International Journal for Rapid Research in Engineering Technology & Applied Science
Volume 4 Issue 4 April 2018
ISSN (Online): 2455-4723

"EECBRP: Energy Efficient Cluster Based Routing Protocol for Effective Data Transmission in Mobile Ad hoc Networks"

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Abstract

With the progress of wireless communication technologies, small-size and high-performance computing and communication devices are more and more used in daily life. Behind the success of second production mobile system, additional interest was started in wireless infrastructure. Regarding to mobile ad hoc network characteristics which all mobile nodes of network connect to each other via wireless, one of the important aspects of this type of network is the limitation of amount of available energy in the network nodes that is the most critical factor in the operation of these networks. The clustering is an important research area in mobile ad hoc networks because it improves the performance of flexibility and scalability when network size is huge with high mobility. All mobile nodes operate on battery power; hence, the power expenditure becomes a significant problem in Mobile Ad hoc Network. In this paper, we propose an energy efficient cluster based routing protocol, i.e. EECBRP, for minimization of energy usage during the active communication session. We estimate the presentation of future energy resourceful cluster based protocol using reproduction. Preproduction results show that the proposed EECBRP algorithm reduces energy utilization and amplify life time of the network.

Keywords: MANET, QoS, Energy Efficient Cluster Based Routing Protocol, AODV, Mobility, NS-2.

1. Introduction:

Communication has become very significant for people to exchange information anytime from and to wherever. With the widespread rapid improvement of computers and the wireless communication, the mobile computing has previously developed into the field of computer infrastructure in high-profile link. Mobile Ad-hoc Network typically has a moving shape and a limited bandwidth. Routing is one of the key anxieties in MANETs owing to their highly animated and disseminated nature; the use of mobile networks is increasing very fast. In demanding, a very big number of current studies focused on Mobile Ad-hoc Networks (MANETs). The exterior of a mobile ad-hoc network depends on the routing scheme employed, and the conservative routing protocols do not work practically in a MANET. Increasing routing protocols for MANETs has been a universal investigate area in existing years, and different practical, reactive and hybrid protocols have been prospect from a variety of observation. These protocols try to assure dissimilar properties, like: circulated implementation, resourceful exploitation of bandwidth and battery ability, optimization of metrics, fast route convergence and autonomy from loops [1] [2].

Every node acts as a router and host to forward the data packets in MANETS. The nodes can progress haphazardly. In a big scale of networking situation, one of the primary networking factors is self-organizing ability for well variation of vibrant condition and interoperating ability among the nodes [3].

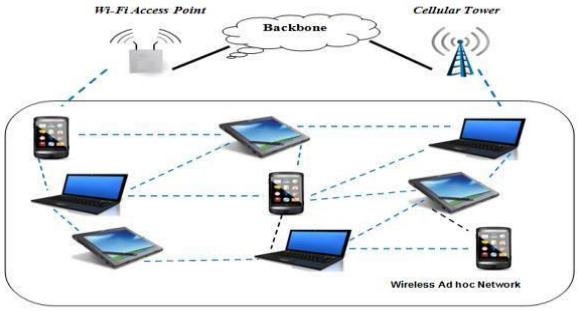

Figure 1 Wireless Ad hoc Network [4]

Mobile Ad hoc Network (MANET) does not depend on fixed communication infrastructures to provide connection. It is collection of nodes. Mobile ad hoc network's every node is behave as both as a host and a router. All the nodes in network are communicated through multi hop link [5]. When two nodes are in a transmission range of other node then can communicate through intermediate nodes. Due to high mobility of nodes network topology gets changes [6]. Network lifetime is important issue in MANET. All the nodes are battery driven [7]. The link breakage in such environment is occur because

1. Nodes are moving out of transmission range of each other.
2. They are dying due to energy exhaustion.

The lifetime of the network depends on the energy levels of the nodes. Thus if the energy levels of the mobile nodes in the network are preserved, the network tends to work for a longer duration of time. The energy efficiency is achieved by balancing the load over the nodes in the network [8]. If the load is equally distributed among the node, they tend to perform for larger time. In mobile ad hoc networks, the load balancing is commonly achieved by using multipath routing protocols, which requires more than one path to be formed between source and the destination node.

