CLUSTER FORMATION BASED BROADCAST EXPENSES CONTROLLING IN MANET

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ABSTRACT

A Mobile Adhoc Networks (MANETs) is a group of autonomous mobile wireless nodeswithout a fixed infrastructure used for communications during emergency situations like disaster management and military deployment. New members can join and leave the network at any time.Due to this mobility nature of the MANET, the nodes state informationchanges frequently and finding a channel schedule for the nodes in the network becomesdifficult. The channel bandwidth and battery lifetime are the two resources to beoptimized to improve the performance of the MANET and it is importantto study the effect of different transmission power levels on the performance of theMANET.This has drawn much attention for research, due to its adhoc nature. This leads to the design of logical clusters, wherethe cluster heads in every cluster play the role of base station and also form of thevirtual back bone for routing the packets in the network. As MANET is very much used foremergency communication, this network should meet with this challenges and it must toleratethe faults occurred due to node death and link failure. In this paper, proposed a new routing algorithm named Cluster Formation based Broadcasting Expenses Controlling (CFBEC) for energy efficient path between sender and receiver. This proposed CFBEC algorithm provides better performance compare to existing Hybrid Energy Efficient Distributed (HEED) clustering algorithm, Low-Energy Adaptive Clustering Hierarchy (LEACH), and Energy Efficient Probabilistic Broadcasting (EEPB) algorithm and also increasing throughput, reducing end-to-end delay with number of nodes, transmission range, and mobility is increased.

Keywords: Broadcasting, Clustering, Routing, Neighbour Coverage, Throughput.

I. INTRODUCTION

A Network facilitates the distribution of files and informationbetween multiple computers. Computer networks can be interconnectedthrough either Ethernet cables or using wireless cards that send and receivedata or wireless medium like air. An Ad hoc network establishes a linkbetween various nodes without any base station.Mobile Ad Hoc Networks (MANETs) are quickly becoming acommon mode in telecommunication because of easy deployment and fastconfiguration. These

networks use broadcasting as a method for communication, forupdating the topology, maintaining the network, giving warning messages.They consist of a group of nodes that communicate with each other over awireless medium like air without the need for any predefined infrastructure.All the nodes are working as source, router or destination. The topology ofthe network can change dynamically because the nodes move in differentdirections, leave or join it. Such change creates problems in maintaining therouting process through energy loss, delay and instability in linking. So, therouting protocol must be designed to provide energy maintenance, avoiddelay and make the link stable.

Till now, variety of routing protocols are developed for MANETs the set of applications for MANETs is numerous, starting from little, static networks that area unit affected by power sources, to large-scale, mobile, extremely dynamic networks. In adhoc networks, nodes don't have a priori information of topology of network around them, they need to find it. Mobile Adhoc Networks (MANETs) represent a replacement type of communication consisting of mobile wireless terminals wherever it's an infrastructure less IP based mostly network of mobile and wireless machine nodes connected with radio. In recent years, MANET has gained quality and much of research is being done on completely different aspects of MANET. It's an infrastructure less network having no fastened base stations. MANET is characterized by dynamic topology low information measure and low power consumption. All the nodes within the network are moving i.e. topology of the network is dynamic therefore the nodes will act each as host furthermore as router to route info excess for its use. It's well-known for its routable network properties wherever every node act as a router to forward the traffic to alternative fixed node within the network. MANET may be a wireless multihop network with none fastened infrastructure, in distinction to today's wireless communications that is predicated on fastened, pre-established infrastructure. All networking functions, like determining the configuration, multiple accesses, and routing of knowledge over the foremost acceptable ways, should be performed in an exceedingly distributed manner. These tasks are significantly difficult, because of the restricted communication information measure accessible within the wireless channel.

II. RELATED WORKS

Survey of Broadcast Expenses Controlling Techniques in Mobile Adhoc Networks have been studied and discussed fromNaeem Ahmad, et.al (2015).Performance Analysis of Broadcast Based Energy Efficient Routing Protocol for MANET Using BTSNA-DS Algorithmhave been proposed by Saraswathi, R. et. al (2018).Broadcasting Based Energy Efficient Protocol to Enhance the Routing Performance in MANET Using BTSNA-DS Algorithmhave been proposed by Saraswathi, R. et. al (2018).Energy Efficient Neighbor Coverage Protocol for Reducing Rebroadcast in MANET were discussed and analyzed from RagulRavi.Ra, et. al (2015). Enhanced Internet Accessibility for adhocnetwork with On-Demand Gateway Broadcast Strategy were studied and

