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# A Weighted Control Dynamic Clustering Approach in Vehicular Adhoc Network

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**Abstract:** VANETs have been appeared as a new area of data dissemination process in which vehicles provide aid to the end users. Vehicles in vehicular ad hoc network have highly unstable (dynamic) topology which produces hindrances in timely delivery of sensitive messages. The best panacea to stabilize the highly unstable networks is clustering process. Unfortunately stable clustering does not minimize the overhead of cluster reorganization to great extent. Thus to tackle the overhead problem of cluster reorganization process, dynamic clustering is an effective way. In this paper, dynamic clustering is proposed and cluster head is defined on weighted control factor and further the cluster reorganization process is minimized by calculating NACH (next available cluster head) factor.

**Keywords**: vehicular ad hoc network (VANETs), cluster head (CH), NACH.

## I. INTRODUCTION

Vehicular Ad hoc Network (VANETs) is the assuring approach to give safety and other applications to the people. Vehicular ad-hoc networks are liable for the communication between moving vehicles in a network. Generally, the VANETS consider two types of communication i.e. V2V (Vehicular to Vehicular) in which vehicles can communicate directly with any another vehicle Or V2I (Vehicle-to-Infrastructure) in which vehicles can communicate to an infrastructure such as a Road Side Unit (RSU). VANETs provide many services to its users including safety and comport applications Post-Crash Notification, Electronic Toll Collection, and Parking Availability, Alert notifications.

For example, vehicles can inform to other vehicles into the network that there is traffic accident or congestion so that the vehicles can change their route immediately. Also, it offers vehicles to connect by Internet to get real time news and weather reports. VANET also provides the huge opportunities to its online users for entertainments like gaming, chatting, multimedia streaming and file sharing via the Internet.

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]. Four verities of communication modes are available in VANETs.

1) In vehicle communication (IVC), 2) Vehicle to Vehicle communication (V2V), 3) Vehicle to Road infrastructure; 4) vehicle to broad band cloud. All the above categories can derive the vehicle performance and all communication modes are designed well for public safety. The design of cluster is fully depends upon the size and communication quality. During the cluster design, the size of cluster and geographical span has to be considered. If it is not designed properly there should be some serious network issues. Protocol operations, wireless channel status and traffic conditions are decided on the cluster performance. Predominantly the analytical models of VANET were focused on the wireless channel fading effects between moving vehicles or the traffic conditions or MAC protocol operations.

The separate analysis or modelling has many drawbacks because it is vigorous only on the single factor the remaining factors are not in the consideration. So it is more challenging to procure a comprehensive design. The cohesive model integrated the three factors into one model and increases the communication quality and further packet loss proportionality will be very low it will raise the overall performance physically and mathematically [2].

A Clustering is a method of dividing the network into smaller groups called clusters. It is used to enhance the performance of the network, but existing clustering technique is not suitable for VANETs network because of its highly dynamic nature.

Clustering is the process of collecting information and distributing it into own members and other clusters. Clusters contain cluster head, gateway node and more than one member.
Cluster head manage cluster activities, collect and distribute information. Gateway nodes manage the inter cluster communication.

## II. RELATED WORK

**Kayis** et al defines new clustering technique on the basics upon speed range of vehicles. The author proposes the

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seven group of speed. The vehicle falling in same speed range belongs to same cluster group. The node which declares itself first as CH will remain same in that area according to "first declaration wins rule". If the cluster member changes its speed then it will find a new cluster.

**Souza** et al defines a new clustering approach in which the author uses the location information to determine the relative mobility of nodes by broadcasting alert messages. Relative mobility matric that uses the location information is termed as Aggregate Local Mobility (ALM) metric. When two clusters come in each other communication range, process of merging takes place. In between the communication between two clusters, one of the cluster moves to contention state, before the expiry of contention time node which has smaller ALM is elected as CH. Due to dynamic topology of VANETs, the concept of ALM is highly unstable.

**Almalag** et al propose the clustering technique in which CH is elected on the basics of similarity in mobility patterns of vehicles. Each vehicle computes the mobility pattern using its lane information. The metric used to describe the lane information is CH level. The vehicle node with maximum CH level is elected as CH.

**Bali** et al propose the clustering technique in which the author defines the leader nodes which further form cluster leadership group. The leadership group is formed on the basics of higher connectivity of nodes greater than or equal to threshold value. Moreover the election of cluster head from cluster leadership group is done on the basics of relative mobility of nodes. The relative mobility is premeditated by aggregating relative velocity of vehicle nodes with respect to neighbouring vehicle nodes which is known as aggregate relative velocity (ARV). Minimum aggregate relative velocity vehicle node is considered as cluster head.

