IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 11, November 2015.
www.ijiset.com
ISSN 2348 – 7968

Enhancing Quality of Data Access in VANET'S

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Abstract- Vehicular Ad-hoc Network is an application of MANET (Mobile Ad-hoc Network) in which there is a communication between moving vehicles and promotes safety on road. VANET provide many applications include providing information related to safety of driver, how to manage traffic, and services related to location information etc. Various researches had been made in field of VANET, which are helpful for every vehicle moving on road. In this paper, we are going to throw some light on previous researches done in this area and will compare various drawbacks of these researches.

I. INTRODUCTION

VANET (Vehicular Ad-hoc Network)

With an immense improvement in technological field, we find Vehicular Communication (VC) as a solution to various problems of our modern day communication system on roads. VC uses the radios of short range in each vehicle, with the help of which various vehicles communicate with each other which is also known as (V-V) communication and with RSU (V-I) communication. Vehicular ad-hoc network is an application of MANET's (Mobile Ad-hoc Networks) in which there is a communication of moving vehicles and promotes safety on road. There are many characteristics in VANET's, which distinguish it from MANET's (Mobile Ad-hoc Networks) such as distributed communication, self organization, high mobility etc. There come many situations which cause harm to vehicles privacy, sometimes vehicles messages get monitored by some malicious authority. There are many methods used which ensure the privacy of vehicles. One of the methods to protect the vehicle is to make sure that vehicle remains anonymous. In Vehicular ad-hoc network, it is possible for vehicles to broadcast warnings about traffic and road conditions (emergency braking, accidents on road), environmental hazards (ice on the pavement), and provide local information to other vehicles such as information related to nearby restaurant, petrol pump etc. once vehicle came to know that there is traffic jam, road closure or accident ahead, then driver can drive safely or avoid that route and choose new path and can save time. Communication between vehicles is possible because vehicles are able to send warnings to other vehicles.

During communication, one needs to be sure that sent messages are valid and network is not used maliciously. However, if the permanent id of vehicle is hidden from other vehicles and is only visible to authorities, then only authorized part will know that request came from which vehicle and then will be able to assist accordingly. This ensures that the malicious user will not be able to know that from which vehicle request came, hence protecting the vehicle from any attack. MANET's differ from VANET's in many ways, such as nodes in MANET's cannot recharge their battery power whereas VANET nodes are able to recharge them frequently. Without having any prior knowledge of each other, vehicles make self-organizing network and work as nodes, so security level is very low and they are the most vulnerable part of the network which can be attacked easily.

VANET's main focus is to fulfill user's needs/requirements while driving on the road and to make their journey safe and comfortable. VANET's have more features as compared to MANET's. VANET's are able to provide more resources than MANET's such as antennas, processing power. VANET's consist of vehicles and roadside infrastructure unit. With the help of VANET's, vehicles can communicate with each other and RSU's. Communication can be 'one-hop' or 'multi-hop', which means vehicles can transmit messages directly or can pass message through the series of the vehicles. The type of communication depends upon nature of message. For example, if vehicles want to communicate individually with another vehicle then 'one-hop' communication is used. In other case, if vehicle wants to contact certificate authority (CA) first, then message is broadcasted and passed through the network until RSU is reached.

VANET's are self-organizing communication networks that are formed by making moving cars as nodes in a network. Vehicular Ad-Hoc Network (VANET) is a network without any infrastructure, fixed routers, hosts or wireless base stations. It changes participating car into a wireless router or node, which allows cars to connect with each other up to 100 to 300 meters. While designing a VANET, two important aspects to be considered are security and privacy. In Vehicular Ad Hoc Network (VANET) there can occur many attacks such as transmission of false warning messages as well as hindrance of genuine messages which results in accidents. That's why security is considered main concern while developing these types of networks.

II. TYPES OF COMMUNICATION IN VANET's

Vehicles communicate with each other by sending messages, messages can be sent through one-hop or multi-hop process. There are two types of communication which is available in VANET's. One is (V2V) vehicle-to-vehicle communication and other is (V2I) vehicle-to-infrastructure communication.

✓ Vehicle-to-Vehicle communication: It is an automobile technology that is designed to allow automobiles to communicate with each other. There are various automakers which work on V2V that includes BMW, Honda, Audi, Volvo etc. The target of V2V communication is that each vehicle on the road is able to communicate with other vehicle efficiently and easily, and then this communication supports various safety applications and safety systems.