discussed from HuaqiangXu, Lei Ju, and ZhipingJia, (2015). An efficient broadcast-based information transfer method based on location data over MANET were discussed from Yosuke Totani, et. al (2016). Network resource efficient routing in mobile ad hoc wireless Networks have been discussed from Ahyoung Lee, and Ilkyeun Ra, (2015). Performance analysis of an extended grid based broadcast algorithm in mobile ad-hoc networks have been discussed nad analyzed from AbderezakTouzene, et al (2015).Performance comparisons of routing protocol in MANET were discussed from Prabu, K., et.al, (2012).Energy efficient routing in MANET through edge node selection using ESPR algorithm were discussed and analyzed from Prabu, K., et.al, (2014).Cluster based controlling of route exploring packets in ad-hoc networks were investigated by Hussain, S.Z., and Ahmad, N., (2014). Energy evaluations of AID protocol in Mobile Ad Hoc Networks were studied by M. Bakhouya, J. (2015).Approaches for Engineering Adaptive Systems in Ubiquitous and Pervasive Environments were studied and discussed by M. Bakhouya and J. Gaber (2015).Energy Efficient Probabilistic Broadcasting for Mobile Ad-Hoc Network have been proposed by Sumit Kumar, and Shabana Mehfuz1 (2016).Broadcasting Mechanism with Less Flooding Packets by Optimally Constructing Forwarding and Non-Forwarding Nodes in Mobile Ad Hoc Networks have been proposed by R. Reka, and R. S. D. Wahidabanu (2014).

III. PROPOSED CONCEPT

A graph $G = (V, E)$ is used to model the ad hoc network in which V, E is a finite setof nodes and bidirectional edges that connect the nodes. Cardinality defined as thenumber of elements in a particular set. The cardinality of set V is constant, but thecardinality of set E is not constant, since it depends on the nodes mobility. Eachnode v_i?v must have unique identity, mobility v_{mob}, and the largest transmissionrange v_{tr}. The node $v_i$is within the transmission range of $v_j$if dist $(v_i, v_j)<v_{tr}$.
Where,

V_{mob} - is the mobility of the node
V_{max} - is the maximum mobility of the node
V_{tr} - is the transmission range of the node

The mobility of the nodes is increased or decreased as per requirements, but a node can have maximum mobility of v_{max}.The weight of each node is calculated using the mobility and the remaining battery power.At the first stage a volunteer cluster head choice function is called.The energy drain rate of the cluster heads was very high. The cluster head re-election process is called when the battery level of the cluster head falls below 20% of threshold value in order to keep up alanced energy level in all the nodes.

Objective of broadcasting techniques, an optimized strategy of blind flooding is broadcasting in which only intended nodes receive the query packet. It is an essential technique to discover the desirable route for data transmission. This technique has multiple objectives in the route discovery

phase which are common for every routing protocol.In MANET nodes are keeping moving and communicate with each other in wireless link. In clustering scheme the network is divided into chunk of nodes known as Clusters where one node in each cluster act as a Cluster head which is used for Routing. Mainly we used creation of cluster and election of cluster head algorithm. The Cluster creation algorithm we check that node is in the communication range or not. If present in range then node will be added otherwise not added. For each node less distance is efficient. The cluster information is maintained by each node. The cluster information is very important. This information keeps track of the all necessary information for clustering algorithm. When updating the information, a node can determine its own status by exchanging cluster information with its neighboring nodes. The cluster information is used for cluster maintenance and routing. Each node maintains neighbor tables that contain Unidirectional and Bidirectional neighbor table. The information stored in neighboring table.

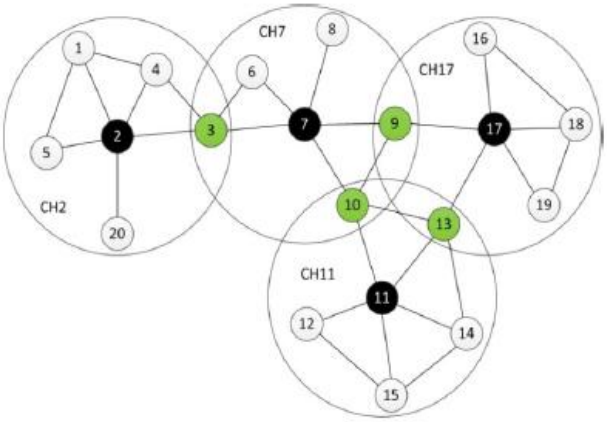

Figure 1 : Clustering in MANET

Cluster Formation: In this method, every node in the network broadcast a hello packet which contains no. of neighbors, energy, hierarchical level & cluster head id. Initially id of cluster head, hierarchical level and no. of neighbors of nodes are blank.

