May-June 2020
ISSN: 0193-4120 Page No. 10763 - 10776

Network Congestion Problem During Communication in VANET: A Review

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Abstract:
VANET plays an important role in the automated route among sources and destinations in the growth of smart cities in the world. The VANETs are focused on fewer network infrastructures. VANETs have difficulties in routing details, such as insecure networking, high fragmentation, and network partitioning, and thus dictated the creation of effective routing protocols. The measurement of the best route tests the efficiency of the communication while routing protocols guarantee information and data routing. Intelligent correspondence involves the study of VANET routing protocols. We have therefore examined various forms of current routing protocols in VANET in this paper. Vehicles are made easier to provide safety information by way of vehicle communications (V2V) or V2I (vehicle to infrastructure) communications. Therefore, a high number of vehicles create congestion problems in VANET to each and all vehicles share the details between them in this article. Medium Access Control (MAC) protocols are built in this sense to facilitate real-time connectivity among vehicles & roadside elements by minimal transmission collisions. The main challenges of the collision control scheme are to preserve contact on the MAC layer due to VANET characteristics. It thus contributes to end-to-end transmission delays and packet losses. The European Telecommunications Standard Institute (ETSI) has innovated to tackle these important problems, the Decentralized Congestion Control (DCC) system. This paper describes the various major congestion management problems. The congestion control is thus one of these networks ' most difficult issues. This article discusses the methods of congestion management.

Keywords: *Vehicular Adhoc Network, Attacks in VANET Communication, V2V, V2I, Network Congestion, Congestion Control, Congestion Control Algorithms.*

1. INTRODUCTION

Vehicle Ad-hoc Network (VANETs) is very important MANET forms. VANETs are systems that are auto composed and transmitted by other fast vehicles [1]. Since VANETs enable data defined to be exchanged by operation and health, etc. VANETs also facilitate data exchange that allows simple life applications. For example, changes in usefulness during crossing and path blending [2]. VANETs are primarily aimed at ensuring effective V2V and V2R communications. VANETs are the main priority of the organization. VANETs support a large variety of applications exclusively for vehicles focused on these two types of communications [3]. The largest group of VANETs applications is safety applications that are intended to increase the overall quality of public health and promote driver and passenger health. Since most of the high-priority safety applications (or all of them) proposed for VANETs are focused on standard vehicle or RSU security messages [3] and provided that the failure to provide security messages that impact the safety of road users, it is necessary for the MAC protocol to give a proficient one-hop broadcast service for these safety purposes. [4].

Fig. 1. VANETs and its communication modes

VANET is now being committed to more & more research. VANET permits V2V connectivity to give drivers & passengers with safety and comfort [5]. This technology can also be used in addition to these technologies for the delivery of numerous vehicle facilities such as clear Internet and Intranet connectivity, telephone networks and information stations. In addition to the constant movement of cars, crucial time and hybrid VANETs architecture making them distinct from other ad hoc networks are a significant research issue for security and privacy. Therefore, it is important to establish security frameworks for authenticating and validating communications between vehicles and eliminating adversaries from the network [6].

VANET security guarantees not leaked or changed messages from the attackers. Since of its distinctive characteristics, VANETs are more susceptible to attacks. Security issues should be properly addressed; otherwise, other constraints for secure contact in VANETs would be created [7]. The congestion of the MAC layer in VANET is an important problem. Bugging takes place as packets are expanded across network bandwidth, resulting in a lack of packets, reduction of standard networks, etc. A congestion management function is thus intended to improve the stability, scalability, and efficiency of the congested network.

2. COMMUNICATION MODE IN VANETS

To improve traffic flow and health, ITS is continuously working towards ensuring stable connectivity and to resolve traffic congestion by using various network strategies such as MANETs & VANETs [8]. In VANET, the vehicles communicate with each vehicle node through wireless connections. Every VANET node serves as a member and a network router since the nodes connect via other intermediate nodes within their transmission radius. V2X contact can share data among vehicles to pedestrians (V2P), V2V, V2I. As explained below, VANETs contact has been split into two sections:

1. V2V (Vehicle-to-vehicle) Communication

The contact between vehicles is wireless. This communication pattern becomes useful when the text becomes transmitted to a group of vehicles or a single vehicle in multicast or unicast scenarios. To order to increase traffic protection, warning messages must be forwarded to incoming vehicles after an incident has been detected. Figure 2 demonstrates a V2V warning propagation diagram [9].

