POWER EFFICIENT MULTICAST OPPORTUNISTIC ROUTING PROTOCOL (PEMOR) TO OPTIMIZE LIFETIME OF MANET

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ABSTRACT - The main idea of this paper is to propose an opportunistic multicast routing protocol with awareness of energy to adopt with the highly dynamic environment of Mobile Adhoc Network. The nodes spread in MANET environment is divided into several multicasting regions based on the geographical location. Each and every node is present in any one of the multicasting region. Each region is assigned with group address. When the source node forwards the data to a multicast group, the source node forwards the data through the node with highest power among the neighbor so, the proposed multicast routing scheme optimizes the total power consumption and increase the lifetime of the network. The performance is evaluated by comparing the results with the traditional method MAODV.

***Index Terms* -** Opportunistic routing, multicasting, MANET, AODV, geographical location

1. Introduction

Mobile Ad-Hoc Networks (MANET) plays a very important role in the important applications such as military application, disaster recovery, etc. Collections of self-configured mobile nodes produce the MANET network architecture. Each mobile node in the MANET is an autonomous node as MANET is a decentralized network. Since all the nodes are mobile nodes, the topology of the network changes dynamically. So, the opportunity of route failure is high in the MANET than other static networks. The lifetime of the network should be increased as the promising use of MANET in different applications. The performance of the ad hoc network has affected by route failure, routing and communication overhead, lack of QoS and the signal fading.

The AODV routing protocol comes under the category of reactive routing protocol, which means that it discover the route after receiving the Route Request (RREQ) from the source node. AODV handles the failure in the route discovered by sending the Route Error (RERR) message to the source node. Then the AODV reroute the data packets to the destination. MAODV is used to multicast the data packets over MANET environment.

Researchers mainly focus on path detection to boost the performance of the MANET. Ad-Hoc On demand Distance Vector Routing protocol (AODV) is commonly used for the route discovery in the MANET. The AODV routing protocol comes under the category of reactive routing protocol, which means that it discover the route after receiving the Route Request (RREQ) from the source node. AODV handles the failure in the route discovered by sending the Route Error (RERR) message to the source node. Then the AODV reroute the data packets to the destination. MAODV is used to multicast the data packets over MANET environment. This multicast protocol forms the multicast group by constructing the multicast tree. This is the very efficient protocol for multicasting in the MANET environment in terms of quality of service.

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To overcome this, this paper proposed a new Power Efficient Multicast Opportunistic Routing protocol. In the proposed scheme defers the choice of next forwarding node until reception of the packet which is to be routed. The forwarding is done by the node nearby to the destination. So, the route is built dynamically. Instead of multicast tree, this scheme forms the multicast group with respect to the geographical location. Each and every multicast group has a unique ID. Any node can come inside any multicast group at any time and come out of multicast group at any time. The following figure explains the proposed multicast routing scheme.

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The enhancement of AODV protocol in the context of wireless ad-hoc network is proposed in [1], [4]. Weight hop based scheduling for AODV routing protocol is proposed in that paper. In this method, the intermediate node schedules the packet and manages its buffer memory depending upon the data transfer rate. If the failure occurs in the route, the intermediate node save the data packets and repairs the route then reroute the data packet in its place dropping the data. It mainly concentrates on the reliability of data transmission but it failed to regard as the snr value of the link earlier than route the data packets.

AODV is most widely used for the ad-hoc networks because it achieves low routing overhead and high performance. A novel stable enhancement for AODV routing protocol is proposed in [2]. This improvement considers the constancy of the node, load balance and the least distance to select the path to the destination. When compared to AODV, it gives better performance. But it did not consider the strength of the receiving signal at the destination while travel through the route.

Metric based enhancement to AODV is proposed in [3] to reduce the route failure. For that they consider the stability of the route while choosing the best path to reach the destination. EM-AODV routing protocol maintains numerous routes to the destination to share the traffic load. This protocol gives better performance when compared with AODV. But it fails to take the signal quality and the trustableness in to account.

Token routing Protocol is proposed in [1], [4] for providing security in the energy efficient manner in AODV. It uses the hash chain algorithm to generate the token which is attached at the end of each data packet. The token is used for the certification purpose. It provides security in the energy efficient manner but the major disadvantage is it did not consider any of the QoS parameters while selecting the route to reach the destination.

Recently, many multicast routing protocols have been recently proposed to execute multicasting in MANETs. In [5] these include multicast ad-hoc on-demand vector (MAODV), core assisted mesh protocol (CAMP), lightweight adaptive multicast (LAM), and differential destination multicast (DDM). Most of these multicast routing protocols are primarily based on flavors of distance-vector or link-state routing plus additional functionalities to assist the routing operations in exacting ways.