Cluster Head: The cluster is coordinator of the cluster. The cluster head forward the packets. Resource management function performed by cluster head for its members & for intra-inter communication. It acts as a base station in the structure. The cluster head shows in (fig.1)with dark filled circle.

Gateway Node: It is non-cluster head node. Gateway node contain inter cluster links. It can access neighboring clusters. It exchange the cluster related information. It acts as an access point between two clusters.There are two types of gateway nodes:

Ordinary Gateway (OG): node which lies within the transmission range of two cluster heads. The cluster head use hops that away from its neighbor and transmits them between the nodes.

Distributed Gateway (DG): node uses the hops that away from its neighbor and both clusters can communicate with each other.

Algorithm for Cluster Formation based Broadcasting Expenses Controlling (CFBEC):

The proposed algorithm is broadcast expenses controlling to find the path using clusterformation functionalities. The below steps are thatconsider in our proposed algorithm.When node receives RREQ request then it doesfollowing steps:

Step 1: Create a cluster in the entire network.
Step 2: Collect information about neighbor node in each cluster.
Step 3: Selectthe Cluster Head(CH) in each clusterwhich contains maximum power.
Where, CH = Cluster Head, N_D = Node Degree, N_{BP} = Node Battery Power,
N_{TP} = Node Transmission Power, and N_S = Node Stability.
Step 4: Each Cluster Head(CH) keep neighbour nodesinformation to forward thepacket to neighboring CH.
Step 5: Source node sends RREQ request to all CHthat are located in the cluster.
Step 6: After receiving RREQ then CH forward RREQto each CH in the network.
Step 7: Check destination node in the network, If yes go to Step 8, otherwise go toStep 9.
Step 8: Broadcast RREQ.
Step 9: Reject RREQ.
Step 10:RREP send to the source from destination.

In the above algorithm executes based on the cluster formation for efficient broadcast to find the path from source to destination and also hop1, hop2 and so on until reach the destination.

IV. RESULTS AND DISCUSSIONS

The performance of the proposed scheme is evaluated using Network Simulator version 2 (NS2). Some of the basic assumptions (Table. 1) made for the simulations are the mobile adhoc networks works in a secure environment and thus not prone to any sort of attack, each of the mobile nodes has a maximum battery power that a mobile node in a MANET could offer since it has to be

used in the military battlefield which may require a high backup to sustain for a longer duration of each and every node has enough memory to store a copy of the token being circulated. Since any node can become a primary or secondary cluster head has to recover the token and circulate it under situations of token loss. With the assumption of the following parameters are chosen for the simulation environment.

Table 1: Simulation Parameters.

Parameters	Values
Simulation	NS-2
MAC Layer Protocol	IEEE 802.11
Mobility Model	Random Waypoint
Terrain Range	1,000 X 1,000 m2
Transmission Range	250 Meters
Examined routing protocol	CFBEC
Channel Bandwidth	2 Mbps
Speed	10-20 m/s
Application Traffic	CBR
Simulation Time	500 s
Propagation mode	Free space
Data Packet size	512 bytes
Packet rate	2 packets/s
Number of Nodes	20–100

The following performance metrics to evaluate through networks simulation (NS2):

1. Throughput: Throughput is the number of bytes or bits per seconds arriving at the time interval t. It is generally measured by kilo bits per second (kbps) or mega bits per second (mbps).

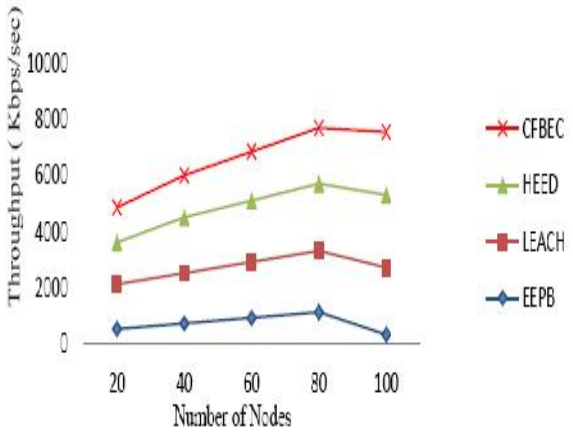

Figure 2 : Throughput (kbps) Vs. Number of Nodes.