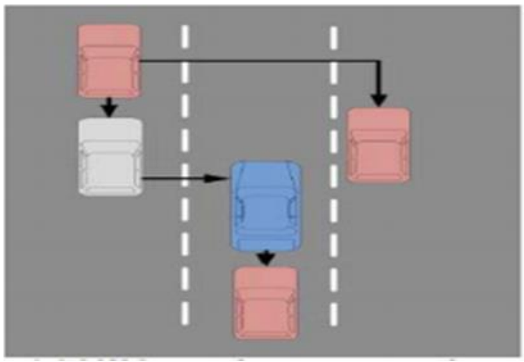

Fig. 2. V2V Warning propagation

2. V2I (Vehicle-to-Infrastructure) Communication

In V2I communication message is transmitted through infrastructure, such as RSUs or a vehicle if a potential danger is found. High bandwidth links are used for connectivity between vehicles and RSU. Fig. 3 displays the V2I warning propagation diagram. But several VANET attacks have been carried out leading to unsecure information transfer [9].

May-June 2020
ISSN: 0193-4120 Page No. 10763 - 10776

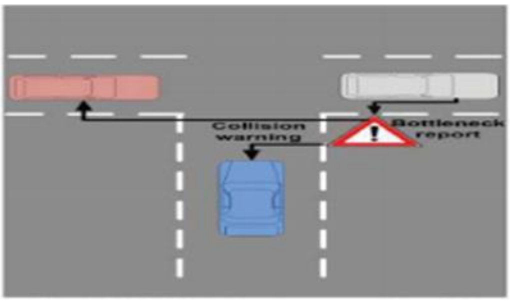

Fig. 3. V2I Warning propagation

3. V2R (Vehicle-to-Roadside) Communication

Switching the mode between V2R and V2V may have a huge effect on transmission efficiency, for example in terms of packet times, usage of bandwidth and packet loss. In addition to the need for good scalability, this fact implies that a criterion based on the optimum direction should be adopted [10]. In Fig. 4, we demonstrate how best to transmit when RSU has been introduced into V2V communication. If the vehicles are inside the RSU set, it gets all the notifications that the cars have in the vicinity. This message is collected by the RSU and delivered to all vehicles in its range. For communicating vehicles of section B, each node will measure CDS and NES while communicating through V2V. In sections A and C of the V2R, single transmission from the RSU is planned.

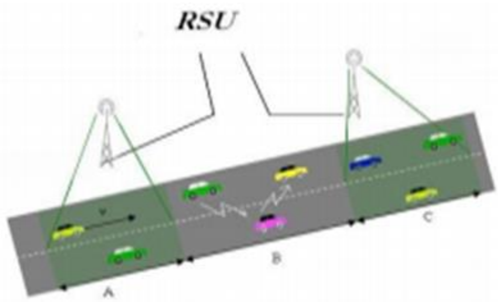

Fig. 4. Combination of V2V and V2R

Table 1
VANETs Characteristics and Architecture [11]

Characteristics	Consideration	Architecture	Location Awareness	Time Awareness
Safety	delay	V2V-V2I	yes	yes
Efficiency	Availability	V2V-V2I	yes	yes
Comfort	Reliability	V2I	yes	no
Urban sensing	Mobility	V2V-V2I	yes	yes

3. ROUTING PROTOCOLS (RPS) IN VANET

RPs in Ad hoc networks are highly important since they are liable to the creation & management of routes for multi-communication & expansion of network coverage area. Also, VANET Routing Protocols are designed to take into account various situations, including node mobility, interruption, and restriction of bandwidth and find key features and limitations of in-vehicle networks. Since we described, VANET has dynamic topology & can serve any kind of application regularly. Thus, continuous research is in progress to increase routing decisions whilst considering restrictions and challenging issues of VANETs [12]. RPs in VANET generally categorized into position based RPs, reactive RPs & proactive RPs [13].

