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A Study of Congestion Control Algorithm in VANETs

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Abstract- Vehicle adhoc network is a moving vehicle network that uses a set of roadside units to assist and communicate with moving cars through its vehicular networks. Vehicle numbers are growing every day, as are the number of accidents. Service efficiency (QoS) has now been an increasingly necessary and complicated factor for safe and easy driving. Controlling congestion is one of those who offer vehicle network quality of service (QoS). The Vehicle Networks (VANETs) congestion control algorithm was extensively explored. However, most congestion management algorithms do not apply to event-driven safety messages as a single priority. The protection signals guided by accidents include stringent delays and reliability criteria. Traffic with the same importance, usually the alert signals with protection applications from specific transmitters, are the main source for event-driven safety messages. Before the node begins the transmission process, the single priority messages should be scheduled. A large number of vehicles in a dense network are broadcasting a high frequency beacon message. Then easily congested the control channel (CCH). To ensure the prompt and efficient transmission of event-driven safety communications, it is vital to maintain the CCH channel clear of congestion. The study also reveals some of these congestion-control algorithms' weaknesses and benefits that can help researchers tackle the congestion problems of the VANETs. This study also concludes with a planned study to disseminate safety messages with a single priority while resolving the congestion issues.

Keywords- CCH, QoS, VANETS, RSU, V2V, V2I

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I. INTRODUCTION

VANET's consist of automobiles fitted with sophisticated wireless networking systems and auto-organized transport networks. VANETs tend to operate without any current network or coordination between the client and the server. Each vehicle fitted with communication devices will be a VANET node and will allow other messages to be received and sent over wireless communication channels. It is a traveling and intelligent vehicle network. A set of roadside units (RSU) are also utilized through road networks to support and communicate with road vehicles in VANETs, in addition to road vehicles. These RSUs are used in VANETs as a permanent infrastructure. Transceiver equipment allows wireless contact between the V2V (Vehicle-to-Vehicle) and the connectivity of the RSU-V2I (Vehicle-to-infrastructure) with the moving vehicle. This network provides a broad variety of facilities like Intelligent Transport Infrastructure (ITS). Some of the most relevant features of ITS is the protection device. If a vehicle, for instance, detects a road accident, it will report a road accident to other neighboring vehicles. The safety messages must be transmitted almost without delays to each neighboring node. Figure 1 depicts a scenario demonstrating the different communications forms that can be exposed to VANET and VANET components.

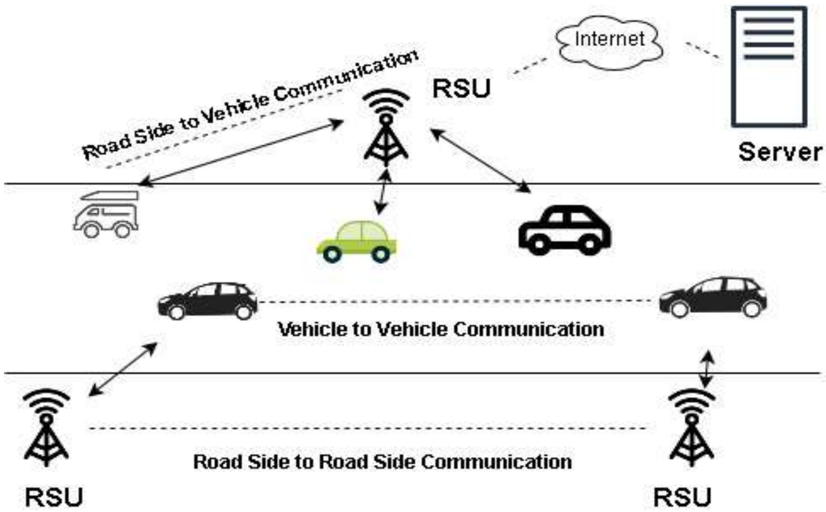

FIGURE 1:- STRUCTURE OF VANET

II. Related Work

Many studies in the VANETs focused on controlling the load of wireless channel algorithms like [17, 18, 19, 20]. The principal purpose of the algorithm for congestion control is to monitor traffic conditions and to increase the performance of wireless communication channels.

Research proposed in[11] an algorithm for congestion control that focuses on convenience applications such as Internet browsing. Nevertheless, our analysis focuses on the spread of the safety messages especially safety messages guided by events. It is really necessary to effectively communicate the event-driven protection message and it will save our lives. If a car detects dangerous items such as a sharp object dropped from a road construction truck, other vehicles are notified behind to avoid the object. The protection message must be sent without interruption to other nodes with great reliability.