In this part, performance analysis of proposed algorithm named Cluster Formation based Broadcasting Expenses Controlling (CFBEC) and existing Hybrid Energy Efficient Distributed (HEED) clustering algorithm, Low-Energy Adaptive Clustering Hierarchy (LEACH), and Energy Efficient Probabilistic Broadcasting (EEPB) algorithm. In Fig. 2 the proposed CFBEC algorithm provides better performance compare to existing HEED, LEACH, and EEPB algorithm and also increasing throughput (kbps) with number of node is increased.

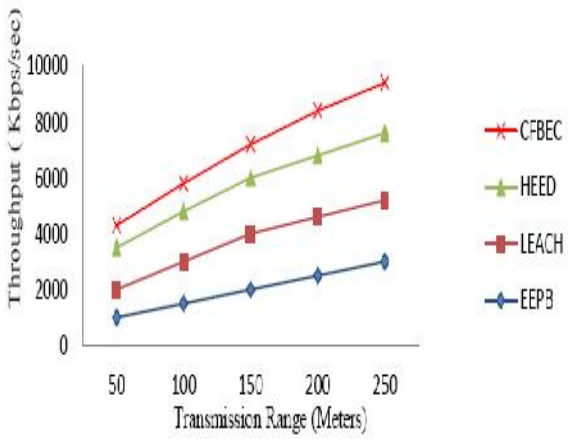

Figure 3 : Throughput (kbps) Vs. Transmission Range (Meters).

In this part, performance analysis of proposed algorithm named Cluster Formation based Broadcasting Expenses Controlling (CFBEC) and existing Hybrid Energy Efficient Distributed (HEED) clustering algorithm, Low-Energy Adaptive Clustering Hierarchy (LEACH), and Energy Efficient Probabilistic Broadcasting (EEPB) algorithm. In Fig. 3 the proposed CFBEC algorithm provides better performance compare to existing HEED, LEACH, and EEPB algorithm and also increasing throughput (kbps) with transmission range (meter) is increased.

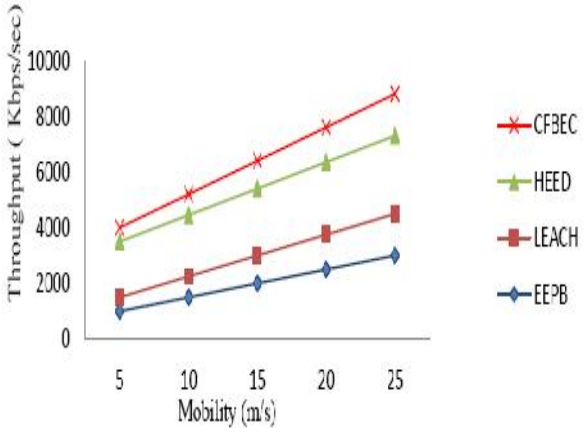

Figure 4 : Throughput (kbps) Vs. Mobility (m/s).

2. **End-to-End Delay:** delay is number of bytes or bits per seconds at time interval t.

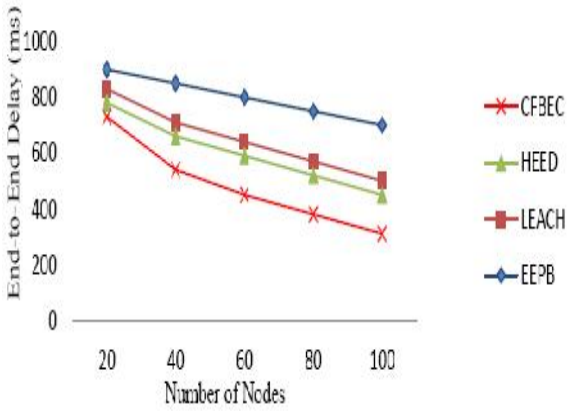

Figure 5 : End-to-End Delay (ms) Vs. Number of Nodes

In this part, performance analysis of proposed algorithm named Cluster Formation based Broadcasting Expenses Controlling (CFBEC) and existing Hybrid Energy Efficient Distributed (HEED) clustering algorithm, Low-Energy Adaptive Clustering Hierarchy (LEACH), and Energy Efficient Probabilistic Broadcasting (EEPB) algorithm. In Fig. 5 the proposed CFBEC algorithm provides better performance compare to existing HEED, LEACH, and EEPB algorithm and also reducingend-to-end delay (ms) with number of node is increased.

