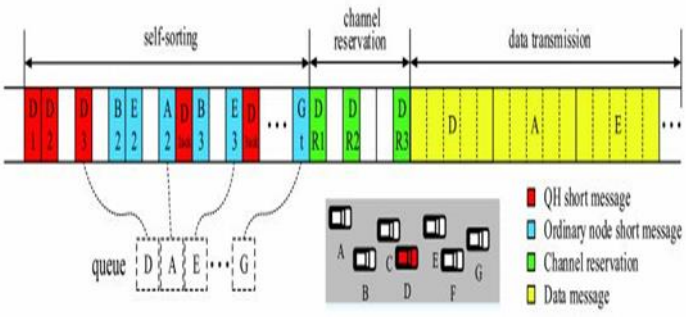

Figure 1.3: Self Sorting Based MAC [2]

B. Hybrid TDMA/CSMA multichannel MAC:

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 [3]. The result of the proposed method shows that this method reduces collision level and enhanced the throughput of the network [4].

C. Directional Multi-channel MAC:

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 [5]. In this experiment MAC protocol is used for the channel coordination the proposed method is used to adjust the length between CCH and SCHs.
Contention free access of service channels (SCH). Traffic is optimized by using Markov model [6].

Dedicated multi-channel MAC protocol for vehicular network with adaptive broadcasting. This approach provides collision and delay free network when the traffic is increased. The simulation result of the proposed experiment shows the effective evaluation [7]. Clustering-based multichannel MAC protocol proposed for quality of service in VANET. In this approach clustering and contention free MAC are combined. Elected cluster head vehicle act as a coordinator to collect real time safety messages. It controls the channel assignments for cluster member vehicles in non-real time traffics [8].

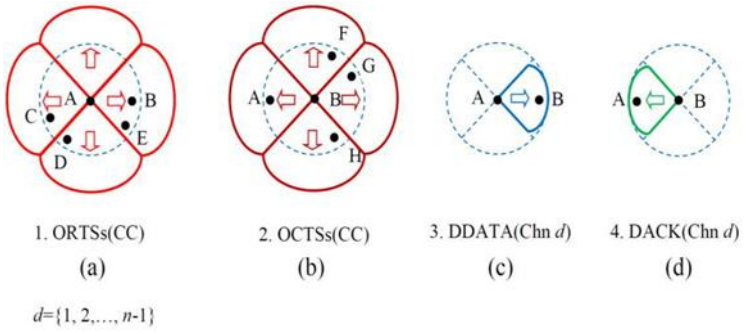

Figure 1.4: Direction Multi-channels MAC

D. Connectivity aware MAC protocol

Shao, Caixing, et al. introduced the connectivity aware MAC protocol for Platoon-Based VANET. It analyzed the connectivity probabilities of vehicle-to-vehicle and vehicle-to-infrastructure. The relationship between the connectivity probability and system throughput is derived by using multi-priority Markov model. Length of the control channel is adjusted by using multichannel reservation approach [9].

E. Hybrid efficient and reliable MAC:

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 [10].

F. Coordinator based MAC protocol:

MAC protocol is used [10] for the channel coordination in vehicular ad-hoc network. In this network multiple channels are deployed that are service channel, control channel which enhance the safety on roads during traffic. The proposed method is used to adjust the length between CCH and SCHs. Multichannel coordination is used to provide the contention.

G. Multi-hop MAC protocol:

Cross layered MAC and clustering scheme introduced for efficient broadcast in VANET. Virtual backbones are created in vehicular network by using dynamic clustering algorithm. These backbones are responsible for the message propagation. In this fast multi-hop forwarding mechanism is used to exploit the role of backbone vehicles under cross layered approach [11].

