

# Survey on Comparative analysis of Cluster Formation and Cluster Head Selection algorithms

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**Abstract**-MANET (Mobile Ad-hoc Network) is an infrastructure less network that is designed by grouping number of mobile nodes. Certain nodes collected together become a cluster. To maintain control across the cluster, cluster head (CH) is selected in each cluster. It is necessary to have a good and efficient cluster formation and cluster head (CH) selection algorithm to communicate across the network. The communication must be fast and reliable. Numbers of clustering algorithms are already available. Battery life, speed, packet delivery ratio, delay etc are some of the vital parameter that defines the efficiency of the algorithm. This paper reveals comparative analysis of mentioned clustering algorithms Lowest ID (LID), Highest Degree (HD), LEACH.

**Index terms**-Cluster, Cluster Head, (MANET) Mobile Ad-hoc network

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## I. INTRODUCTION

Mobile ad-hoc network is formed by grouping of nodes without help of the centralized management or fixed infrastructure [2]. The network thus formed by mobile nodes and other devices in the network being able to detect the presence of other devices and perform the necessary set-up and configuration to facilitate communications across the network [8].

It is a self-configuring network. Each node is embedded with wireless transmitter and receiver called as trans-receiver which allows it to communicate with other nodes in its radio communicating range via bidirectional wireless links [2]. In order a node to forward a packet to another node that is out of its radio range, the co-operation of other nodes in the network is needed, this is known as multi-hop communication. The network topology frequently changes due to the mobility. The self-configuring ability of nodes in MANET made it popular among critical security applications like military use or emergency recovery [1]. In MANET Cluster and Cluster head are most vital elements. Cluster plays an important role in increasing the performance of MANET to some extent. In a cluster Structure, Cluster head and boundary node happens to be virtual backbone for routing among all clusters which are very close to cluster [9].

This comprehensive survey focuses on the cluster and cluster Head selection algorithm. The objectives lies in

entitling specific node as a cluster head (CH) who's duty is to act as the local coordinator, exercising transmissions of packets in full duplex manner along intra-cluster and inter-cluster arrangements.

## II. BACKGROUND

Clustering is the process of dividing the network into interconnected subsystem called as cluster. Cluster further is responsible for proper selection of Cluster Head. Clustering increases overall capacity of network and reduces the routing overhead which brings more efficient and effective routing in MANET. Every clustering algorithm consists of two mechanisms, cluster formation and cluster maintenance. In cluster formation, cluster heads are selected among the nodes to form the hierarchical network. The Cluster Head of one network is communicating to make system secured as well as full proof. Traditional clustering algorithms suggest CH election exclusively based on node IDs or location information and involve frequent broadcasting of control packets, even when network topology remains unchanged. Two nodes cannot directly communicate with each other the communication has to be done via CH of that cluster. For inter cluster communication node need to communicate with its cluster head (CH), this CH relays the packet to the CH of cluster to which receiving node belongs which in turn connects to the receiving node.

Some of widely used algorithms for developing and creating Cluster as well as selection of Cluster Head are.

1. Lowest ID
2. Highest Degree Clustering Algorithm
3. LEACH

These algorithms have worked according to their constraints. They have some advantages as well as disadvantages

### 1. LOWEST ID (LID)

In this algorithm searching of lowest and oldest ID from current cluster is done. The node having lowest ID chosen as Cluster Head (CH).

### 2. HIGHEST DEGREE CLUSTERING ALGORITHM (HD)

Here the algorithm take the node as a cluster head which is having highest degree. The degree of node is calculated on the basis of how many nodes are there in its radio range.

### 3. LEACH :

In this algorithm CH will be selected by performing rounds. Each round having two stages one is set-up stage and other is steady stage. Random selection of cluster head had done in LEACH. It is self-organized and self-adaptive algorithm.

## III. RELATED WORK

The survey discusses about the cluster formation and cluster head selection algorithms. Following is the detailed analysis of each of the algorithm..

### 1. LOWEST ID (LID)

It is identifier based clustering algorithm. It will first assign unique id to each new node entering the ad hoc network.