2.Literature Survey

Network layer protocols are more efficient for saving power. Scheduling of the network interface is driven by network layer for put on sleep state, active or idle state. The first and easiest method is a synchronized power save mechanism, nodes periodically going to sleep state and wake up to listen to announcements of pending traffics, and exchange it if necessary.

In the recent past energy resourceful routing in ad-hoc network was addressed by different investigate works which has produced so much improvement and novel ideas in this field.

L.Tan et al. [9] introduced an Error-aware Candidate Set Routing Protocol (ECSRP) that avoids overusing certain route. If there are more routes in the candidate set, ECSRP employ a metric achieving the trade-off between energy efficiency and load balancing the optimal routes. The condition of the channel will be considered by examiningthe probable packet loss in the computation of energy consumption**.**

C.K. Toh et al. [10] proposed provisional Max-Min Battery Capacity Routing (CMMBCR). This paper chooses a shortest pathway if all nodes in all probable route, have enough battery, while the battery capacity for various nodes goes below based predefine threshold, route going during these nodes will be avoided. Consequently this algorithm was comprehensive the life time of routing.

S.y. Wang et al. [11] proposed a manner for avoiding flooding in a large scale network. This paper introduced two propose as bellow: (i) Merging some small flooding message to a large one and (ii) Limiting the scope of flooding. It is shown that with using this method the flooding message reduced without delivering failure rate. Thus reducing the flooding causes reduces the energy consumption.

G.Schiele et al. [12] proposed a middle ware named SANDMAN. In this protocol any node has two state, sleep or aware. Any node after α sec in idle state can go to sleep state for β sec. After β sec it waked up via an inside timer.

Zhenxin et al. [13] used the idle and listening state and promote saving energy. The wireless card starts the work every 5 second if there is not any information to communicate it go to sleep again.

Vijay et al. [14] shows that in the ad hoc network there are the below fact: 1- energy consumption is significant low if the size of packet is greater than 100 byte and the bandwidth (transmission rate) is also high.2- energy consumption is significant high for sending the small packet (the size of packet is less than 100 byte) 3- RF power level does not have more side effect on energy consumption if the packet size is greater than 500 byte.

M. Cardei et al. [15] by dividing network"s nodes into some adjoined sets proposed a manner to maximize network lifetime. All sets of the network nodes satisfy the network function. They prove that the node participation in several sets may improve network lifetime.

WBDSR [16] Weight Based DSR is a development of conservative DSR. In this protocol, the burden of every route is measured as metric for route assortment.

Weight of every route preserve be calculated as:

- Compute the node weight of every node weight i= battery level of this node + Stability of this node

❖Compute the route-weight as the minimum of all node weights included in this route. To select the main route the one having the maximum route-weight. If two or additional routes have the similar route weights then choose the route which has minimum hops.

Thus WBDSR gives evermore the longest network life time in jointly high mobile networks and static networks because it opportune change the used route with a dissimilar one which preserve the use of the nodes which progress the network life time.

3.Proposed System

The proposed solution includes the energy efficient and promising route discovery. The algorithm can be described using some suitable steps, additionally the proposed algorithm can be summarized below and to understand the working of individual step.

This section includes the proposed Energy Aware Efficient Weighted clustering algorithm which includes the fresh route information. The proposed routing algorithm is described in two different section first the most important calculation and secondly the cluster head selection.

Table 1: EECBRP Algorithm

Input: Number of Nodes;

Output: Weight Calculation, CH Selection, Selection of Energy Efficient Route;

Calculation

1: For Each Node in Network

2: Find Remain Energy E

3: Find Mobility using

$$M = \frac{1}{T}\sum_{i=1}^{T}\sqrt{(X_t - X_{t-1})^2 + (Y_t - Y_{t-1})^2}$$

4: find Buffer remain for all nodes as B

5: find number of neighbor nodes as C

6: Calculate the Weights

$$W = w_1 * c + w_2 * e + w_3 * M + w_4 * b$$

Process

7: discover the memory, buffer, connectivity and mobility for each node

8: find weights for all the nodes

9: for each node in network

10:*if* node weight is maximum ***than*** cluster-head

=1

else

cluster-head=0

end if

end for

11: broadcast the massage to neighbor nodes where cluster-head=1

12: mobile nodes

13: determine new role of nodes

14: repeat process to step ***1***

4.Implementation

The simulation is being implemented in the Network simulator [17]. Protocol used here is AODV.