In this study, due to dynamic topology of vehicles node in VANETs if the minimum ARV node that is cluster head (CH) leaves its particular cluster then there will be immense need for the cluster reorganization process. Frequent cluster reorganization process results in frequent change in cluster head.

## III. PROBLEM DEFINATION

Clustering is the technique of partition the network into smaller groups of moving nodes embedded with computing and networked devices. It has several advantages including proper usage of bandwidth, distribution of resources and scalability. Cluster formation plays a vital role in VANETs for information gathering, aggregation and dissemination.

Static clustering is a technique to form stable grouping of computing devices on the fly that does not have physical connections. The scheme forms a moving stable cluster on a lane between two intersections by considering parameters such as vehicle speed, direction and connectivity to other vehicles. The topology of VANETs is very uneven so there is immense need for stabilize the VANETs network. Mechanism which has the potential to stabilize the highly dynamic nature of vehicles is clustering. The goal of many clustering techniques is to minimize the cluster reorganization when cluster head leaves a cluster. Cluster re-election process increases the maintenance cost as well as the cost of cluster head (CH) election cost.

## IV. PROPOSED APPROCH

In the proposed method, we take Broadcast messages that contain information about their velocity, position, acceleration which is known as Weighted Control (WC) factor. The higher the WC factor, the higher the chance for this vehicle to be elected as a CH. If a vehicle has the highest WC factor among all vehicles within its range, it will elect itself as a CH and set the field CHID in its status message to its own ID. If there is another vehicle, within this vehicle's range, that has the next highest WC factor; it will elect it as a temporary CH by setting its field NACH to this temporary Cluster head ID.

This newly elected temporary CH will check first if it has the highest WC among all vehicles within its range, if yes it will elect itself as a CH. If not, it will accept this temporary position and will not participate in electing a new CH within its range waiting either to merge with another cluster or to change its state to a main CH. Vehicle that do not have a CH within its own range and lies within the range of a temporary CH will join this cluster and will not participate in electing another temporary CH.

Therefore, the CH will calculate the expected positions of all of its members after time based on their advertised speeds, acceleration and position. The CH will select a NACH that has the highest WCfactor among all vehicles around the cluster. This NACH CH ID will be announced as next available cluster head if the current one dies or become out of communications.

The CH will remains as a CH if all its members will continue to be within its range or has more coverage than its NACH CH for the next time interval. Otherwise, it will hand the responsibility to the NACH by setting its field CHID = NACH and advertise a status message. Upon receiving this message, cluster members will start communicating with the new CH without the need for a re-election process.

## V. PROPOSED ALGORITHM

Dynamic clustering algorithm for efficient data dissemination in VANETs on the basis of calculation of weighted control factor and next available cluster head (NACH).

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NN: Normal Node
WC: Weighted Control
CH: Cluster Head
NACH: Temporary Cluster

### CLUSTER FORMATION

Normal routing: dynamic clustering
Prevention: backup cluster for less cluster redistribution.

Step 1: Begin

Step 2: NN initiate the network
{

Step3: Normal Node (NN) participates for cluster head election and finds the WC.

Step4:

If (WC=MAX1&&MAX2<=MAX1)
Broadcast CH and NACH
Cluster is formed; Transmission in Network
Else If (CH leaves)
{
NACH will become cluster head and find new NACH;
}
CH&&NACH updated in network;
Cluster is formed;
Transmission in Network;
}

Each node broadcast its mobility information average speed average acceleration through Hello Packet in transmission range.

The weighted control value is calculated .the node with the higher WC value will be consider as Cluster head and node with second higher value will be consider as Next Available Cluster head NACH.

The detailed cluster formation operation in algorithm is discussed as below

1. The nodes are taken as normal nodes initially and they broadcast a HELLO message to neighbours nodes with its velocity and acceleration information. As hello message is received by each node then it will calculates WC value by using the above Eq. (1) to (6).

2. After cluster formation when a CH goes out of range, backup cluster NACH will be formed as cluster head and new cluster head id will be broadcasted to neighbour nodes. The cluster formation process finishes and transmission process starts between cluster head and normal nodes.