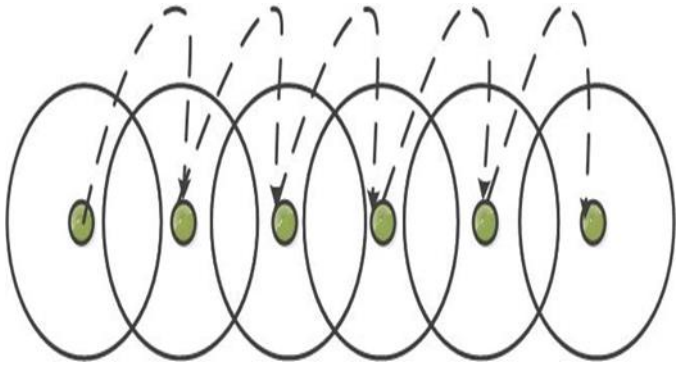

Figure 1.4: Multi hop MAC

H. Secure MAC protocol:

MAC protocol is proposed for dedicated short range communication. This protocol is used to design a secure vehicular network for message transfer between the nodes on network. It provides a reliable communication with better latency rate [12].

I. Hybrid Multi Channel MAC:

MAC aware routing protocol for the wireless network in which next node decision is made on the basis of TDMA is proposed in this work. These decisions are based on the metrics delay, energy consumption, and hop number. The results of simulation show that this protocol provides high-density networks compared to the state of the art.

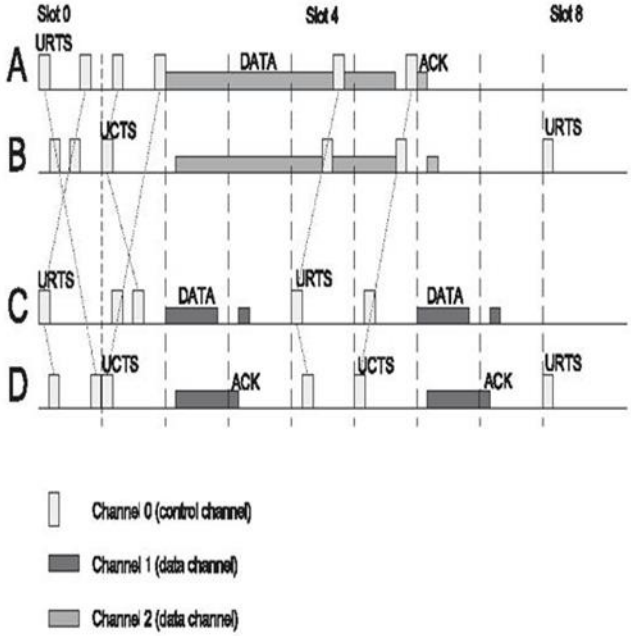

Figure 1.5: Hybrid Multichannel MAC

J. Adaptive TDMA based MAC:

Adaptive TDMA based approach is proposed which is based on the time division multiplexing access with Medium access protocol (MAC). This approach improves the performance of the VANET by handling the issues of dynamic topology change and high mobility in the vehicle modes [15].

K. PCF MAC Protocol:

Point Coordination function represents the MAC protocol is proposed in this work for energy saving by idle station by turning into the sleep condition and at this time active nodes exchange the data packets and improve the energy efficiency. The cycle analysis model is used to evaluate the energy efficiency in PCF and PGP protocol. The performance evaluation of the proposed work shows that it saves energy efficiently [16].

L. HE-MAC Protocol:

The proposed MAC protocol is proposed to overcome the degradation problem in the distributed coordination function. In this protocol Markov chain model and steady state probabilities are derived and used for performance analysis. The EH rate is maximize by the optimization process on the basis of frame generation and transfer rate. For performance analysis HE-MAC is compare with another protocol and provides better performance than the existing methods.

Protocol Name	Author	Packet delivery Ratio	Throughput	Delay	Overhead
1. Self-sorting Based MAC Protocol	Ngo, Quynh et al Shen, Zhongyi, et al.	√	√		
2. Hybrid TDMA/CSMA multichannel MAC	Nguyen, VanDung, et al. Kawakami, et al.		√		√
3. Directional Multi-channel MAC	Dang, DucNgoc Minh, et al. Wang, Qing, et al.	√	√		
4. Connectivity aware MAC protocol	Lu, Ning, et al. Su, Hang, et al.		√		
5. Hybrid efficient and reliable MAC	Duc Ngoc et al.		√	√	
6. Coordinator based MAC protocol	Sahoo, Jagruti, et al.	√			√
7. Multi-hop MAC protocol	Bononi, Luciano et al.	√	√		
8. Secure MAC protocol	Qian, Yi, et al.		√		√
9. MAC	Louail, Lemia, et al.			√	
10. Adaptive TDMA based MAC	Cao, Shengbin et al.	√	√		
11. PCF MAC Protocol	Zheng, Guan, et al.		√		√
12. HE-MAC Protocol	Ha, Taeyoung et al	√		√	

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)

$\theta_i \leftarrow \theta_i - \alpha . gradient$ **{Update the variance on the basis of variance change the queue length}**
Here α is learning rate.