1. Position-Based Routing Protocols

Such kinds of protocols are dependent upon the physical position of nodes. Path to destination. Several locations were suggested for the routing protocol.

Connectivity Aware Routing (CAR) [14] gives a name adaptive beaconing system of a new kind. Depending upon no. of adjacent nodes in adaptive illumination range of HELLO beacons. This uses a chosen preferred group broadcasting (PGB), an

May-June 2020
ISSN: 0193-4120 Page No. 10763 - 10776

advanced methodology for broadcasting. It reduces overhead monitoring messages by reducing redundant transmission. This protocol implements a positioning tool in the route selection process. However, because of convergence, the overhead issue is the packet.

Geographic source routing (GSR) protocol [15] Path from source to destination is identified by using a city map. For a geographic information system (GIS), the city map is digitized and preserved. A reactive location service (RLS) is used by the GSR protocol to define the role of preferred contact partners. The map includes details about a road and street intersection. On this basis, it defines a path this passes a bridge & sequence of road aspects. A source node (SN) floods n/w with location requests to this node classifier. If node matches request identifier, the response back location information on the source node. Request ID information. The transmitting node then calculates the route through a series of road junctions to a target with a city map. GSR operates well in the towns, where routing protocols typically suffer from other roles. However, GSR does not take into account the number of nodes when selecting the next path connections.

GPSR (Greedy perimeter stateless routing) [16] is position depends on RP. GPSR archive scalability by saving a small amount of information per node in terms of the number of network nodes & mobility rate. It just stores the node identifier and actual node location in the table. GPSR operates in two modes: i) packets are sent into a node in the greedy forwarding node, which is closest to the target node geographically. ii) Whether greedy loses, turns on the function of transmitting perimeter. Packets are sent in this mode around the node edge, where greedy has fallen. If any node is located nearer to the destination, it goes back to greedy mode. At a high mobility point, this protocol produces good performance. Nonetheless, GPSR has disadvantages as several packet losses because of the creation of routing loops in perimeter forwarding mode. An advanced technique was also designed i.e. GBR-CNR with Efficient neighbor nodes selection (GBR-CNR-ENS) [17]. This technique is used for selection of the neighbor and executed. It improves the quality of services of the network.

GySTAR (Greedy Traffic-Aware Routing) [18] Protocol includes a method of predicting movement during the selection of routes. It routes packets to the destination between the road junctions. The distinction is that junction is selected depending upon no. of vehicles between crossovers & length to next junction. Node holds packets until it discovers a way to move on. This protocol has a forward and forward strategy. It's stronger than GSR. This protocol has problems with intermediate node failure as packets are kept.

2. Reactive Routing Protocols

Such kinds of protocols only launch route calculations on-demand, meaning that they perform more efficiently than constructive routing protocols. Too several reactive RPs are suggested.

AOMDV (Ad hoc On-Demand Multipath Distance Vector) [19] conquers a regular breakdown of AODV routes by the collection of many routes by a source to destination. This is reactive RP. This produces numerous inverted paths, as opposed to AODV, with just one inverted path. This will offer the protocol robustness and the packet can be redirected from another route as if one route fails. However, during the path discovery process, this AOMDV Protocol doesn't find real-time data. An updated variant of AOMDV has been suggested to solve this problem with the information in real-time. The AOMDV is easier focused on speed estimation. Speed metric combines velocity & position of node. This protocol utilizes information on speed metrics that choose route depending upon the information in real-time.

ARP (Adaptive Routing Protocol) [20] is a set of reactive and proactive RP, it is a hybrid one. This varies transmission range by node speed & distance. This measures the node density using special characteristics known as LET (Link

May-June 2020
ISSN: 0193-4120 Page No. 10763 - 10776

Expiration Time). Whether LET is small, this implies lower node speed & low node density & long node speed & lower node density. The protocol is subject to an overview question since speed and location information is frequently shared.