With the help of V2V communication, drivers are able to prevent 80 percent of the crashes on the road, and hence reducing fatalities and injuries that occur each year. It doesn't require any infrastructure such as RSU. It is able to provide communication at distances of up to 1 km. examples of V2V communication are alert in case of accidents, alert signal whenever there is slow traffic (traffic jam, road work, poor weather conditions, etc.), alert in case of emergency vehicles, parking management, highway hot spot, etc.

III. PROPOSED PROTOCOLS

Various protocols are designed to improve the quality of accessing data in VANET'S. Some of the protocols are discussed below:

CONGESTION-CONTROLLED-COORDINATOR BASED MAC PROTOCOL (CCC-MAC):

For the distribution of safety-related messages, framework is provided by VANET, through which messages get transmitted reliably. Sometimes, situation comes in which there exist number of messages and density of messages become high; this result in problem such as scalability problem, congestion problem, reliability of safety messages also get affected. In high-density situations, there may be loss of some emergency messages or there may be some delay in reaching the destination vehicle. Due to high density, number of packet collisions also keep on increasing, which results in delay. So, a new protocol CCC-MAC is proposed. This protocol is designed for distributing safety-critical messages such as beacons and emergency messages. Time is divided into periodical units and in that time slot or segment; each vehicle can transmit one beacon. This protocol is also helpful in maximum bandwidth utilization in both cases, one is when vehicles are uniformly distributed and other is when vehicles are non-uniformly distributed. Before CCC-MAC protocol, various protocols were proposed, which were helpful in improving safety messages reliability. But there were various drawbacks in those protocols.

In VeSO protocol, vehicles, on the basis of position information decide the time slots. But as vehicles do not have any knowledge about those vehicles which are out of its communication range, so hidden terminals presence affects the whole performance. Secondly, if all slots are occupied and any farthest vehicle wants to reuse that occupied slot, in that case collision occurs. At last, when vehicles density increases, there will be overlapping in time slots and it affect packet reception probabilities. All these drawbacks get overcome in this protocol. In this protocol, there is no delay in message sending and enough bandwidth is allocated to beacons and safety messages, so that reliability don't get affected by presence of number of vehicles.

BANDWIDTH UTILIZATION AND FAIRNESS ENHANCEMENTS-MAC (BUFE-MAC):

VANET technologies are helpful in providing traffic safety for drivers and provide comfortable services for passengers. As vehicles communicate with Roadside Unit (RSU) for exchange of data, but if there are large number of hops from vehicle to RSU, then vehicle take long time for exchanging its data with RSU as there is more collisions due to number of hops. As a result, bandwidth utilization is less. So to increase utilization of bandwidth, BUFE-MAC protocol is proposed, which focus on utilizing more bandwidth and enhancing its fairness. Main problems were collisions, and due to collision, the vehicles which are far from RSU's get less opportunities for exchange of data with RSU's. Before

BUFE-MAC, various MAC protocols were proposed. One is contention based approach, which find the time of transmission on the basis of distance between source vehicle and destination vehicle. This protocol reduces the chances of contention but number of forwarder selection increases. As a result, packets get transmitted to inappropriate forwarders. Second approach is contention-free protocols, in which schedule of transmissions is set in advance to avoid contention. Third approach is integrating approach in which both contention-based and contention-free approaches are combined. But in these approaches, whole segment don't get utilized. On other side, in BUFE-MAC protocol, both uplink and downlink transmissions are integrated in single channel and helpful in determining appropriate segment length. In this protocol, cycle time is divided into number of time slots for vehicles to access bandwidth. Two modes are supported by BUFE-MAC, one is mesh-backbone based mode and other is infrastructure mode. In mesh-backbone based mode, vehicles can transmit packets in multi-hop manner. On other side, in infrastructure mode, vehicles can directly exchange data with a gateway.

RELIABILITY ANALYSIS OF ONE-HOP SAFETY-CRITICAL BROADCAST SERVICES IN VANET's:

When two or more vehicles communicate with each other, main thing to consider is that whether vehicles are receiving safety-related/emergency messages on time or not. Also delivering messages reliably to neighboring nodes is a big challenge. If one vehicle receives messages after a specific time, then it is of no use. Many emergency messages or safety related messages get lost in network due to many problems such as hidden terminal problem, collisions due to concurrent transmissions, due to high mobility of nodes. Sometimes, two different vehicles are not in communication range of each other and they send message to third vehicle simultaneously. In that case, third vehicle receives only message of one vehicle and other message get lost in network and of no use. So to resolve these problems, to make sure that every message get delivered on time and reach the particular vehicle reliably, four new reliability metrics are proposed, which are Packet Reception Rate (PRR), Packet Delivery Ratio (PDR), Packet Delivery Probability (PDP) and Effective Range (ER).

