

Distance and Priority Based Routing Protocol in VANET

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ABSTRACT: Vehicular Ad-Hoc Network mainly involves Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) communication. This communication accelerates in reducing number of accidents, avoiding traffic congestion, enhancing the transport facility with the aid of infotainment and entertainment application. One of the major challenges of VANET application is in routing the packet in efficient manner since the network topology is dynamic. In this paper, we proposed a solution that improves the efficiency of Distance Based Routing protocol by using a priority of messages. This paper presents a Distance and Priority based Routing Protocol in Vehicular Ad hoc Network (VANET). We focus mainly on a emergency message routing in vanet. The proposed protocol, is evaluated using simulation software NS-2. The performance parameters include average delay, percentage of message reception. The results show that this protocol achieves both message prioritization and maximum delivery of messages in fully dynamic environment.

KEYWORDS: Vanet, Distance, Priority, Routing.

I. INTRODUCTION

The *Global status report on road safety 2015*, reflecting information from 180 countries, indicates that worldwide the total number of road traffic deaths has plateaued at 1.25 million per year, with the highest road traffic fatality rates in low-income countries[1], this increases the interest of researchers in the field of the Transport system. Vehicular ad hoc network is a part of intelligent Transport system. Vanet used for communication between vehicle to vehicle. Transmission of messages from one vehicle to another is difficult due to the moving topology, congestion in networks. This paper proposes the Distance[2] and Priority[3] based routing protocol for effective transmission of messages in VANET.

The rest of the paper is organized as follows: Section II illustrates the Related work of routing protocols in VANET. Distance and Priority based Routing Protocol is proposed in Section III. The simulation, results and analysis are discussed in Section IV, and Section V concludes the paper.

II. RELATED WORK

Vanet routing protocols are categorized in mainly

- Topology based protocols
- Position based protocols
- Geocast based protocols
- Cluster based protocols
- Broadcast based protocols

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1. Topology Based Routing Protocol

Destination Sequence Distance Vector routing(DSDV) -DSDV is a table driven proactive routing protocol based on classical distributed Bellman-Ford routing mechanism. Each node maintains routing table of all other nodes[4].

Optimized Link State Routing (OLSR) - OLSR is a proactive routing protocol meaning it will exchange the topology information with other nodes in the network in a regular manner. Due to the proactive nature of the OLSR the protocol acquired the firmness of the link state algorithm so that the routes will be available immediately when needed[5].

Adhoc On demand Distance Vector (AODV) – In AODV route is discovered by firstly broadcasting a RREQ (Route REQuest) and when destination receive that packet it will send a RREP (Route REPLY) to the source. AODV maintains all the route information in the form of routing table. The destination sequence number is used for prevention of routing loops and avoidance of old and broken routes[6].

Dynamic Source Routing- In DSR If a node wants to send data packet to another node in the network then it will go for route searching when needed and send the data from source to destination. First the node go for route discovery by broadcasting RREQ (Route REQuest) with a unique ID from source and when the packet is received by the nodes in the network it will find where the data packet need to be sent in the network and broadcast until it is received at correct destination. The destination node receives the data packet and broadcast a RREP (Route Reply) packet back to source with unique ID. This protocol can be useful in maintaining network information and send to roadside unit about the density of traffic.[7]

2. Position Based Routing Protocol

As compared to topology based routing protocol position based routing protocol provides information of mobile nodes position in participating network. This helps for easy dissemination of information broadcasting if position is known in the network. The few types of position based routing protocols are greedy perimeter stateless routing (GPSR) [8] and distance routing effect algorithm for mobility protocol (DREAM)[9].

3. Broadcast Based Routing Protocol

In vehicular network if an emergency situation occurs then broadcast routing protocol is appropriate in sharing information among vehicles participating in the network. The nodes will send packets to all the nodes in the network.

Few of the broadcast routing protocols are distribute vehicular broadcast protocol (DV-CAST)[10][11] and urban multihop broadcast (UMb) [12].

4. Geocast Based Routing Protocol

The mobile nodes in geocast routing protocol uses the principle of routing data packet from one source to all mobile nodes belonging to destination called zone of relevance. Zone of forwarding is used to confine the message forwarding until it reaches ZOR through flooding. Few of the protocols are DG-CASTOR and DRG[13].

5. Cluster Based Routing Protocol

In vehicular ad hoc network the nodes having the same characteristics such as moving with same velocity in the network can form as cluster and share information. They elect the node as cluster head which manages the cluster in the network of inter cluster communications. Few routing protocols are CBRP and COIN[14].

III. DISTANCE AND PRIORITY BASED ROUTING PROTOCOL

In this approach ,We consider each vehicle is aware of the road map with intersection information and its location and speed information in the network by using onboard GPS[3]. Every vehicle maintains routing table having Location and distance information of its neighbor vehicles by periodically exchanging Hello Packets. Distance between two vehicles is calculated as per subsection I formulas. When a vehicle wants to send message to another vehicle it firstly check its own routing table and finds the farthest vehicle from his own and which is in the direction of destination vehicle. Each message has associated a vehicle ID and priority according to a importance and urgency of the message. When intermediate vehicle receives messages it first sort all the messages by its priority and the messages with highest priority get forwarded first to next longest vehicle. Same process follows by all the vehicles till message rich to destination.

Distance Calculation Between Two Vehicles

The distance between two vehicles is calculated using the concept of propagation delay. The distance (D) is directly proportional to velocity (V) and propagation delay (P). The equation of distance, velocity and propagation delay is given by equation

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$$D=V \cdot P \quad (1)$$

Here D defines distance between two vehicles, V is velocity of vehicle and P is propagation delay. It shows that distance between two vehicles is directly proportional to velocity and remains constant till velocity of vehicle is constant.