AODV (Ad hoc On-Demand Distance Vector) [21] is reactive RP, which discovers a route to the destination on-demand basis. Its protocol allows for the path seeking method even when it is not a clear path to the destination. Each node in this protocol keeps the routing table with details on the destination. By storing only next-hop data, the size of the routing table was minimized instead of saved the entire path. AODV retains one path to the destination from the source. But this may be an issue with regular path defects in high node mobility. One of the energy efficient protocol was designed [22] and it explain the modified local link repair protocol and this will focus on repairing the broken links in an energy efficient way. It improves the throughput, Packet deliver ratio, routing overhead and End to end delay of the network.

OLSR (Optimized Link state routing) [22] is proactive RP stores the whole route by source to destination. Since of this routing size, no. of nodes in the network will increase significantly. By sharing a fresh route file, you periodically update your routing list. Whenever a source node transfers the packet to a different destination, its particular routing table is scanned. Whether a path to the destination is not accessible, SN calls for processes of road exploration. It will find the best route by source to destination using Bellman ford algo. This algo resolves the problem of routing loop. An issue with this is that OLSR has to periodically refresh its routing tables using battery power & small bandwidth, particularly though the network is disabled.

3. Proactive Routing Protocols

It keeps routes by source to destination through regular routing table change.

Density aware routing protocol [23] to route packages, using details contained in path hierarchies. Road is graded as high-density road, low density & secondary road. That maintains two highways. If the first path fails, the packet is routed via a different route. This considers the traffic information of the real-time path by send the test packet first and then measures nodes density on that route. The test packet contains node density on the path. The road is chosen afterward. It chooses path depending upon information in real-time. However, it has a disadvantage as the use of bandwidth (BW) due to tests and new packets.

4. CONGESTION IN VANET

An important requirement for defense implementations, vehicles using very low latency & packet loss can communicate through nearby vehicles. This is an extremely difficult problem for VANETs because of its high mobility, poor channel efficiency & high message volume. Recent years have seen significant progress in the improvement of congestion control algos, ensuring dependable delivery of security messages in V2V communication. The secure transmission of safety messages is the main requirement of V2V communication. These messages are typically transmitted based on CSMA / CA in Media Access Layer (MAC) to neighboring vehicles using DSRC or WAVE technology. Because of wireless multi-access channels, several factors may delay or fail to disseminate security messages. The limited available channel bandwidth for transmitting safety messages allows for easy congestion of shared radio channels as vehicle densities increase. Channel congestion is a key factor contributing to delayed or ineffective transmission of messages. It is not clear if the channel capacities are enough to accommodate the data load created by beacons & event-led security messages with higher vehicle density. The development of successful V2V communications congestion control strategies in recent years has therefore been of great importance and an area of intense research interest [24].

TEST Engineering & Management

May-June 2020
ISSN: 0193-4120 Page No. 10763 - 10776

1. Network Congestion Problem

Congestion and congestion control are a challenging problem in VANETs. The Web is built on an end-to-end model where transportation protocols, for example, TCP, identify overload conditions at intermediate nodes at endpoints. Source decreases the data rate in the event of congestion. Nevertheless, the topology shifts for VANETs within seconds and, at a moment when the sources respond to the congestion, a congested node utilized in transmission a few seconds ago could not be utilized at all. This paper, therefore, proposes a scheme in which each node adapts locally to BW available. It is recognized that multi-hop wireless n/w Ad hoc multi-hop networks are influenced by IEEE 802.11 approach CSMA (Carrier-Sense Multiple Access). Where communication takes place mostly in the form of end-to-end data flows, CTS or RTS protocol in combination with an equal per-flow schedule will partially reduce this unlawfulness. Such mechanisms cannot be used in VANETs as transmitting communication dominates in this case [25].

2. Parameters Affecting Congestion

Parameters that affect channel congestion directly are referred to as primary parameters [26] such as transmission rate, power & beacon frequency; and parameters based on the key parameters of priority, fairness and utility functions.