Table 2: Simulation Scenarios

Parameters	Values
Antenna Model	Omni Antenna
Dimension	1000 X 1000
Radio-Propagation	Two Ray Ground
Channel Type	Wireless Channel
Traffic Model	CBR
Routing Protocol	AODV
Mobility Model	Random Waypoint

4.1 Simulation using the AODV Routing of EPAR Approach: In this network recreation the network is configured using the traditional AODV routing protocol. The given simulation screen shows that all nodes are spread in topography area to communicating each other simultaneously data packets are transfer from source to destination. The simulation of traditional approach is implemented with different nodes 20, 40 60, 80, 100.

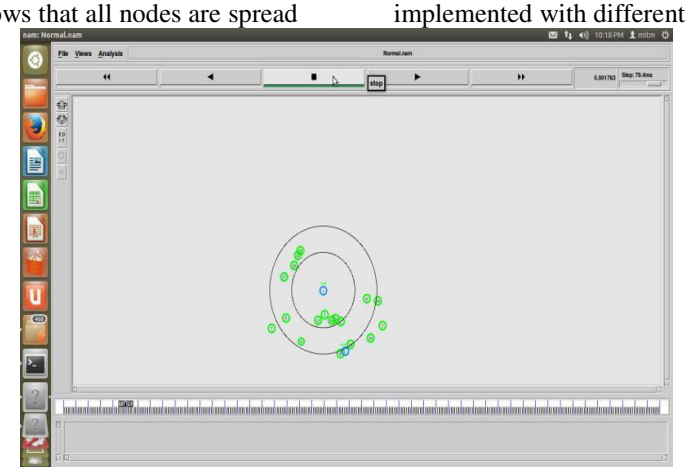

Figure 2 AODV under EPAR Approach

4.2 Simulation using Proposed Energy Efficient Routing Method: In this phase, proposed energy aware efficient route selection method is demonstrated in figure 3. In this simulation screen the green nodes show as normal network nodes with AODV modification. When the proposed method is deployed network performance is improve and large number of packet is delivered to the destination. The proposed method is very efficient when there are multiple paths contain high energy constraints and this method selects the path that consume less energy and minimize routing overhead. Consequently, huge numbers of data are received on destination side.

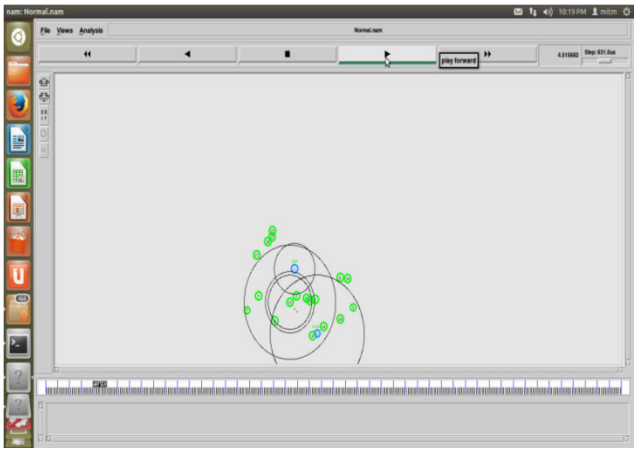

Figure 3 proposed energy efficient cluster based approach

5.Result Analysis

5.1 End to End delay

End to end day on network refers to the time taken, for a packet to be broadcast crossways a network from resource to purpose device, this delay is calculated using the beneath known formula.

$$E2E\ Delay = Receiving\ Time - Sending\ Time$$

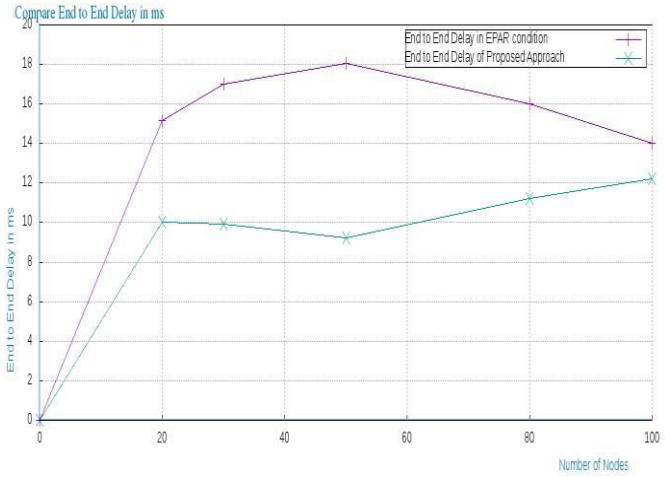

Figure 4 End to End Delays

Figure 4 shows the comparative End to End Delay of the normal approach and the proposed efficient energy aware routing method. In this figure 4 the X axis contains the number of nodes in network and the Y axis shows the presentation of network in terms of milliseconds. According to the find consequences the future method is produces less end to end delay as compared to traditional technique under different nodes. Therefore the proposed technique is applicable for efficiently select path produces less amount of time. **5.2 Packet Delivery Ratio**

