



An Analysis Of Reviews On Techniques For Emergency Data Dissemination In Vehicular Adhoc Networks

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Abstract— A Vehicular Ad-Hoc Network (VANET) is an amazing application of Mobile Ad-Hoc Network (MANET) that facilitate vehicles to vehicles and vehicles to road side units and its base stations communication with the main objective of providing secure and safe transportation in an efficient way. The emergency alert message information are transferred through V2V (vehicle to vehicle data communication), so the parameters like network strength, wait time, high mobility and repeated network disconnections plays vital role for the data communications. The different data dissemination advances in VANET can be followed to intimate the vehicles about the traffic congestion which leads a safe and efficient travel journey. In this paper, different data dissemination techniques are widely reviewed and identified the main challenges in it. There are many VANET data dissemination techniques were applied, but it really does not provide adequate transmission speed for emergency oriented data transmission services.

In most of the situations it leads to unexpected traffic congestion and accidents. To minimize the same, VANET network need intelligent and effective routing protocols for intra vehicle communication. The various data dissemination techniques used to share the information in highway and urban environment with good quality of services, rebroadcast and the assurance of message when it reaches the destination are studied and reviewed with different research authors papers. It covers application areas, challenges, different dissemination techniques and security issues in the VANET.

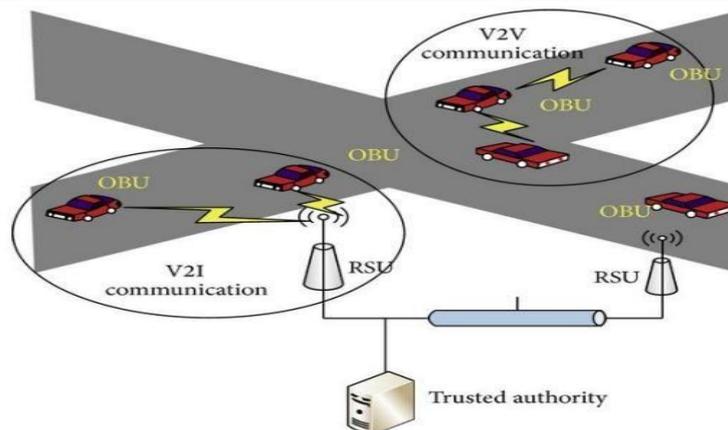
Keywords: Data Dissemination, Vehicular Ad-Hoc Network, Dissemination Techniques and Challenges, Routing Algorithm, Road Side Unit, On Board unit, Authentication Unit, Quality of Service.

1. INTRODUCTION

The Traffic congestion and accidents are rapidly increasing with the increase in the usage of vehicles around the world. As per the UN study report, India loses 3% GDP in road accidents. Every year \$58 billion loss due to road accidents and the traffic congestion cost in four cities (Delhi, Bangalore, Mumbai and Kolkata) as \$22 billion per year. Vehicular Ad hoc Networks (VANETs) are the finest application to boost the transportation features such as road safety, traffic congestion information and sharing infotainment within the network infrastructure where a huge number of event-

driven messages require to be disseminated in a programmed way. The Vehicular Ad Hoc Networks (VANETs) are created by using the basic ideas of Mobile Ad Hoc Networks (MANETs) to exchange the information with vehicles close by using data dissemination techniques. The Hybrid Intelligent Transportation Systems (ITS) is used to distribute the information between the vehicles which acts as a router and host for the data transmission. In recent years, VANET attracts attention from both research and industry communities. The main focus of VANETs is to make the road journey safer and comfort [1].

It allows to deploy different architecture for vehicular network in highways, urban and rural environments to support the applications with different Quality of Service. The VANET architecture with its components On Board Unit (OBU), Application Unit (AU) and Road Side Unit (RSU) are shown in Figure 1.



2. APPLICATIONS

VANET applications monitors various information types such as the vehicle conditions, surrounding roads, approaching vehicles, surface of the road and weather conditions to make the infrastructure more secure and efficient.

Safety Related Applications

These applications mainly used to increase the safety related on the road and the traffic congestion, the various applications are discussed below,

Collision Avoidance: The major accidents can be avoided if the drivers are given the information in proper time like 0.30 seconds before the collision happens. The accident information like a indicator or a spot location is shared to other vehicles to avoid and prevent the other nearby vehicles to not to choose the same road.

Cooperative Driving: A continuous and safe travel can be accomplished by having traffic related information warning or alert signals like route change, the speed limit of the road, signboard for a bridge, school, bend or curve ahead etc. Traffic Optimization: In VANET, the vehicles can send and receive the information. The various signals like Traffic jam, Roadworks and Accident etc., can be sent to the vehicles selected the same route or nearby when the route has a disruption, so the vehicles can choose an alternate route.

User Based Applications

It sometimes called as user based permissions and used for securing applications at individual level. The VANET provide following services as follows,

Peer to Peer application system: This applications are used to offer services like video, songs, pictures and short messages between the vehicles in the network area.