1) Packet Reception Rate (PRR): It is defined as the percentage of nodes

ISSN 2348 – 7968

that successfully receive a packet from a tagged node among the receivers.

2) Packet Delivery Ratio (PDR): It is defined as a ratio of number of packets received successfully by all receivers to the number of packets transmitted.
3) Packet Delivery Probability (PDP): It is defined as the probability that a node i with distance Di from a sender successfully receives a packet from the tagged node.
4) Effective Range (ER): It is defined as the range within which the worst case of QoS metrics is satisfied.

MODELLING BROADCASTING IN IEEE 802.11p/WAVE VEHICULAR NETWORKS:

In VANET, for communication between two vehicles, various standards are used for supporting wireless access without any delay. Two types of applications, safety and non-safety related messages, are broadcasted for exchanging data and advertisement messages. To avoid any type of collision between broadcasted messages, a certain frequency is set, so that messages are broadcasted in a particular sequence. Wireless Access in Vehicular Adhoc Network (WAVE) operating frequency is fixed in Dedicated Short Range Communication (DSRC) of 5.85-5.925 GHz. Time interval is divided into two intervals, i.e., Control Channel (CCH) and Service Channel (SCH). In given range, one CCH is reserved for system control and safety-related messages and six SCH's are reserved for exchanging non-safety related messages. Beacons are transmitted over CCH, which periodically update information related to position of vehicle, vehicle's speed and direction.

TRUSTWORTHY BROADCASTING IN IEEE 802.11p/WAVE VEHICULAR NETWORKS:

If one vehicle wants to communicate with other, then both vehicles exchange messages between them. Two types of messages are transmitted, one is safety-related messages and other is non-safety related messages. Drivers also receive information related to traffic, emergency related messages. These messages can be true or not. It may happen that these messages are transferred by some un-authorized users to create confusion among receivers. So, it becomes necessary to make sure that transmitted messages are secure and not get attacked by any untrusted third party. Untrusted third party can add false warnings to cause accidents or they can also change traffic information. In those cases, for providing trust and to avoid any type of attack, plausibility of received information is checked by consensus mechanism. As drivers are expected to react on messages received from other road users. Before any reaction to false information, vehicle waits for receiving a Wave Short Messages (WSM) from neighbors. Decision is taken on the basis of majority wins approach. According to this approach, information regarding the hazard is considered to be trustworthy if half of the nodes are able to detect it.

In this majority wins approach, vehicles are moving close to each other and can detect events occurring on the road. Area covered by the vehicles is detection area. Some vehicles act as intruders and some as legitimate users. Intruders broadcast fake information again and again, whereas legitimate nodes broadcast same true information. In decision area, decision is made about the realism of hazard on the basis of received broadcasts.

AN EFFICIENT AND RELIABLE MAC IN VANET:

In VANET's, when two vehicles communicate with each other, it is made compulsory that messages should reliably reach other vehicle. Sometimes, packets or messages get lost in network and don't get recovered. It may happen that emergency messages don't reach to particular vehicle on right time to create warning for vehicles. Late arrival of emergency messages does not mean anything. So, it is necessary for every message to reach on right time, so that vehicle can take actions to avoid any serious problem.

In this paper, a new efficient and reliable MAC protocol is proposed in which nodes are able to broadcast safety packets twice during both Control Channel Interval (CCHI) and Service Channel Interval (SCHI), which further helpful in increasing safety broadcast reliability. IEEE 1609.4 is used for multi-channel operations. Seven channels are located for Dedicated Short Range Communication (DSRC). One is Control Channel (CCH) and six are Service Channel (SCH). For transmitting emergency messages, all nodes first connect to CCH and then switch to any one of six SCH's. So in this way, IEEE 1609.4 is not able to utilize all SCH resources, this result in wastage of resources. In VEM-MAC, SCH resources are utilized fully. But VEM-MAC is not able to avoid high collisions and as a result, nodes may lose EMG packets. New protocol, Efficient and Reliable MAC protocol for VANET's (VER-MAC) ensure reliability of safety packets

ISSN 2348 – 7968

and also increase throughput. This retransmits the EMG messages and utilizes CCH during SCHI for EMG retransmissions and improves reliability of EMG broadcasting. By utilizing SCH resource efficiently, VER-MAC also increases the service throughput. In VER-MAC, if EMG packet is broadcasted in CCHI or SCHI, copy of that EMG packet is scheduled, so as to broadcast it in upcoming SCHI or CCHI by some delay. Delay is helpful in avoiding high congestion at starting of CCHI/SCHI.