Transmit Power: As for the power content of each node, the power transfer is defined. With transmitting power control; the reception rate of beacons decreases and the reception of the incident increases. This further decreases channel running time and congestion. [27]

Transmit Rate: This is called the rate of transmission of packets across the channel. The probability of event-driven transmission control increases, thereby reducing CBT and congestion. [27]

Beacon Frequency: It is several node-transmitted beacon messages per unit time. The frequency of the beacon dense network decreases; the frequency of the light increases as the intensity decreases. This frequency control increases the likelihood of the beacon reception, thus raising canal load and therefore channel congestion. [28]

Fairness: It gives a decent amount of available resources to each node to obtain equitable channel prospects. This improves individual coverage and thus road security and exploits equity in limited transmitting power.

Prioritization: This ensures that messages powered by events have more priority than beacons message; it enhances security & reduces congestion.

Utility Function: This measured the utility of delivering the individual program's data packets. Different application utility features for every packet & encoded in the packet header to determine capabilities of each data packet at every node. It depends upon measured data packet utility. A data rate of each node is set by itself. Higher packages are excluded for congestion.

Node Density: The characteristics of traffic flow are influenced by VANET. The density of vehicles (node) influences the average node speed and thus the stability of the network. Typically as node density enhances, packet transmission rate enhances, resulting in channel charge that is eventually congested. Generally, this parameter is used for simulation and research.

3. Protocol Stack

Protocol stack utilized by USA (WAVE) & Europe (DCC) is illustrated in detail [29].

1) Wireless Access in a Vehicular Environment (WAVE)

Many research conducted around the world to help describe the standard for vehicles ad-hoc network that fairly works on routing algorithms, frequency allocation, security issues, PHY and link layer standard, and some new application. VANET used

WAVE for communication. WAVE consist the IEEE 1609.x family. These family members are:

- IEEE 1609.1: WAVE Resource Manager Application, define service for vehicle
- IEEE 1609.2: Wave Security Application, describes a secure message
- IEEE 1609.3: WAVE data Exchange, using routing the message between the network layer and transport layer
- IEEE 1609.4: WAVE Multi-hops operation, based on IEEE 802.11 that specify PHY and MAC layer.

DSRC band operates the IEEE802.11 devices for v2x communication. DSRC spectrum using 5.9GHz bandwidth for reliable communication however partitioned into seven of 10MHz wide channels. Here only one control channel (CCH) i.e. 178 channel (5.885-5.895 GHz), it is mainly used for the safety communications. For the future safety application purpose, two channels are reserved in WAVE. The idle channels are called service channel (SCH), which is worked for both security & non-security applications. At PHY level, IEEE802.11p design to make a fair communication connection with WAVE devices between fast-moving vehicles in the environment.

2) Decentralized Congestion Control (DCC)

Intelligent Transport System (ITS) designed by ETSI. When high density is increased MAC layer suffers from congestion. This situation decreases the transmission of safety applications on time. Through the control channel, a safety message is transmitted among vehicles. To reduce channel load ETSI design the DCC mechanism that adapts various transmission parameters. For the DCC mechanism, compulsory to go through the ITS-G5 stations. The ITS-G5 station such as:

- DCC Access: to control congestion by act on transmission parameters Transmit rate control (TRC), DCC Sensitivity control (DSC), Transmit power control (TPC), Transmit data rate control (TDC), TAC (Transmit access control). DCC Net: mapping the traffic with Cooperative Awareness Message (CAM) to the DCC profile.
- DCC facilities: provide service according to Decentralized Environment Notification Message (DENM) & CAM profiles.
- DCC Management: inter-operation among multiple layer-specific DCC entities.

ETSI has been described as 2 forms of messages that are DENM and CAM. CAM provides data of vehicle presence, position & crucial status to one-hop neighbor within 1to 10 Hz range of frequency. DENM simulated to event-driven message. The message is triggered when ITS station detects any kind of hazard event, it broadcasting the DENM message to the specific geographical area repeatedly, till the event is over.

5. CONGESTION CONTROL SCHEMES IN VANET

The primary objective of control of congestion is to view the resources provided whilst avoiding the constant overload of network nodes & connections. Significant mechanisms of congestion management are very necessary to allow network activity. Ensure congestion management in the vehicle ad hoc networks, which face specific obstacles and environmental specifics. In this work, we describe a coefficient and completely distributed congestion management strategy based in this document, to make sure decent & safe communication within the VANET network, dependent upon evolving scheduling & transport of these priority basis messages. [30]. we may classify congestion control strategies into 3 main groups: rate adaptation & MAC, as well as trajectory-based systems [31].