The goals of all these protocols contain minimizing control overhead, minimizing processing overhead, maximizing multi-hop routing ability, maintaining dynamic topology and prevent loops in the networks etc. The goals of all these protocols contain minimizing control overhead, minimizing processing overhead, maximizing multi-hop routing ability, maintaining dynamic topology and prevent loops in the networks etc.

However, many multicast routing protocols do not perform well in MANETs because in a fast dynamic environment, nodes move arbitrarily, thus network topology changes frequently and randomly. Moreover, in [6] bandwidth and battery power are limited. These constraints in permutation with the dynamic network topology construct multicasting routing protocol designing for MANETs extremely challenging.). Most of these multicast routing protocols are primarily based on flavors of distance-vector or link-state routing plus additional functionalities to assist the routing operations in exacting ways.

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To overcome the above challenges, this paper proposes a new multicast routing protocol Power Efficient multicast opportunistic routing protocol. This protocol constructs the route dynamically. It enables the source node with choice of next forwarding node until reach the multicast group. The detailed description of the proposed scheme is given in the following section.

II. Proposed Method

As the MANET is widely used in the critical application like disaster recovery and military surveillance, the multicast routing is required for the highly dynamic environment. There are several proactive and reactive routing protocols are available for multicasting. The reactive multicast routing protocol is the best suit for the dynamic environment of MANET. The reactive protocol selects the path only on demand. Reactive multicast routing has better scalability than the proactive multicast routing protocols. But the major disadvantage of reactive routing protocol is the source node may endure with long delay to construct the route before forwarding the data packets.

To overcome this, this paper proposed a new Power Efficient Multicast Opportunistic Routing protocol. In the proposed scheme defers the choice of next forwarding node until reception of the packet which is to be routed. The forwarding is done by the node nearby to the destination. So, the route is built dynamically. Instead of multicast tree, this scheme forms the multicast group with respect to the geographical location. Each and every multicast group has a unique ID. Any node can come inside any multicast group at any time and come out of multicast group at any time. The following figure explains the proposed multicast routing scheme.

The source node attaches the unique multicast group Id with the data packet to be sent. If the multicast group is inside the communication range of the source node means it directly transmit the data or it transmits via multiple forwarder nodes. The forwarder node is selected based on the residual power of the node. The residual power indicates that the remaining power available in the node after the transmission. The residual power is calculated by using the following formula.

$$Residual\ power = P_T \times E_P$$

Where,

P_T →Number of packets transmitted

E_P →Power required for transmitting one data packet

In the proposed scheme, the source node itself doesn't know the intermediate nodes in the path to reach the multicast group. So, the proposed scheme is very suitable for the highly dynamic environment of the MANET. It reduces the delay in the network by constructing the route dynamically. The lifetime of the network get increased by forwarding the data packets via node with high residual power.

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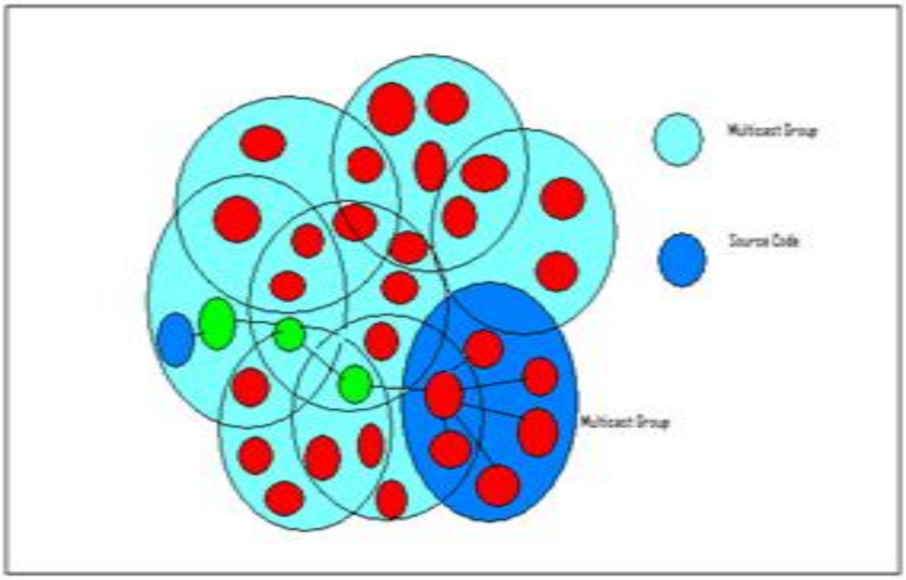

Figure 1. Architecture of Power efficient multicast

The source node forwards the data packet only via the node with highest residual power and the closest to the intended multicast group as shown in Fig-1. Each multicast group has any number of mobile nodes.