Prioritization of Messages

Message prioritization means very urgent or important messages will be transmitted first then other less urgent messages. Message Priority (P)[3][4] depends mainly upon message's urgency and dissemination distance. The very urgent message at the first transmission will be assigned the highest priority ($P=1$). However, when the message is repetitively rebroadcasted far away from an accident location, the priority drops due to the fact that the message becomes no longer urgent. Thus, P of the message will become higher (lower important) when dissemination distance increases. This mechanism is applied to all messages. In order to calculate P, we assume that messages have three levels of urgencies, which are very urgent, urgent, and general messages. A value of Priority Index (I) depends on how fast a message priority decreased regarding dissemination distance. Thus, any decreasing functions can be implemented to determine the value of I according to the system's requirement. One example implemented in this paper is a use of exponential decreasing function shown in (2).

$$I=k \cdot e^{(-0.05 \cdot d)} \quad (2)$$

where k is priority coefficient, which represents how quickly the message priority dropped. For example, in this work, k is set to 10, 5, and 2 for very urgent, urgent, and general messages, respectively.[4] d is dissemination distance from a location of occurred event; a distance between event's and receiver's locations. As I is exponential function of d, It is noticed that I of all message's urgencies is dropping while d is increasing. P is assigned according to the value of I, $P=1$; the highest message priority is assigned to messages if their indexes are greater than 5. $P=2$ is assigned to messages of which indexes are between 5 and 2.5, and messages of which indexes are lower than 2.5 will be assigned $P=3$ which is the lowest priority. Consequently, a very urgent message will have highest priority ($P=1$) only if it is broadcasted within the first 14 km. Further from that, priority of the message will be decreased ($P=2$). Eventually, the message will be assigned the lowest priority ($P=3$), when its dissemination distance becomes greater than 28 km.[4]

$$P=1 : I \geq 5 \quad (3)$$

$$P=2 : 5 > I \geq 2.5 \quad (4)$$

$$P=3 : I < 2.5 \quad (5)$$

IV. EXPERIMENTAL RESULTS

The proposed routing protocol is simulated using Network Simulator 2(NS2). Figure 1 shows that number of packets generated in the network and get transmitted successfully. Figure 2 show that number of messages get delivered in network with hop count of transmission path.

In Figure 1 X axis represents time and Y axis represents number of packets generated and get delivered by using distance and priority based protocol.

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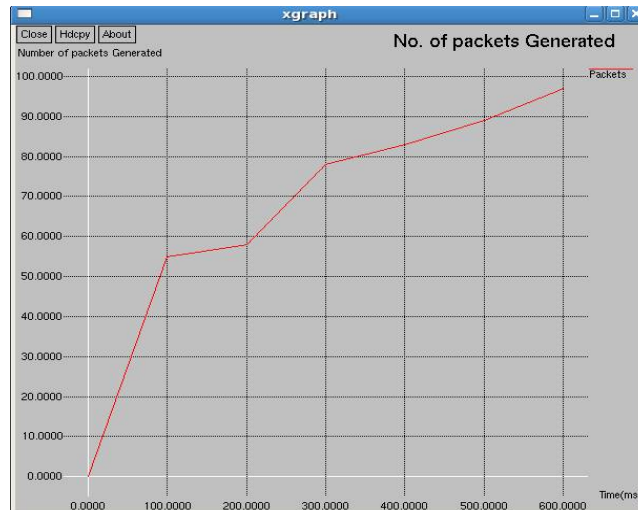


Fig 1: Number of packets generated and delivered

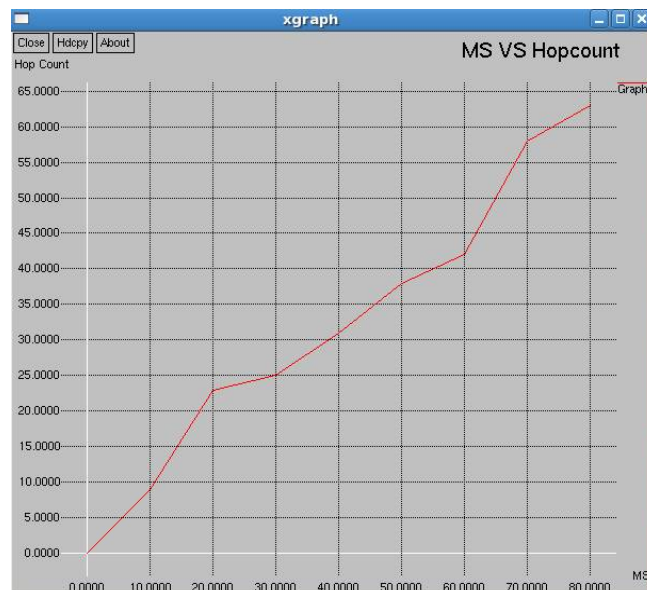


Fig:2 Message delivered with hop count

In figure 2 X axis represents time in milliseconds and Y axis represents that number of Hops selected by protocol while delivery of messages.

VI. CONCLUSION

In this paper we have implemented Distance and Priority based routing protocol for vanet. The proposed protocol uses the longest vehicle as a intermediate node for routing and all the messages with higher priority get transmitted first. Simulation results shows that the proposed protocol has better performance on highly dynamic environment of vanet and message dissemination rate higher than other protocols.

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Vol. 5, Issue 7, July 2016

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