1. Rate Adaption Schemes

In the rate adaptation category, algorithms control flow rate by the state of the network to produce a new flow rate away. In this group, we consider mainly techniques for sending rate of routine messages & priority of Event-Driven (ED) messages, so that the network interruption is prevented or minimized.

1) (DRCV) Distributed Rate Control Algorithm for VANETs [32]

It method runs at any network node and is a distributed algorithm. Periodic messages control is concerned; it consists of 3 stages. The first is a transmission channel monitoring process to decide next n/w parameters:

- Number of neighbors
- Chanel Busy Time (CBT)
- Data Rate Package (DPR)

2nd stage is a calculation process of future transmission rate, in which algo. decides the next transfer speed. The third step is the action step, in which the algorithms send periodic messages with a defined flow rate in the preceding phase or wait until they arrive. This is focused on the ED messages that are received. In additional words, if an ED message is received by a node at t, it will not be sent until t+ Δt. It transmits periodic messages with the expected rate in step two following this delay.

2) Performance Evaluation of Beacon Congestion Control Algorithms for VANEs [33]

Its technique also includes periodic messages & consists of 3 phases: monitoring, assessment, and adjustment. It is based on 3 different methods to change the concentrations of periodic messages as per received ED messages.

Rate Control (RC): this technique aims to evaluate sending rate of Periodic Messages using giving metrics:

- Ni(t): no. of nodes that have node i in their carrier-sense range (CR)
- CBT_{th}: channel busy time threshold
- C: positioning constant
- P_{size}: Periodic Message size

Adapted rate is evaluated by giving equation:

$$R_i(t) = \frac{CBT_{th}}{N_i(t) + 1} * \frac{C}{P_{size}}$$

Power Control (PC): Unlike 1st approach, it attempts to monitor the transmitting power of periodic messages with an estimation of the communication range (CR) of the nodes, which corresponds in a high probability to a range of packets transmitted. With high (CR), the packets are transmitted through more distant nodes but are more likely to collide because of signal interference. On the other hand, if (CR) is small, fewer nodes are obtained, but the likelihood of collision is reduced.

Joint Power + Rate Control (PRC): Its 3rd method is to merging the previous 2 approaches; change rate & power to send messages simultaneously. In other words, the flow rate is modified by the above equation to prevent network congestion and the transmission rate is lowered.

3) Congestion Control Algorithm in VANETs [34]

This algo concerns ED messages as well as periodic messages. It is intended to ensure that such messages are disseminated rapidly and efficiently. It consists of two different modules: event-driven detection and measurement-based detection. That component has a relation to one message form.

Measurement-Based Detection: CCH (Control Channel) must track this part to assess the congestion of the CCH. With this method, when five of the packets in the queue are reached, the CCH is deemed congested. Both incoming periodic messages are ignored (rejected) after this point.

Event-Driven Detection: ED Messages will be monitored in this module whenever an ED message is identified immediately, to start a congestion control procedure. The congestion control protocol freezes all transmission queues without ED queue to permit for high ED Message transmission consistency.

2. Media Access Control (MAC)

May-June 2020
ISSN: 0193-4120 Page No. 10763 - 10776

MAC category algos work in a different way. These algos utilize several methods of media access as per the state of the network.

1) **MP-MAC (Multi-priority supported medium access control in VANETs)[35]**

For ED messages as well as for Beacon messages, this algorithm uses a method to identify specific priority areas for packet transmission. It utilizes Markov Multi Priority Method to optimize network state usage of channel. Also, a p-persistent MAC is introduced to decrease the likelihood of crashes during transmission. This algo implements a strategy that determines different priority rates by packet type. ED messages and periodic messages are given high-level priorities. It also introduces the Markov multi-priority mechanism for more effective use of the transmission channel as per network traffic.

