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REVIEW ARTICLE

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Clustering in vehicular ad hoc Network: A Survey

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***Abstract*:** VANET is a special type of MANETs which uses vehicles as a mobile node. It uses the intelligent transportation system in which vehicles can communicate with each other to avoid large number of increasing accidents on roads. The communication between the vehicles is at greater risk because the messages are broadcasted by wireless channel and vehicles move with high mobility. With dissemination of messages, vehicles can change their position and direction which causes a communication gap between the vehicles. So, In all VANETs applications, connectivity Maintenance is a primal goal to achieve. To improve the connectivity and achieve efficient communication among these vehicles clustering algorithms are used. This paper focus on the various clustering algorithms developed by different researchers where cluster Head has selected by using some methods. Each cluster has at least one cluster Head and two or more cluster members where cluster Head may responsible for managing all functions and coordination tasks.

Keywords: VANET; ITS; Cluster Head; Clustering; Connectivity

I. INTRODUCTION

VANET (Vehicular Ad hoc Network) is the subclass of MANET (Mobile Ad hoc Network). VANET uses vehicles as mobile nodes that communicate with each other. In this communication, vehicles are connected but they can move freely and no wired connectivity is required. Here each vehicle has its own platform, self-organize and self-manage information in a distributed fashion. Each Vehicular Device has an ability to connect with any other device in the network. To pave the way for communication between the source and destination each intermediate node forwards the message to the next node. Such Networks may work by themselves or may be connected to a large Internet.

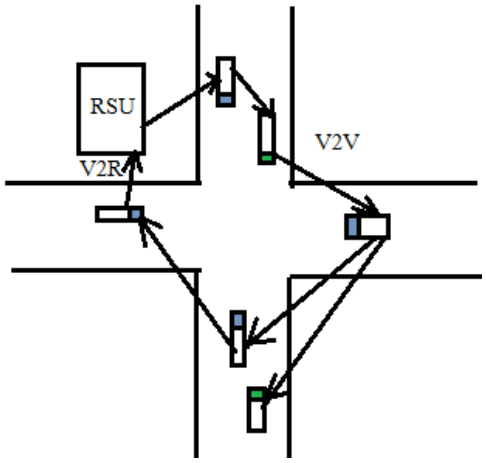

Figure 1: VANETs structure

The Vehicular Network System is made up of a large number of Vehicles, approximately number of Vehicles above 750 million in the world today. [1]

To provide both security and comfort applications, Vehicle manufacturers are interested in implementing vehicular communications such as collision avoidance, road condition awareness and Internet access. It provides great facilities to users they want to send the data onto the road.

For example, if one vehicle detects high volume of jam on a road, it could inform other vehicles in the same area, so they could select another road. Customers could check emails, download files and even play online games through vehicular communication network.

Although Vehicular communication network provides many facilities to their users, but each are constrained by many factors. Mobile vehicles have a limited transmission range and limited storage capacity. Except these common problems in wireless networks, one unique feature of a vehicular communication network is the high mobility of vehicles and VANET communication.

To make communication, all VANETs applications need connectivity of vehicles on to the network. So connectivity maintenance is the primal goal to achieve.

Though VANETs resembles in various aspects with MANETs it possess various distinguish characteristics which are not provided by MANETs i.e. Highly dynamic nature, Patterns and Quality Model, Higher power capacity, Memory storage, Large size.[2]

VANETs provide many applications that are usually used i.e. Real-time traffic, Post-Crash Notification, Electronic Toll Collection, Parking Availability, Fuel Saving.

II. ISSUES IN VEHICULAR AD-HOC NETWORK

The Vehicular ad hoc network (VANET) is a new structure of the mobile ad hoc network for wireless communication between vehicles on the road or in between the vehicle to road side unit. Due to the dynamic nature of network topology, routing in VANET play a vital role in the performance of the networks. There are various researches and studies in this field in attempt to propose more efficient routing protocols. Still, there is not a routing protocol that can perform efficiently in every situation. The existing

routing protocols are performed well only when the vehicle population is small. The Reactive routing schemes had failed to discover a complete path due to frequent network partition.