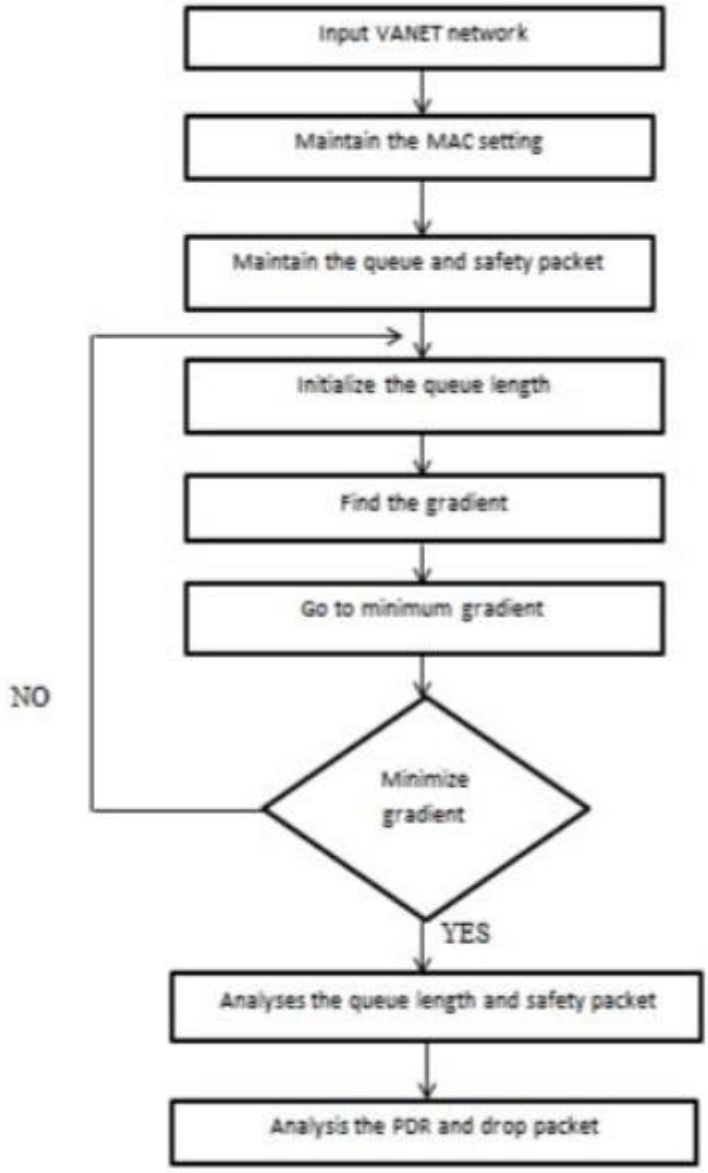

Figure 1.1: Flow Chart of the Methodology Steps

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 analyze is 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 segment gives a feature on presentation assessment procedure by the gained outcomes on diverse quantity of vehicles. The limitations for the presentation are also conversed in this section. The charts shown in the section signifies the enactment of the current and planned 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 vehicles 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.

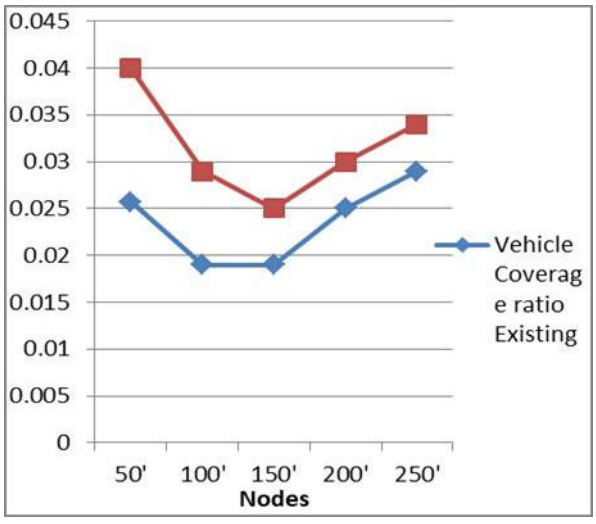

Figure 1.2: Vehicle Coverage Ratios in Existing and Proposed Approach

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 values of the Approach. The coverage of vehicles in the proposed approach is maximum then existing approach which shows the better network coverage in VANET.