Internet Connectivity: VANET provides the stable and steady connectivity of the internet to the users without any disconnection for long time through which people connect with each other for sharing of information.

Other services: VANET can be used in application like payment service to collect the taxes, to locate the fuel station and to pay restaurant bills, etc., [3] [4].

3. CHALLENGES

There are huge challenges persist in wireless communication networks and design requirements due to the different form and application of VANET. It must be noted that the research challenges in VANET are wide and not limited to only these areas.

Quality of Service (QoS): To meet the emerging requirements of heterogeneous applications in the Internet which is able to provide only best effort service. QoS is a guarantee given by the network to provide performance and efficiency for a flow in terms of bandwidth, delay, jitter, packet loss probability, etc., [6]. Adhoc networks have more challenging problem in QoS than ever before, despite some of reactive routing protocols can be configured to return only paths that comply with QoS parameters.

Efficient Routing Algorithms Design: Routing algorithm is used to send data packets from one node to another in time and proper manner. Efficient routing algorithm means a routing method with minimum delay, maximum system capacity and less computational complexity [7] in network in an efficient way. Currently, designing such algorithm which can be implemented in multiple topologies of the network and satisfies all of the above-mentioned properties is an dynamic area of research in VANET [6] [7].

Message Communication in Vehicular Networks: The VANET applications require transmission, collecting, assembling and processing the large volume of data packets / Message. The message broadcasting is an alternate solution for its low cost and support for huge volume of data in automotive wireless communication networks. Hence, several broadcasting techniques and mechanisms have been taken into consideration by many researchers.

Highly Dynamic Spatio Temporal Traffic Conditions: The density of vehicles in VANET varies from very tiny as in highway scenario to extreme large as in a traffic jam in city scenario [7]. The flow of vehicular traffic is also dynamic, primarily contingent upon the time of the day. To deal with varying spatio temporal traffic conditions is important and challenging. Specifically, in the beginning phase of VANET deployment, it is anticipated that only few vehicles are VANET enabled [9]. Participation by only few such vehicles possibly aggravates the problem of frequent network fragmentation, thereby the defective diameter of a VANET is restricted. Cooperative Communication: A key challenge in VANET is enabling the communication between different nodes in the network. The different concepts of cooperative communication from wireless network may not be directly fit to VANET.

Security: The Security issues are the main critical and large challenging area for research in ad hoc networks. Since nodes use the open and shared radio medium in a unsecured environment, they are particularly prone to malicious attacks.

4. DATA DISSEMINATION METHODS IN VANET

The data dissemination methods can be categorized based on the mode of communication as broadcast, multicast, anycast and unicast. In the broadcast method, there is a source node as the sender and all other nodes are receivers, while a group of nodes will be the destination receivers in multicast. In anycast, the node attributes such as speed or position satisfy some conditions will be the receivers. In the unicast, there is only one node as the receiver pre-defined by its ID or position.

Many problems in VANET are resolved by the process of effective data dissemination. During data dissemination the parameters such as network size, vehicle's speed, patchy and intermittent connectivity between mobile nodes [13] are to be considered. In addition, there is one more problem which can severely affect the entire process is latency requirements. Consequently, content information has to be discovered quickly and distributed among all nodes. According to the literature, there are many schemes to deliver the information in VANET [13].

The following are the different approaches for data dissemination:

Opportunistic Data Dissemination: The information can be received from infrastructure or vehicles as the target vehicle pass nearby or cross them [12] [14].

Vehicle-Assisted Data Dissemination: All vehicles carry information along with them and deliver it either to the infrastructure (RSU) or to other vehicles when they come across. In order to disseminate the information, the mobility is also concerned apart from the wireless transmissions [13].

Cooperative Data Dissemination: Partial information can be downloaded by the vehicles that can be shared later to obtain the complete information. This method is mainly appropriate for content dissemination [13].

Vehicle placement is devised as a weighted and forced consensus control problem. Many algorithms are introduced with convergence properties. Due to vehicle conditions, a desired distance before an vehicle differs at different locations by using this following formula,

$$L = \sum^r d_{(i)}t$$

The recent technological advances on communication such as dedicated short range communication(DSRC). Considering the desired i^{th} vehicle position defined by the below formula,

$$x_{i_des} = x_i - 1 - L_i$$

In each section, a cluster is formed between the moving vehicles. Then apply a scheduling algorithm including two levels. In the first level, nonadjacent clusters can broadcast at the same time.

The distance between the vehicles and relative velocity are measured by a radar or a laser scanner. However, ACC is mostly proposed as a comfort system. This method also incorporate a time delay $D(s)$ representing the latency θ stimulated by the wireless network due to different factors like queuing, contention, broadcast and propagation. The delay in network can be compensated by an estimator using this block scheme, $\Gamma_i(s) = \Gamma(s)$ (independent of i) can be shown as below,

$$\Gamma(s) = \frac{1(D(s) + G(s)K(s))}{H(s)(1 + G(s)K(s))}$$

Where the vehicle transfer function $G(s)$, spacing policy transfer function $H(s)$, feedback of law is $K(s)$.