2) **VC-MAC (Cooperative MAC Protocol in VANETs)[36]**

This protocol employs a principle of VANET-oriented supportive communication. To optimize network efficiency, all vehicles are interested in similar messages by access point, ensuring that the data transfer scenario is the same. Several vehicles cannot get correct messages during transmission because the wireless channel is unreliable. Vehicles that receive messages are then chosen to communicate with their neighbors. Thus, Protocol doesn't utilize all n/w vehicles to decrease collision or interference risk, however, it utilizes a collection of good relays provided by only a few vehicles.

Table 2: Comparison of Media Access Control schemes [35]

Approach	Algorithm	Types of messages	Parameters		Results	Weaknesses
			ED Msg. throughput	PER Msg. throughput		
Rate adaptation	Distributed Rate Control Algorithm for VANETs	Event-Driven Messages	Not improved	improved	Number of vehicles that receive ED Msg. sent by a node (by bursts) is higher	The scenario is very rare. Performance is not improved
	PEBCCAV	Periodic Messages	Improved	improved	A decrease in CBT throughput	The performance is insignificant when the number of intersections is small
	Congestion Control Algorithm In VANETs	Both Periodic Messages and Event-Driven Messages	Not improved	Not improved	Warning delay (delay of ED Msg.) is greatly lesser	The queue threshold is static. ED Msg. are prioritized on PER Msg.

May-June 2020
ISSN: 0193-4120 Page No. 10763 - 10776

Media access control	VC-MAC	Periodic Messages	Not improved	improved	Throughput increased, and collision reduced	Design only to lead with a broadcast scenario.
	MP-MAC	Both Periodic Messages and Event-Driven Messages	Improved	improved	High reliability of ED Msg. and collision reduced	Not suitable for Multi-hop communication.

6. LITERATUTRE SURVEY

The survey on VANET congestion and preventive measures and methods of this issue are discussed in this section.

S. Sharma et al. [2019] Security applications require effective V2V communication to reduce the number of incidents. Vehicles broad cave via Control Channel (CHH) of Dedicated Short Range Communication (DSRC) 2 kinds of Messages, Emergencies & Beacons. The influence of congestion on the safety of vehicles is controllable by the design of a DCC algorithm that provides a more efficient, timely receipt of the safety messages with a priority model and signal transmission rate. DCC manages congestion by optimizing the transmission rate in safety messages of high priority. With several indexes, like PDR (Packet-Delivery Ratio) & Delay from E2E (End-to-End) new approach is introduced to congestion management. The scheme suggested increases the traffic densities for PDR & E2E [38].

O. Akinlade et al. [2019] introduce a new method, depending upon network vehicle number, to change transmission capacity. The goal is to decrease network channel congestion & enhance overall network performance. The results of our simulation show that this method can lead to an increase in packet loss efficiency and a delay between packets. [39].

Sathish et al. [2019] Initiate P&A-A (prediction & adaptation Algorithm). Novel congestion control protocol which allows joint transmission rate/performance adjustments based on an altruistic short-term prediction. P&A-A also acclimates transmitting criteria to ensure strict lighting requirements to satisfy the degree of understanding needed for very important VANET applications. Simulation tests obtained in practical scenarios affirm our theoretical assumptions, demonstrating the efficacy and reliability of the protocol by detecting significant performance changes (up to 8% & 14% collision rate improvement; and up to 10% & 20% change in busy ratio predicted for our previous framework and ETSI method, correspondingly) and achieved a level of awareness (higher coverage with higher transmission rate & power in dense scenarios, as well as up to 8% & 55% enhancements in density perception accuracy related to our prior method & ETSI methods, correspondingly) [40].

Y. Zhang et al. [2018] this paper offers a new Cluster-based Multi-Channel Medium-Access Control (CCFM-MAC) protocol to address intra-cluster & inter-cluster collision problems in VANETs. Depending on linking times to their neighbors, all nodes are divided into separate clusters. Adjacent clusters use various channels to avoid interfering with the cluster. A cluster head (CH) assigns its Members time slots to achieve packet transmissions without collision according to state and relative location. Also, a CH assigns time

May-June 2020
ISSN: 0193-4120 Page No. 10763 - 10776

slots to members in compliance with their traffic demands to ensure fair access and enhance performance. Finally, simulation results illustrate that the protocol suggested exceeds EDCA MAC protocol for average throughput, average delay E2E and effective possibilities of transmission. [41].