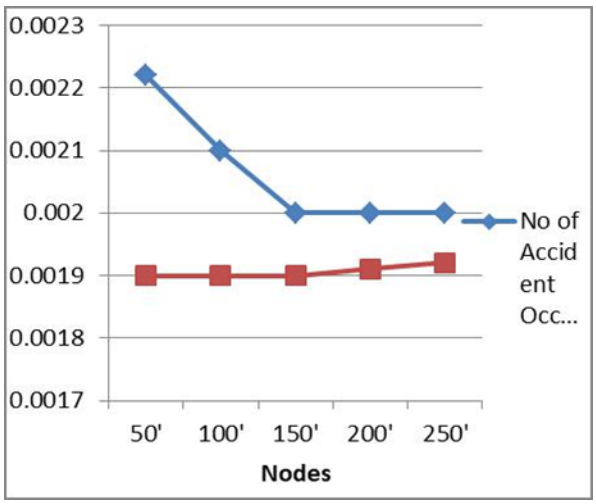

Figure 1.3: Number of Accidents in Existing and Proposed Approach

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 accidents occur in the existing approach is maximum then proposed approach which shows the better efficiency of network in VANET. The least number of accidents shows the effectiveness of the VANET.

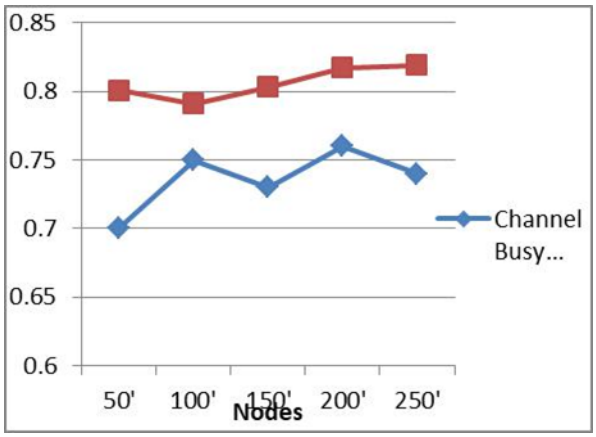

Figure 1.4: Channel Busy Ratio in Existing and Proposed Approach

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 approaches. The red line depicts the value of proposed approach and blue line depicts the value of existing
and maximum. 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.

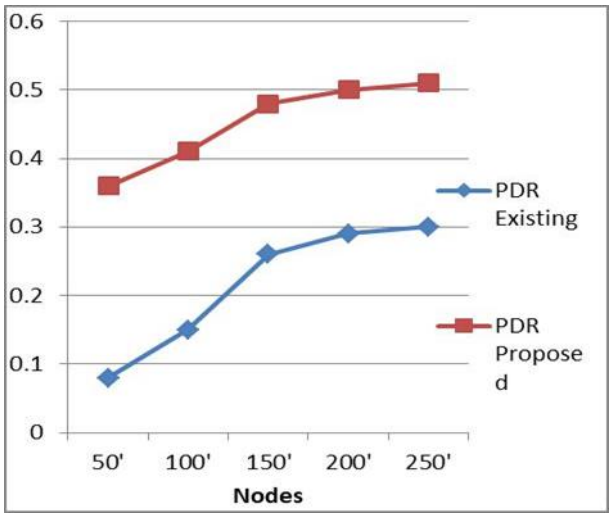

Figure 1.5: Packet Deliveries Ratio in Existing and Proposed Approach

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 procedure is used for the improved queue properties. The network is struggled by the queue heads and each queue is based on the network based TDMA methodology. During earmarked slot of a queue grasps for service submission are also communicated by the queue associates. The performance appraisal of this work is done by improving the packet transfer percentage.

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