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3. Simulation Analysis

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During the simulation the delay throughput is recorded in the trace file. While executing the trace file the following output has been obtained.

Parameter	**Value**
Simulator	NS2(Ver. 2.28)
Simulation Time	60 ms
Number of nodes	60
Routing protocol	EAMORP
Traffic model	CBR
Mobility model	Random Way Point
Mobility speed	300m/s
Simulation Area	1000×1000
Transmission range	250m

Lifetime Analysis

The graph shows the lifetime analysis of our proposed multicast routing scheme refuge Power Efficient Multicast ondemand Routing. The graph is plotted between the number of nodes in the simulation and the lifetime of the Nodes in the MANET. As the number of nodes in the simulation increases the number of malicious nodes also gets increased.

Figure.2 shows that our proposed scheme gives better performance than the AODV alone used to find the route to reach destination.

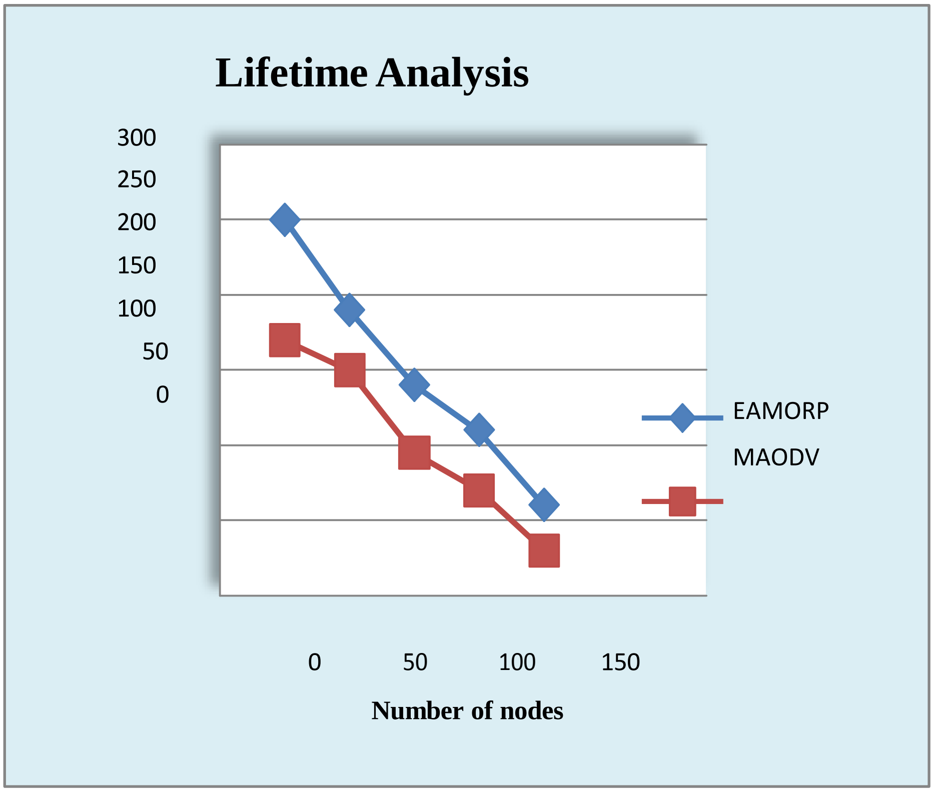

Figure.2 Lifetime analysis of proposed scheme

Then the throughput is calculated by number of packets received per unit time. The value obtained from that calculation is tabulated above. The above graph is obtained by executing the npkts.tr trace file. The number of packets received by each receiver is calculated by npkts_ command in ns2 simulator. **seen in the figure.4.** Then the throughput is calculated by number of packets received per unit time. The value obtained from that calculation is tabulated above. The above graph is obtained by executing the npkts.tr trace file. The number of packets received by each receiver is calculated by npkts_ command in ns2 simulator. Then the throughput is calculated by number of packets received per unit time. The value obtained from that calculation is tabulated above. The Throughput is calculated by using the following formula Then the throughput is calculated by number of packets received per unit time. The value obtained from that calculation is tabulated above. The Throughput is calculated by using the following formula.