The presentation parameter Packet delivery ratio sometimes termed as the PDR ratio provides information regarding the presentation of any routing protocols by the effectively delivered packets to the purpose, where PDR can be predictable using the formula given:

$$Packet\ Delivery\ Ratio = \frac{Total\ Delivered\ Packets}{Total\ Sent\ Packets}$$

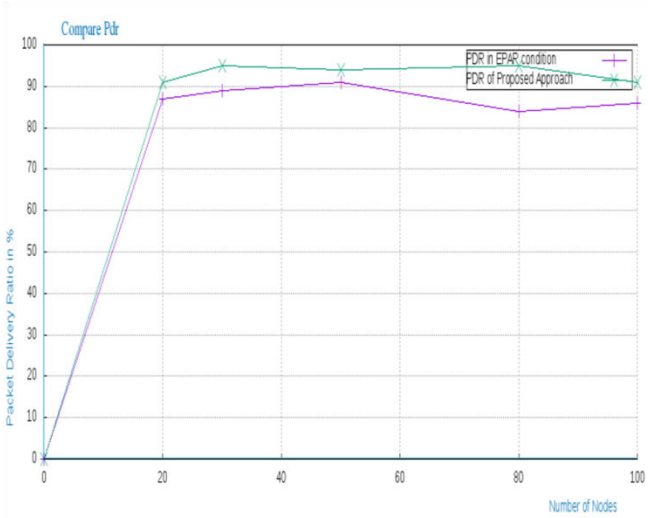

Figure 5 Packet Delivery Ratios

The comparative Packet Delivery Ratio of the networks is given using figure 5, in this diagram the X axis shows the number of nodes in the network and the Y axis shows the amount of packets successfully delivered in terms of the percentage. The red line of diagram represents the performance of the normal approach and the green line shows the presentation of the proposed technique. According to the obtained results the future method delivers additional packets as evaluate to the traditional technique even when the network contains various multiple routes from source to destination and algorithm select the less energy path therefore the proposed technique able to escape the inefficient path and improve the network performance.

5.3 Throughput

Network throughput is the typical rate of successful message delivery over a communiqué channel. This data might be delivered over a physical or logical link, or pass during a certain network node. The throughput is typically considered in bits per second (bit/s or bps), and sometimes in data packets per second or data packets per time slot.

The comparative throughput of the network is demonstrated using figure 6 in this diagram the X axis shows the number of nodes in network and the Y axis shows the throughput of the network in terms of KBPS.

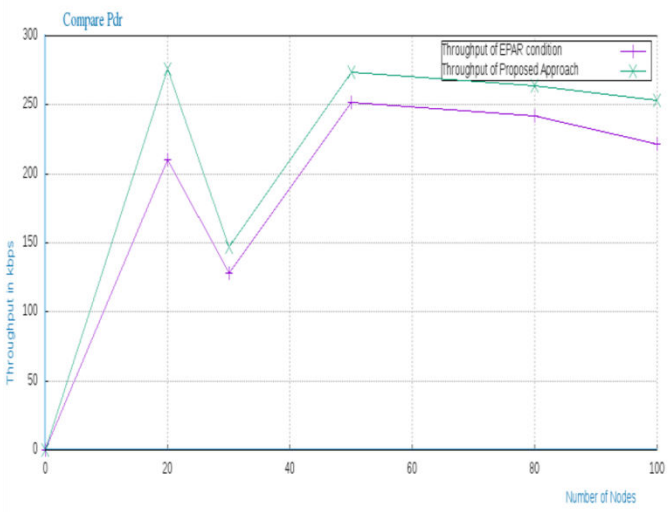

Figure 6 Throughput

The green line in this diagram 6, shows the presentation of the proposed method and the red line shows the presentation of the normal method. According to the find presentation the proposed method improve the throughput of the network also therefore the technique is effectively avoid the network congestion when there are multiple disjoint routes exist as compared to the traditional EPAR.