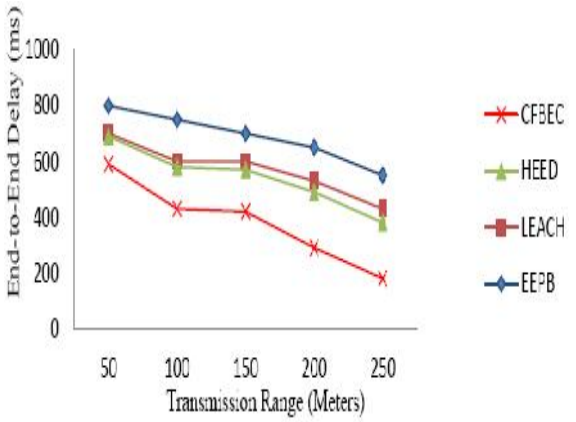

Figure 6 : End-to-End Delay (ms) Vs. Transmission Range (Meters)

In this part, performance analysis of proposed algorithm named Cluster Formation based Broadcasting Expenses Controlling (CFBEC) and existing Hybrid Energy Efficient Distributed (HEED) clustering algorithm, Low-Energy Adaptive Clustering Hierarchy (LEACH), and Energy Efficient Probabilistic Broadcasting (EEPB) algorithm. In Fig. 6 the proposed CFBEC algorithm provides better performance compare to existing HEED, LEACH, and EEPB algorithm and also reducing end-to-end delay (ms) with transmission range (meters) is increased.

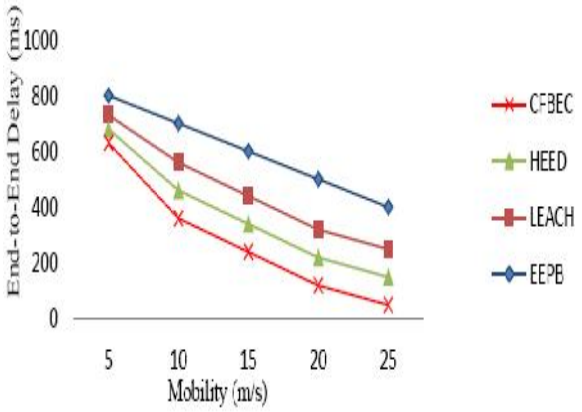

Figure 7 : End-to-End Delay (ms) Vs. Mobility (m/s)

In this part, performance analysis of proposed algorithm named Cluster Formation based Broadcasting Expenses Controlling (CFBEC) and existing Hybrid Energy Efficient Distributed (HEED) clustering algorithm, Low-Energy Adaptive Clustering Hierarchy (LEACH), and Energy Efficient Probabilistic Broadcasting (EEPB) algorithm. In Fig. 7 the proposed CFBEC algorithm provides better performance compare to existing HEED, LEACH, and EEPB algorithm and also reducing end-to-end delay (ms) with mobility (m/s)is increased.

V. CONCLUSION

Mobile Adhoc Networks (MANETs) are considered as the most active research areas inthe recent trends in networking communication world. Mobile Adhoc Networks (MANETs) are thewireless infrastructure in which the nodes in the MANET do not haveany fixed infrastructure and communication happens in the ad-hoc manner.In MANETs nodes communicate with the adjacent nodes within the radiorange and use multihop communication for long distances.The infrastructure less networks and mobile networks are energyconstrained, but no limitation at the base station. In this paper, proposed a new routing algorithm named Cluster Formation based Broadcasting Expenses Controlling (CFBEC) for energy efficient path between sender and receiver. This proposed CFBEC algorithm provides better performance compare to existing Hybrid Energy Efficient Distributed (HEED) clustering algorithm, Low-Energy Adaptive Clustering Hierarchy (LEACH), and Energy Efficient Probabilistic Broadcasting (EEPB) algorithm and also increasing throughput, reducing end-to-end delay with number of nodes, transmission range, and mobility is increased.

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