Work on protection messaging based on [18, 17]. However, work in[17] concentrated only on the EBL-F protection function (Emergency Wireless Brake Light). In other incident driven protection applications such as pre-crash sensing and lane shift notification, this congestion management algorithm shall be checked. Safety messages are also the focus of work in[14], but protection messages are not divided into beacon and event-driven safety messages. As stated, the safety message guided by the incident is critical and should be transmitted with high reliability in due course.

Some investigators consider the use of packages as an important part of an algorithm such as [19, 17] for congestion control. Work has proposed a new idea in [20] for the effective congestion management method and packet distribution of VANETs. The UBPFCC is introduced on top of IEEE 802.11 MAC protocol, because it is named unified utilities-based packet forwarding and congestive power. The congestion management algorithm utilizes an application-specific utility feature which transparently encodes measurable services knowledge for all applications in a particular area in each transmitted data packet. A clustered algorithm measures each node 's total usefulness dependent on the efficiency of its data packets and assigns a proportionate share of the usable data rate to the relative priority. The priority message determined by this congestion management algorithm focused on usefulness and package size would lower the efficiency of distribution of event-driven protection messages.

Research into [21] used the complex factor message utilitarian, focused on the quarter's retransmission level. For eg, whether the X node will send message A but the X node receives the same message A received by a separate node at the same time. The X node will adjust the complex component of message A. In the smaller field, the highest priority message is issued. In addition, work in [14] evaluated importance dependent on certain considerations including node pace and message validity. The outcome has shown that in the worst case, the latency of the event-led protection notification is 50 ms. This result is critical because pre-crash sensing safety application message need to disseminate to adjacent nodes within 20 ms.

In [21] work also developed an algorithm for congestion management, and then modified dynamic schedulation dependent on goals. Dynamic priority scheduling is designed to ensure that high priority packets are forwarded without delay, and medium and low priority packets are reprogrammed. The message was actually given with EDCA based on its content , for example critical or not.

In the context of their congestion control algorithm, research proposed in [17] transmission power control. Research in this field has been expanded to include researchers from [19] in particular. The objective of power control transmission to maximize energy consumption and connectivity for point to point communications. In general , a higher data rate typically allows a larger sender capacity to relay, such that other nodes will interact further. The dynamic power control device, which typically includes standard one-hop transmission communications, will restrict the amount of channel usage and assign a fraction of the bandwidth for the protection program dynamically. The aim is originally to monitor the transmission power of low-value communications to retain the highest priority traffic transmission power[21]. In [19] work have suggested complex transmission power management congestion regulation. They have adjusted the transmission power for all packet types and investigated the impact of power transmission controls on VANET congestion. The IEEE 802.11p physical layer (PHY) can communicate in vehicle environments with an increased transmission power level, within a range of 100 meters to 1 km. The congestion management algorithm needs places fitted with RSUs.

Smart efficient retransmission algorithms were suggested in research [19, 20], in order to prevent question of congestion chain by limiting forwarded packets. The blindly sent light signals trigger a number of redundancies which add to the question of storm transmission. The intelligent [20] retransmission scheme only operates cars on a single lane and will deliver the event-driven protection warning behind the car. The cars can transmit a safety message after this event-led safety message from the front cars has been received successfully. This safety message. It also includes certain lanes in actual situations in the case of an collision.

III. Congestion Control

When the load offered crosses the specific limit, the performance falls significantly and the delay increases. The phenomenon is referred to as congestion. The sudden increase of network traffic may lead to congestion. If too many packets are sent through a network, performance is completely collapsed and nearly no packets are supplied. It is necessary to take into account quality of services (QoS) in order to provide secure connectivity in Vehicle Ad Hoc Networks (VANETs). Packet failure and delay are two big QoS parameters which are used for congestion management. Different strategies or techniques for addressing the congestion problem of VANETs have been recommended over several years. Congestion control algorithm consists of two key components, congestion detection and congestion control.

A. Congestion Detection Component

We will use the three forms of congestion detection techniques. The congestion management method, focused on metrics, detects channel activity and calculates parameters such as amount of messages in line, channel usage frequency and channel occupancy. The congestion detection portion regularly tests the amount of channel usage to identify congestion. The Event-driven detection technique [6] watches the incident control message and determines when the event-driven safety message is sensed or generated to start the congestion management algorithm. The strategy of blocking of the MAC is based on beacon transmissions control in order to reduce traffic load and congestion management.