5.4 Routing Overhead

During the communication scenarios it is required to exchange the packets for different tracking and monitoring purpose. Therefore the additional injected packets in network is termed as the routing overhead of the network. The comparative routing overhead of both the energy aware routing method i.e. normal approach and the proposed efficient technique is given using figure 7.

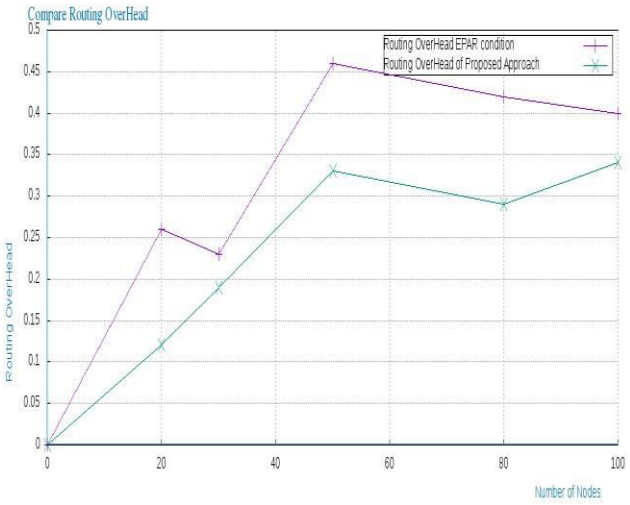

Figure 7 Routing Overhead

In this diagram the X axis shows the amount of network nodes exist during the experimentation and the Y axis shows the routing overhead of the network. In this diagram for representative the presentation of the proposed technique the green line is used and for traditional technique the red line is used. According to the obtained performance of the techniques the proposed technique produces less routing overhead as compared to the old EPAR approach. Therefore the traditional technique offers higher bandwidth consumption as compared to the proposed routing technique.

5.5 Energy Consumption

The amount of energy consumed during the network events is termed as the energy consumption or the energy drop of the network. In networking for each individual event a significant amount of energy is consumed. The given figure 8 shows the energy Figure shows Energy Consumption of the network in both the simulation scenarios.

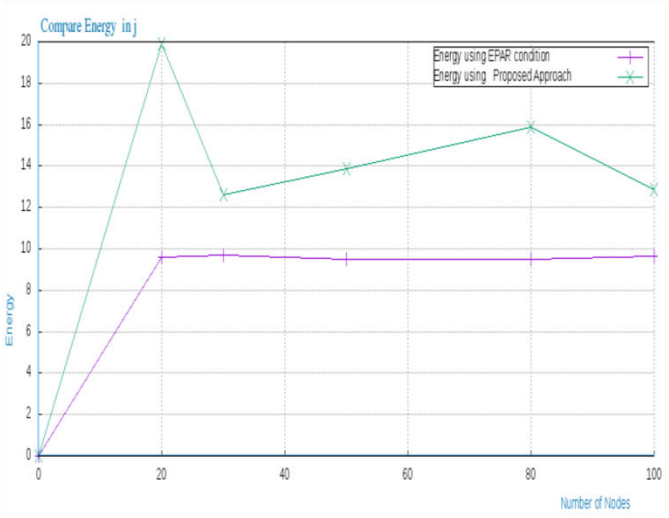

Figure 8 Energy Consumption

The red line of the diagram shows the amount of energy obsessive with the AODV routing protocol under normal approach additionally the green line shows the amount of energy consumed during the proposed algorithm based network. In the normal approach the network energy is frequently consumed as compared to the energy aware method. Therefore the proposed technique is effective and

able to recover the network whereas different nodes are simulated.

6.Conclusion

Since MANET does not have any fixed infrastructure the routing becomes challenging when the nodes are moving.

Every node is power constrained and efficient use of battery is important to increase the lifetime in the network. In this paper, we proposed an Energy Efficient Routing Protocol (EECBRP) technique, designed to improve the presentation of MANET in conditions of energy consumption. The implementation and simulation of the proposed technique is performed with the help of NS2.35 simulation tool EECBRP makes use of the Weighted Clustering algorithm. It guarantees the appointment of best cluster head and progress the cluster life time by reducing the energy expenditure.

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