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A Review of Various Clusters Based Routing Techniques on Vehicle To Vehicle Communication in Vanets

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Abstract
Vehicular ad hoc networks (VANETs) are the leading application of mobile ad hoc networks (MANET) where the nodes in the network of inter vehicular communication will be replaced by moving vehicles. In emerging vehicle-to-vehicle communication, many new applications such as infotainment services are being proposed by researchers. Nevertheless, these networks come with the issues of link stability based on their high inherent mobility scenarios. This paper survey the various techniques related to the cluster based routing in vehicle to vehicle communication for information dissemination.
Keywords: VANET, Mobility, Link stability

I. Introduction

Vehicular Ad-hoc Networks (VANETs) has generated interest in researchers based on its wide variety of services that it can provide in the context of Intelligent Transportation System (ITS). The main objective of VANET is to help a group of vehicles to set up and maintain a communication network among them without using any controller or central base station. Vehicular ad-hoc networks are responsible for the communication between high speed moving vehicles in an environment. The main issue of VANET is high dynamic network with high speed and mobility which makes the routing more difficult in VANETs shows the variation from MANETs. Thus if the stability of the routes are not maintained, it defeats the purpose of the network.

VANET communication is broadly classified as when a vehicle can communicate with another vehicle directly called as Vehicle to Vehicle (V2V) communication [1], or a vehicle can communicate to an infrastructure such as a Road Side Unit (RSU) [2] which is known as Vehicle-to-Infrastructure (V2I). In this paper we review on the broad category vehicle to vehicle communication.

Vehicle-to-vehicle (v2v) communication: It will be an expensive thing if we are installing a permanent infrastructure on roads. In such cases by the support of GPS devices that have an effective range of connected vehicles, the V2V communication will be cost less. V2V communication is mostly used in safety applications like traffic information, safety warning, road obstacle warning, intersection collision warning etc. In vehicle to vehicle communication each vehicle in the cluster is equipped with GPS (Global Positioning System), sensors, networking devices, digital map which has the computing devices and road segment information. Vehicles sense its own traffic messages and communicates with its neighboring vehicles by broadcasting beacon messages periodically.V2V communication uses both unicast and multi-cast packet forwarding

techniques between source and destination vehicles. In unicast forwarding, a vehicle can only send/ receive packet to/from its direct neighbors. In multi-cast forwarding, the vehicle enables the exchange of packet with a remote vehicle using the intermediate vehicles as relays Fig 1. Shows V2V Communication.

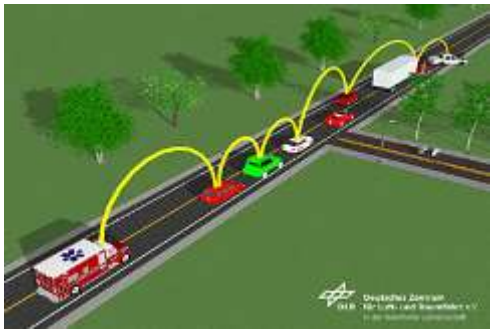

Fig 1: V2V Communication

A key requirement of VANET applications is the availability of effective and efficient routing protocols for message dissemination [3]. Due to high mobility of VANET nodes, frequent changes in topology, and limited life time existing internet or MANET routing protocols are not suitable [4]. To address the issues in VANET, several VANET routing protocols have been proposed which is broadly classified into five main categories, namely broadcasting protocols [5], route-discovery protocols [6]–[8], clustering-based protocols [9], position-based protocols [10], Moving Zone Based Architecture in VANETs [11], and infrastructure-based protocols [12]. Among all these protocols, clustering based protocols appear to be the most promising one as they attempt to capture the mobility of VANET nodes in a natural way and provide relatively stable units for communication but still development of clustering-based protocols is still at an early stage. The clustering strategies are relatively straightforward and they use simple clustering criteria, require a large amount of message exchange between member vehicles and cluster heads.

Cluster based Routing Protocol

Cluster based routing protocol [13] separates the network into cluster with similar characteristics like topology, velocity, speed etc. Cluster of vehicles have a cluster head which is responsible for intra and inter cluster communications. A virtual link is created for intra cluster communication and cluster head is responsible for inter communications. Fig. 2 shows VANET cluster model.