The proactive routing protocols will be overcome by the fast topology changes and even fail to converge during the routing information exchange stage. The Position based routing schemes usually need additional vehicle physical position information during the routing decision process. A location service like GPS is needed as well to provide the position information of vehicles. Due to the high vehicle mobility and the movement constraints of mobile vehicles the conventional topology based routing schemes are not suitable for VANETs.

Thus, due to the dynamic nature of VANETs, it's likely to face stale entries, congestion from flooding and the dense network leads to the hidden terminal problem. In order to overcome these kind of problems, many Solutions have been proposed of which clustering is one of the solution technique. A clustered structure can make the network appear smaller and more stable in the view of each vehicle. In addition, the hidden terminal problem can be reduced by clustering and it also decreases the messages count and increase the connectivity in the network.

III. CLUSTERING

Clustering is a technique for grouping nodes in geographical area together, creating the network more robust and scalable. The process of grouping nodes, i.e. mobile devices, vehicles, etc. together according to some rules and it divides the network into interconnected substructures called clusters. Clusters are a kind of virtual groups that have been formed by a clustering algorithm. Each cluster contains at least one cluster Head and two or more cluster members. The nodes in a Cluster have organized according to similarity of special characteristics between them. As a result, less topology changes as compared to the whole network. Moreover, managing the cluster is easier than managing the whole network.

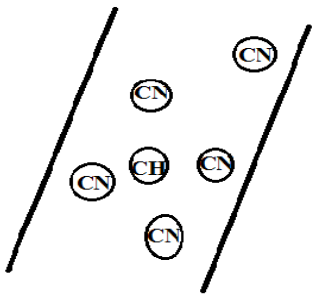

Figure 2: Cluster Structure in Highway Scenario

In VANETs cluster is represented by a set of mobile vehicles that are moving on the Highway scenario and urban scenario. The figure. 2 describe the Highway scenario where cluster Head is in the Center and cluster nodes are moving around it. Each cluster node can communicate directly with Cluster Head. In clustering, cluster Head selection is most significant to run the clustered nodes smoothly. Clustering provides many of the advantages i.e. Handle Dynamic Network, Stable Network, Improved Congestion, Reduces Broadcast

IV. LITERATURE REVIEW

M.Hari Prasad et al. [3] Proposed a new algorithm to construct Stable clusters to perform cluster based routing (CBR) and to better the performance of VANETs. The stable clustering algorithm groups the nodes based on the position and direction information to form stable clusters and elects cluster head based on a multi-metric algorithm. The node becomes a cluster head is determined by its suitability value u, i.e., computed based on mobility information of its neighbourhood. The nodes which have higher no. of stable neighbours, having closer distances to their stable neighbours and having closer speed to the average speed should have a higher suitability, value; they have a higher probability to elect as a cluster head. This method decreases the overhead of re-clustering and lead to an efficient hierarchical network topology.

L. Ahmed et al. [4] Introduces a clustering mechanism based for connectivity maintenance in VANET. A novel cluster-based algorithm for connectivity maintenance in vehicular ad-hoc networks is proposed (AODV -CV). In this algorithm author's purpose to improve cluster connectivity maintenance by making stable and long-living clusters as much as possible. The Main Idea of cluster head election mechanism based on the average speed of the vehicles moving is the same direction and the virtual mobile cluster formation. Results show that AODV-CV seems fit to improve cluster maintenance and performances in the highway where the vehicles' speed limit doesn't exceed 120 km/h.

M C Aswathy et al. [5] Studied the dynamic change in topology effects the effective time of routing. Hence routing in VANETs is complex. During the route discovery process AODV broadcasts a route request message (RREQ). It generates many unused routes between a source and a destination node. To improve the performance, the VANET is made into small clusters with long Cluster Head duration. The AODV protocol is improved by exchanging broadcasting by RREQ packets with the forwarding of RREQ packets to Cluster Heads and there by managing routing by Cluster Heads and Gateway Nodes. This paper focus on improving the performance of AODV by enhancing the existing protocol by generating stable clusters and performing routing by Cluster Heads and Gateway nodes.