I. F. Kurniawan et al. [2018] Introduces a comparative performance study of 2 obtainable MAC strategies that are and priority-based MAC history-based MAC, in controlling traffic growth in IVN. History-based MAC uses previous active transmitting settings to attempt current transmitting, while priority-based MAC manages the communication timing of each node. Our computational simulation results demonstrate the correlation between these 2 schemes of delay and production rate. On average, a high-frequency transmission delay results from the priority system, but get PDR is obtained. The historical method only manages a small queuing delay if the transmission attempts are less effective per unit of time. [42].

A. Rostami et al. [2016] Study two classes of state-based and linear adaptive congestion control algorithms that is this work introduces a reactive, state-based method to European Telecommunications Standards Institute as a decentralized congestion management system. A linear adaptive approach is shown by Linear Message Rate Integrated Control (LIMERIC) Algorithm 2 methods control transmission of security messages through channel load [that is CBP (Channel Busy Percentage)]. A linear adaptive method, in comparison, describes the driving actions of CBP towards a target channel charge. This paper provides three key contributions to address this issue. The triggers are established and robust reactive algorithms are implemented. The performance of the robust reactive system and legacy IEEE 802.11p eventually compares with the linear adaptive solution. Linear adaptation approaches for some output metrics are demonstrated to achieve improved message efficiency for any given vehicle density [43].

N. Taherkhani & S. Pierre [2016] A centralized & decentralized data congestion management plan for managing data congestion at intersections is introduced in this report. The proposed plan includes 3 units to congestion detection, clustering & data congestion management. The channel consumption level is calculated in this strategy to identify data congestion on channels. Messages are stored, filtered & then grouped using algorithms of machine learning. K-means algorithms cluster messages depending upon the size of the message, message validity & message form. Appropriate values for transmission & rate, containment size of the window, & interframe spacing for every cluster are calculated by the data congestion control unit. On crossings, RSUs send necessary parameters of contact to vehicles stopped before the red light to prevent traffic collisions. Simulation results illustrate that, relative to other methods used by the existing congestion management strategy, the strategic approach increases the latency, throughput and packet losses ratio considerably. It also gives some suggestion about open source software tools [44, 45].

A. Haghighi et al. [2015] The concept presented provides an output over VANET by different protocols of the established transport layer. Westwood NRBWP (bandwidth proportionality), which is used to bifurcate losses using the loss tolerance method, was developed to conquer the issue of TCP WestwoodNR. Losses discrimination There are three RTT criteria of the Losses Discrimination Scheme. TCP WestwoodNRBWP checks the congestion avoidance status of the network and sets CWND (congestion window) for failures. The well-known Network Simulator (NS-2) & Traffic Simulator Bonn Motion should be used to simulate the new TCP Westwood NRBWP algorithm, TCP Westwood NRBWP. Simulation tests suggest that the theoretical scheme will boost the complexity and latency than the real TCP WestwoodNR. It also suggests that software quality can be used in software acquisition to support quality and process control throughout the lifecycle of a software-intensive system [46, 47].

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7. CONCLUSION

Recently, VANETs have become a popular research area for ITS (intelligent transport system) as they provide drivers and passengers with protection and safeguards respectively, with a big deal of interest in the field of wireless & communication technology. VANET is a modern MANET subset. On-road where vehicles are mobile nodes, VANET is introduced. Active safety & intelligent transport are significant VANET applications that want appropriate communication technology from vehicle to vehicle, particularly routing technology. The protocol routing must be configured to tackle VANET problems, like high node mobility, Random Topology, and heterogeneous networks. VANET is a changing technology in the world today that is predicted to dominate soon. Mobility and numerical processing power of the VANET vehicles. The vehicles form an Ad-hoc network of partnerships also are peers. This paper deals with the treatment of VANET traffic congestion.

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