Measurement-Based Congestion Detection Techniques

This system detects channels of contact and tests parameters such as degree of channel usage. The value is linked to a prefixed threshold for the channel consumption point. Therefore, if the level of use of the channel exceeds the limit, the channels are presumed to be congested. In [7] Periodically each device senses the level of use of the channel. Compared with the predefined threshold limit, this channel use level. In [8], scientists used a simulation to detect congestion based on channel occupancy time. In [2], distortion in the VANETs is observed by the channel level. In [6], authors detected congestion using the channel. In comparison to the predefined threshold limit (table 1) for this channel use level.

References	Congestion detection methods	Remarks	Simulator	Performance metrics
[7]	Event driven	Based on queue freezing	WARP2	Delay
[7]	Measurement-based detection	Channel usage level	WARP2	Delay
[8]	MAC blocking detection	MAC blocking happens at a node	NS-2	Packet received
[9]	Measurement-based detection	Channel usage level is compared with threshold	NS-2	Delay, packet loss, throughput
[6]	Measurement-based detection	Channel usage level is compared with threshold	NS-2	Delay, packet loss, retransmission, packet loss ratio, throughput
[11]	Measurement-based detection Event driven	No. of packets in the channel queue is compared with threshold Queue freezing method	Veins	Delay
[14]	Event driven	Queue freezing method	Veins	Delay, packet loss

TABLE 1:- REVIEW OF VARIOUS CONGESTION DETECTION TECHNIQUES

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Event-Driven Detection Technique

This methodology watches the event-driven protection message and determines when an event-driven safety message is sensed or produced that the congestion management algorithm should start. In [3] the writers used a form of event-driven prediction of VANET congestion. If a computer receives a safety warning, it should automatically activate the congestion management to ensure protection applications. In [4] the analysis of congestion is based on an event-driven strategy.

MAC Blocking Detection Technique

This technique is based on the control of transmissions of beacon message in order to reduce congestion and traffic congestion controls. Congestion detection is carried out on the basis of detection of the MAC block.

B. Congestion Control Component

In the related work section, which focuses on controlling congestion, numerous control systems for congestion were described within a vehicle scene. The proposals implemented different management techniques for congestion, for example changing the dispute duration, regulating delivery and modifying management speeds. Many researchers suggested many algorithms to tackle the problem of congestion [5]. Efficient algorithms are difficult to find in a congested environment to increase user safety and transport efficiency. There are three types, proactive, reactive and hybrid congestion control algorithms. The author suggested an event-driven safety message congestion management algorithm in [2]. Simulation reveals that in terms of the packet latency, the proposed algorithm is successful (Table 2).

Authors suggested a new, integrated method of congestion reduction in [1]. This system offers the detection and avoidance of congestion by disconnecting and using road information. In [4], the writers suggested an approach to congestion management focused on the principle of proactive priority preparation in order to maintain efficient and secure communications within VANET. The authors proposed the techniques of congestion control for fairness and stability analysis in [5]. These algorithms adapt the rate and power of transmission based on network measures such as channel-occupied ratios. For all typical cases of road density, stability is verified. In certain systems, justice is automatically accomplished.

Reference	Strategy used	Quality of service (QoS) parameters	Simulator used	Class
[9]	Transmission range and rate	Delay, packet loss, throughput	NS-2	Reactive
[7]	Transmission range and rate	Delay, packet loss, No. of retransmission, packet loss ratio, throughput	NS-2	Reactive
[11]	Scheduling messages	Delay, packet loss, throughput	NS-2	Reactive
[12]	Sharing congestion information	Average travel time	Java-based simulator	Proactive
[15]	Scheduling messages	Delay	TransModeler	Reactive
[8]	Transmission rate	Packet received	NS-2	Proactive
[10]	Scheduling messages	Bandwidth	UPPAAL verification tool	Reactive
[13]	Transmission range and rate	Stability (in time) and fairness (in space)	MATLAB	Reactive
[14]	Scheduling messages	Delay, packet loss	Veins	Proactive
[16]	Transmission rate	Channel busy time (CBT)	NS-2	Proactive

TABLE 2 REVIEW OF CONGESTION CONTROL TECHNIQUES

IV. Conclusion

We reviewed and described in this paper different methods of congestion Detection and congestion control techniques used in VANETs. After an analysis of these strategies, the ad hoc network for vehicles will play an significant role in the smart transport framework. In the field of car safety and transport efficiency, existing transport systems need to be significantly improved. A smart transport network will reduce congestion in road traffic, increase reaction time to collisions and insure that driving is healthy and efficient. VANETs present enormous challenges. We shall suggest a congestion control system to identify and avoid congestures in future research, according to our findings.

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