S R. Pandi et al. [6] designed a new weight based clustering algorithm to improve the performance in this wireless technology. This clustering algorithm takes the maximum hop distance from the cluster head to its farthest cluster member is two hops which will ensure that each non cluster head node is managed by only one cluster head which are its neighbours within two hops. For weight calculation each node compares the weight of its neighbours. The node which has the largest weight proclaims itself as a cluster head

R Y Zaydoun et al. [7] This approach takes the speed, in addition to the location and direction, into consideration to accurately identify nodes showing similar mobility pattern and group them into a cluster. A new multi-metric Cluster Head (CH) election technique has developed. This technique can be used by vehicles to predict their suitability value. Hence, the elected cluster head is expected to stay

connected with its members for the longest period of time. Therefore, nodes having a higher connectivity degree, maintaining closer distances to their neighbors, and having closer speed to the average speed of their neighbours is more qualified for winning the CH role.

W.Grzegorz et al. [8] Presented a new clustering algorithm for Vehicular Ad-Hoc Networks (VANET). The proposed solution is an enhancement of the Basagni's Distributed and Mobility-Adaptive Clustering (DMAC) algorithm. The main goal is to avoid re-clustering when groups of nodes move in the different direction. The idea is based on periodically sending hello messages and estimating the connection time of two moving nodes is introduced. When a freshness value is calculated, it is possible to avoid re clustering when two nodes comes in connection over a short period of time. The cluster head election is when the node does not accept the node which have higher weight than the weight of its current cluster head as the new cluster head.

M S.Thamarai et al. [9] Proposed a cluster based vehicle model for vehicle communication, this paper pay attention on the development of clustering technique, by considering the vehicle density, speed and position of the vehicles to decrease the delay overhead. The cluster head is elected based on speed and position of the vehicles. The cluster head switching technique is proposed technique that is if the new vehicle speed is greater than the cluster head than the new vehicle is elected as the cluster head.

IV. CONCLUSION

In order to provide reliable communication, VANETs needs stable routing protocols to deliver data packets to the destination. So, clustering is one of the best solution to handle the special characteristics of VANETs i.e. high mobility, movement constraints. In this paper, the various methods are described, each have its own pros and cons. The above discussion shows that clustering is being used in VANETs with a great demand and it seems very useful for vehicular ad hoc network and to choose a stable cluster Head makes the network more effectively. In the future work, we will introduce the long living cluster Head so that vehicles can be connected with a longest period of time with cluster Head that may increase the network stability.

V. REFERENCES

[1]. M Raya, D Jungels, P Papadimitratos, I Aad, JHubaux,"Certificate Revocation in Vehicular Networks Laboratory for computer Communications and Applications (LCA) School of Computer and Communication Sciences, EPFL,Switzerland, 2006.

[2]. P. Ayonija Identification of malicious vehicle on VANETs environment from DDOS Journal of Global Research in Computer Science Review, Volume 4, No. 6, June 2013

[3]. M.Hari Prasad Performance Enhancement of VANETs Using Cluster Based Routing International Journal of Innovative Research in Science, Engineering and Technology Vol. 3,Issue 5, May 2014

[4]. L. Ahmed Clustering-based Algorithm for Connectivity Maintenance in Vehicular Ad-Hoc Networks 2014 IEEE

[5]. M. C Aswathy cluster based enhancement to AODV for inter- vehicular communication in vanet International Journal of Grid Computing& Applications (IJGCA) Vol.3, No.3, September 2012

[6]. R. Pandi Selvam et al, Stable and Flexible Weight based Clustering Algorithm in Mobile Ad- hoc Networks International Journal of Computer Science and Information Technologies, Vol.2 (2), 2011

[7]. ZaydounY. Rawshdeh Toward Strongly Connected Clustering Structure in Vehicular Ad hoc Networks IEEE 2009

[8]. W. Grzegorz Modified DMAC Clustering Algorithm for VANETs International Conference on Systems and Networks Communications 2008 IEEE

[9]. M .S Thamarai A Cluster-based Highway Vehicle Communication in VANET International Journal of Computer Applications National Conference on Recent Trends in Computer Applications NCRTCA 2013