Hao Wu and ZhangduiZhong, LajosHanzo[3] proposed idea of giving ID to each node. With that unique ID it will broadcast the information to other node in that cluster. For selection of lowest ID, it will make cluster, and in that cluster search for lowest node having lowest ID. That node will be declared as a Cluster Head for that particular network. If node belongs to multiple cluster then it will served as a gateway between that two clusters.

DamianosGavalas [4] explained LID algorithm works in simplified manner. This novel proposed new algorithm Lowest-ID with Adaptive ID Reassignment (LIDAR). It maintain process of algorithm fast, simple and low cost effective. It is specially designed for maintaining balanced computational load and power consumption among all

movable node. This technique increase the battery of that cluster head

In [5] proposed new modified clustering algorithm named as Lowest Node ID (LNID) . It will maintain the state of machine as a semi-stable state and having ability to change state during work. So effects are that if power drainage occurs it will give its control to another node and prevent from losing data. It will maintain MAC address as a ID of that node. Node which is lowest MAC address will be the Cluster Head for that particular network

### 2. HIGHEST DEGREE (HD)

Highest degree algorithm chooses the node with highest degree as the cluster head(CH). Highest degree of the node refers to node having maximum no. of nodes in its transmission range.

In [6] the nodes which are in transmission range of particular node they are receiving ID from one of the node. If ID sending node is surrounded with highest number of node with that cluster then that node will be considered as a Cluster head for that Cluster Head. Nodes from cluster are 2-hop away and cluster heads are directly connected to each other. In this number of cluster are low.

In [7] they are clarifying the calculation Consistent bunching calculation in that hub which is having degree as i number and that degree is most astounding in that group then it will think about as a Cluster Head for specific system. It will likewise chip away at Energy related decency component  $F_i$  it will check the vitality of Cluster Head.  $F_i$  additionally takes the past data that how frequently it served as a Cluster head for that Cluster.

### 3. LEACH

LEACH (Low-Energy Adaptive Clustering Hierarchy) is energy-efficient hierarchical based protocol that balances the energy expense, saves the node energy and hence prolongs the lifetime of the network.

In [7] they improved previous LEACH algorithm into LEACH protocol with two level cluster head (LEACH-TLCH). In this Cluster Head formation is same as traditional method. Picking up the any one number among all nodes in Cluster, Checks the energy if it goes below the threshold value it will stop receiving data. Then secondary head is responsible for receiving and fusing data. Primary head will idle now.

In [8] they explained way to minimize global energy usage. It will distributed load in a time in all points. It performs static clustering algorithms to acquire volunteers which is having high energy will be head for that cluster. It will adapt all the responsibility. LEACH is completely distributed; no control information is required from base

station. In order to operate LEACH no knowledge of global information required

Following table shows shortly the working, advantages & disadvantages of cluster formation & CH head selection algorithms:

Algorithm	Working	Benefits	Drawbacks
Lowest ID Clustering Algorithm	Node with Lowest ID is selected as CH	very easy to understand and CH will be elected on the basis of unique ID	Few nodes are prone to power drainage due to serving as CH for long period of time.
Highest Degree Clustering Algorithm	node which is surrounded by highest no. of node is selected as a CH	CH will be selected by considering its degree, so transmission of data will be easy and quick	If no. of node increases in the network, The load of network increases due to CH, it leads to increases overheads.
LEACH	CH will be selected by performing Random selection of CH.	CH selection randomly so no fix constraints.	It is time consuming. Not much trust worthy transmission consumed more energy.

#### IV. CONCLUSION

The Lowest ID , Highest Degree and LEACH are all Cluster formation and Cluster head selection algorithm. But each one has its own advantages and disadvantages. Lowest ID is prone to power drainage due to serving as Cluster Head for long time. And selection based on only lowest ID. No other criteria for selection of Cluster Head. Highest Degree Cluster head select on the basis of more numbers of node surrounded by that node. But when node increases in the network, load of that node also increases. It will increase network overheads. In LEACH, Head selection criteria depend on the no of rounds and at a time only two nodes will be active others are sleep. But this is time consuming because it will take long time to broadcast data as only two nodes alive so the packet delivery ratio to the destination node will be low. So from the survey we can conclude that it needed to develop such an algorithm which will prove better in parameters like life time, packet delivery ratio decreases overheads, delay rate in MANET.

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