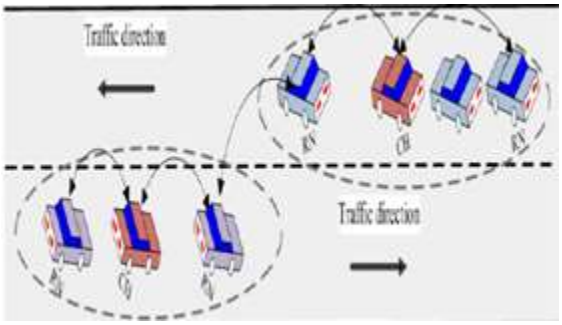

Fig 2 VANET cluster model

Various Clusters based routing protocols are CBR, COIN, CBDRP, BRAVE, MOZO etc. Cluster based routing protocol provides good scalability for large networks and due to dynamic topology of VANET the delay and overhead of maintaining these clusters is large. This paper presents the review of different cluster based routing techniques proposed by various investigators in the past. Finally, the paper has been concluded in section III.

II. Literature Survey

This section represents various cluster based routing techniques used in vehicular ad hoc networks for routing the data effectively.

CBDRP Cluster-Based Directional Routing Protocol [14] CBDRP is mainly designed for vehicles which move in same direction. The process starts when a source node or vehicle passes the packet to cluster header then cluster header passes the packet or message to vehicle of that cluster which is moving in same direction. Cluster header takes the main responsibility to forward the packet to destination cluster. This protocol maintains the direction and velocity of the vehicle are noticed when the packet forward to the cluster which CBR lacks. The CBDRP resolves link stability which is one of the main issue in VANET and data transfer in the network through clusters is more reliable and rapidly control packet overhead is low packet overhead is low. Due to more reliable for transmission of packets retransmission is more occurred.

MOZO The Moving-zone based design have been designed by the investigators [15] in which vehicles cooperate with one another to form dynamic moving zones with the intention of simplifying data distribution. They have proposed a new method that presents moving object demonstrating and indexing methods from the concept of huge moving object databanks into the design of VANET routing procedures. In each zone a captain vehicle (cluster head) is elected which is responsible for managing information about other member vehicles in the zone as well as the message dissemination. The captain vehicle maintains a moving object index that manages up-to-date information about all its member vehicles in its zone. Moving zone construction starts from a vehicle logging onto the cluster zone. The vehicle will execute the joining protocol to find a nearby moving zone or form its own zone. The zone forming criteria is based on the similarity of vehicle movement. This novel cluster model greatly reduces communication overhead and improves message delivery rate compared to other existing approaches in VANET. The outcomes on actual road maps validate the dominance of the method which is equated with both clustering and non-clustering based routing procedures [16].

COIN: Network Routing Protocol (COIN) [17], the cluster based protocol divides the network into different cluster based on three different parameters: movements of nodes, position of nodes, and behavior of nodes. Each cluster has a specific time called time to live in the approach which reduces control overhead. The mobility of nodes should be low to communicate with each other for long time.

Cluster Based Routing Protocol (CBR) [18] is geographical cluster based protocol that divides the network into number of square grids and does not require discovering the route from sender to receiver. Cluster is formed based on the position of the vehicle. In this approach, each node forward the data from one node to next node by using geographical information and a vehicle that is selected as a cluster head in a square grid and it , broadcast message to all its neighbors. The cluster head forward the LEAVE message to all neighbors before leaving the grid. The main disadvantage of CBR is that it does not consider the important parameters Velocity & direction for VANETs

Technique Name	Operations
CBDRP	• Data distribution is done by cluster head from source to destination (same or other cluster) vehicle which moves in same direction. • The direction and velocity of the vehicle are noticed while transferring packets. • Resolves the link stability. • Reliable and rapid data transmission results in more retransmission
MOZO	• Data Distribution is done by using dynamic moving zones which are formed on the basis on similarity of vehicle movement. • Each zone has captain vehicle that relays information for each zone. • Improves the control overhead and delivery rate.
COIN	• Cluster is formed based on three different parameters: movements of nodes, position of nodes behavior of the nodes. • To communicate with each other for long time ,mobility of the node should be low.
CBR	• This protocol divides the network into number of square grids and does not require discovering the route from sender to receiver. • Disadvantage of CBR is that it does not consider the important parameters Velocity & direction in network.

III. Conclusion

This paper describes the various techniques related to information transmission in vehicular ad hoc networks in a best possible way. The authors have also defined novel MOZO technique which optimizes the data dissemination in comparison to other traditional routing protocols. The MOZO approach greatly reduces communication overhead and improves message delivery rate compared to other existing approaches.

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