T. Taleb, et.al, proposed an Effective Risk Conscious and Collaborative Vehicular Collision Avoidance System [21]. The Cooperative Collision Avoidance (CCA) for intelligent transport system and the risk aware medium access control (MAC) protocol are used to boost the responsiveness of the CCA scheme. With the use of CCA system, the number of accidents and the associated damage can be reduced significantly. where only one vehicle can be located in each block. Each road block is identified with index (i, j) where $0 \leq i \leq N-1$ and $0 \leq j \leq M-1$ each road block is assigned a time-slot label as shown below, $\delta = i + j \times N + 1$ (7) The second level scheduling mainly deals with every cluster inside and implement a time division multiple access (TDMA) approach.

The simulation results shows that the proposed algorithm enhance the reliability in beacon message dissemination. The information accuracy of each and every vehicle can be obtained from its nearby vehicles are increased. Thus the proposed second level scheduling leads to huge enhancement of the safety level provided by Beacon Safety Messages (BSMs).

The Automated Highway System (AHS) are projected to maximize the throughput and highway safety with computers, communication and sensing controls. In the platoon concept for AHS, vehicles travel on highways in a closely spaced groups. Within a platoon, vehicles are separated by very short distances of spacing from platoon to platoon can be considerably longer to minimize the likelihood.

There are two types of packet forwarding in EDB like UMB, that is directional broadcast on the road

section and directional broadcast at the intersection of the roads. In directional broadcast on the road section, a source vehicle broadcast a packet and the vehicles follow the source in a stream will rebroadcast the same packet to other vehicles until no vehicle in the downstream. To minimize the number of duplicates in rebroadcast packets, EDB allocate a waiting time before packet rebroadcasting to each vehicle within the network range of the transmitter. The waiting time function can be arrived by using the distance between the vehicle and the transmitter and transmission range. In detail, when a vehicle receives a packet, it calculates its own waiting time by the following function as,

$$\bar{w} = (1 - d)maxWT$$

S. Lakshmi, et. al proposed prioritized directional broadcast technique[26]. The message priority assignment technique is used to prioritize the message as urgent, very urgent or general messages. Binary partition phase is executed to discover the candidate relay node inside the source coverage area. Prioritized directional broadcast technique with message priority assignment is proposed to avoid the vehicles from huge accidents. At first, the message priority assignment is used normally and then the message priorities can be assigned according to the message's nature and dissemination distance to keep QoS of the messages. when a very urgent message is received from the source. it signify the received message is in emergency message transmission. The Priority Metric (PM) value is used to assign the priority to a message as very urgent, urgent or general message. The PM can be calculated as shown below,

$$PM = K * \left(\frac{1}{0.05*d} \right) \quad (9) \quad e$$

where K is the priority coefficient that stand for how fast the message priority dropped, d is the dissemination distance that is the distance between the incident and receivers position.

M. O. Cherifet.al[28], used Under the Road Oriented Dissemination (ROD) protocol, data is disseminated separately in each direction, aiming to optimize data dissemination at an intersection. To fulfill these goals, these mechanisms make use of vehicular GPS positions, which are inserted in the header of broadcasted messages and used to locate the node in the road map. The ROD protocol includes data that encodes the coordinates of intersections, hence it requires a considerable amount of side information, that is location specific.

Jagruati Sahoo et al[29], proposed an IEEE-802.11 based multi hop broadcast protocol to handle the issue of emergency message dissemination in VANETs. The protocol implement a binary partition approach to partition the area inside the transmission range repeatedly to get the extreme probable segment. The forwarding work is assigned to a vehicle selected in that segment. To achieve the directional broadcast for highways environment, the protocol shows good adaptation to handle difficult road structures. The broadcast delay must be minimized for time critical safety applications. The contention delay remains stable even any changes in vehicle density.

5. CONCLUSION

VANETs are innovative technology which can specifically applicable to disseminating emergency messages in roadways to improve highway safety and information services. We reviewed data dissemination techniques of VANETs and its challenges which affects the performance of network communication. However, the performance and efficiency of VANETs depends heavily on the mobility, routing protocol scheme, vehicular density, driving environment and many other factors.. Since emergency alert messages are communicated as a wireless transmission then, V2V delay, efficiency and mobility should be considered. Nowadays the vehicles are equipped with WLAN devices to enhance traffic safety and improve transport efficiency.

The vehicles can directly communicate with each other and with roadside units. In such networks, vehicles can share information within a short range. In turn, VANETs are composed with high mobility nodes. Thus, they exhibit a topology that may change fast and in irregular ways to complicate the communication. Therefore, it is essential to provide the user with a well organized configuration of the communication protocols to facilitate the best quality of service (QoS) possible before to its deployment. VANET applications range from safety and crash avoidance to Internet access

and multimedia. Nevertheless, VANET shows its unique characteristics which impose both applications and challenges to the research communities

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