3. If new node join cluster it will become normal node and it will start the transmission with CH in the network.

### PROPOSED METHODOLOGY

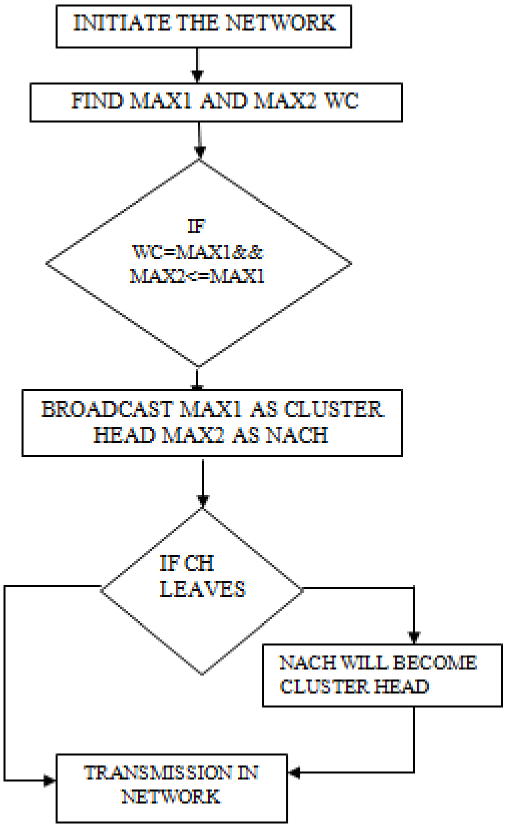


Fig1. Flowchart of proposed methodology

### VI. RESULT AND ANALYSIS

**Throughput:** It is defined as the amount of MAC layer Service Data Unit (MSDU) transmitted per unit of time i.e. the amount of bits that can be transmitted in unit second. Throughput is calculated in kilobits per second (kbps). The Fig 2 shows the increase in throughput with increase in time in proposed technique NACH as compared to previous ARV technique.

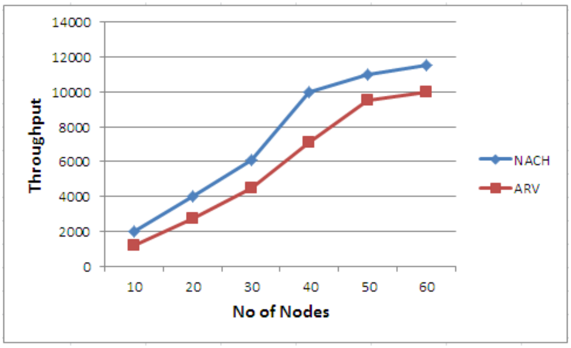


Fig 2: Throughput Evaluation

**PDR:** Packet Delivery ratio is the ratio of number of data packets successfully delivered to the destination by the number of packet transmitted by the source. The Fig 3 shows the increase in packet Delivery Ratio with increase

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in time in proposed technique as compared to previous ARV technique.

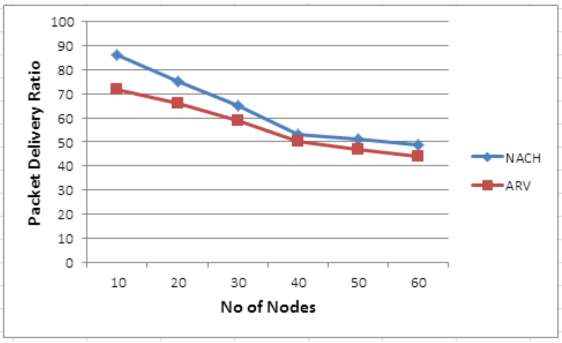


Fig 3: Packet Delivery Ratio Evaluation

**Latency:** Latency is a time interval between the stimulation and response, or, from a more general point of view, a time delay between the cause and the effect of some physical change in the system being observed. Latency is physically a consequence of the limited velocity with which any physical interaction can propagate.

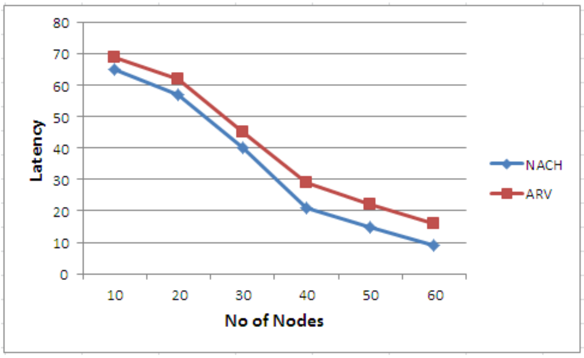


Fig 4: latency Evaluation

## VII. CONCLUSION

In this paper dynamic clustering algorithm for VANETs is proposed. The cluster structure is formed by Weighted Control factor. With the formation of next available cluster head (NACH), cluster re-election process possibility decreases. The scheme forms a moving cluster on by considering parameters such as vehicle velocity, position and acceleration to other vehicles.

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