S. No.	Name	Author	Objective	Methodology	Drawbacks
1.	Context Aware Driver Behaviour Detection System in ITS	Saif Al-Sultan, Ali H, Al-Bayatti, and Hussein Zedan	To increase road safety and to increase facility of information sharing between moving vehicles	A five-layer context aware architecture is presented and a Dynamic Bayesian Network (DBN) algorithm is generated	Driver behavior was not able to be detected, as a result accidents on road increased.
2.	Modelling Broadcasting in IEEE 802.11p/ WAVE Vehicular Network	Claudia Campolo, Alexey Vinel, Antonella Molinaro, nad Yevgeni Koucheryavy	To deliver data and control packets on right time, most messages are delivered on given frequency during CCHI	An event-driven custom simulation program is developed.	Non-transmitted frames get drpped or lost in network
3.	Reliability Analysis of One-Hop Safety-Critical Broadcast Services in VANET's	Xiaomin Ma,*Senior Member, IEEE*, Jinsong Zhang, *Member, IEEE*, and Tong Wu	To deliver messages reliably on network and to check packet delivery ratios	To check the delivered packet ratios, four reliability matrics are introduced.	Hidden terminals created problems and collisions caused by concurrent transmissions .

4.	An Efficient and Reliable MAC in VANET's	Duc Ngoc Minh Dang, *Student Member*, *IEEE*, Choong Seon Hong, *Senior Member*, *IEEE*, Sungwon Lee, *Member*, *IEEE*, and Eui-Nam Huh, *Member*, *IEEE*	To increase safety, comfort and efficiency of driving. To reduce collisions and loss of EMG packets.	2-D Markov model is used to analyze performance. VER-MAC protocol is proposed, which allows nodes to broadcast safety packets twice during both CCH and SCH	High rate of collisions at beginning of CCHI and nodes might lost EMG packets
5.	Trustworthy broadcasting in IEEE 802.11p/WAVE Vehicular Networks: Delay Analysis	Claudia Campolo, Alexey Vinel, Jonathan Petit, and Yevgeni Koucheryavy	To decrease false warnings, to make decision whether or not driver can trust information and to guarantee trustworthiness	Meand Decision Delay mechanism is used	Wrong or false information was not able to be detected.
6.	Congestion Controlled Coordinator Based MAC for Safety Critical Message Transmission ion VANET's	Jagriti Sahu, Eric Hsiao-Kuang, Wu, *Member*, *IEEE*, Pratap Kumar Sahu, and Mario Gerla, *Fellow*, *IEEE*	To increase scalability in high density areas, to decrease latency of safety messages and to ioncrease reliabilities, to increase bandwidth utilization and to ensure fast and reliable propagation of	CCC-MAC protocol is used which uses pulse-based reservation mechanism.	In high density areas, there exist the problem of scalability.

			emergency messages.		
7.	Special issues on Inter-Vehicular Communication.	M. Raya, Panos Papadimitratos, and Jean-pierre Habaux	Vehicular Communication exhibits unique security challenges, induced by the high speed and sporadic connectivity of the vehicles.		Secure positioning is an open problem, VC exhibits Short-Lived certification (CRLs).
8.	BUFE-MAC: A Protocol with Bandwidth Utilization and fairness Enhancements for Mesh Backbone Based VANET's	Li-Ling Hung, *Member,IEEE*, Chih-Yung Chang *Member,IEEE*, Cheng-Cjang Chen, and Yu-Chieh Chen	To increase bandwidth utilization, avoiding collision and to maintain fairness.	BUFE-MAC Algorithm is generated.	Vehicles far from RSU get less opportunity to exchange the data and bandwidth was not utilized properly.

IV. CONCLUSION

In this paper, various new protocols are discussed, which work to increase reliability of messages, to avoid collisions during message exchange, to increase the throughput, to increase bandwidth utilization and many more. In future, we will generate a new algorithm for improving the data access rate in vehicular adhoc network (VANET).

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