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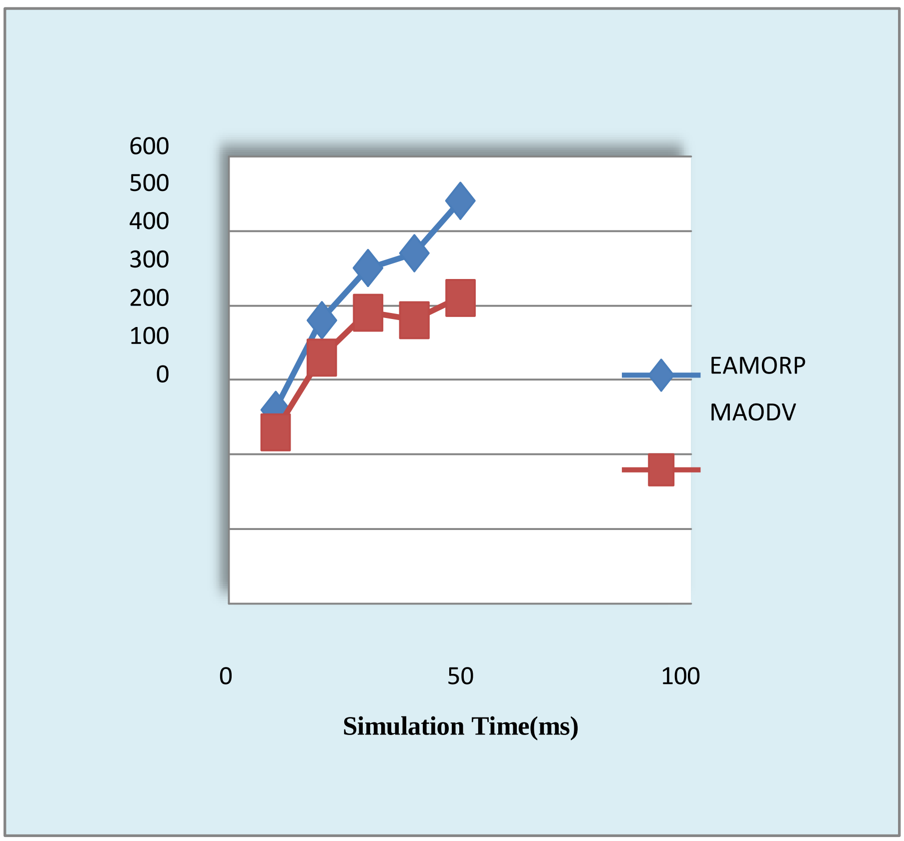
Throughput Analysis



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Throughput= No. of packets received/Time

Figure.3 shows that our proposed scheme provides high throughput than the MAODV alone used to find the multicast route in the Mobile Adhoc Network

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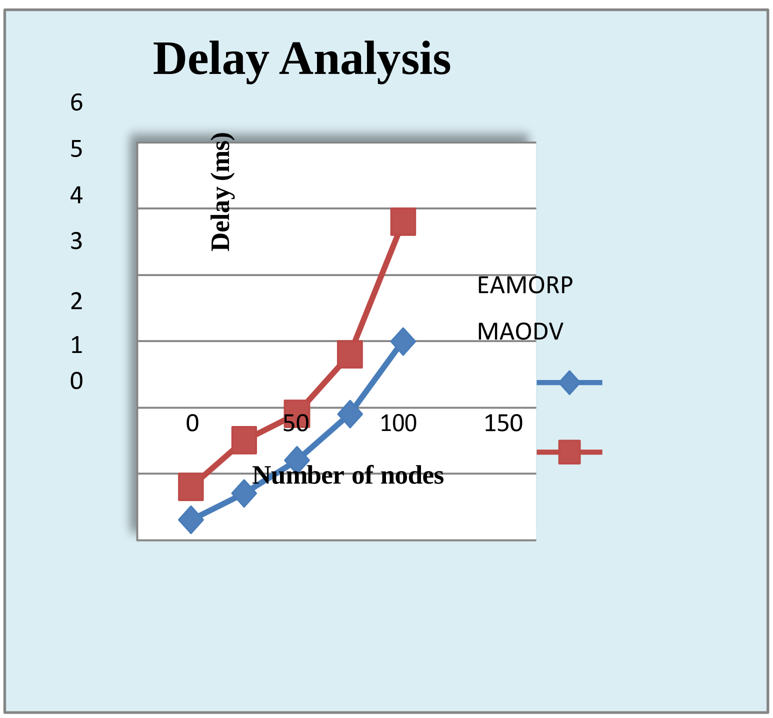

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Packet delay=Current packet received time-Last packet received time

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4. Conclusion

This paper proposed a power efficient multicast opportunistic routing scheme for MANET. In this proposed scheme, the nodes no need to maintain the routing table. The route is discovered only on-demand. The source node transmits the data packet to the multicast group with the reference of unique multicast group ID. The delay occurred in the network is monitored and stored in the trace file periodically. The delay occurs in the network while we are using our proposed scheme and the MAODV is tabulated above. The delay in the system is calculated by using the following formula.

The intermediate multicast forwarder node is selected based on its residual power and distance between the multicast groups. The nodes with the same group ID receive the data packets when intermediate node forwards to the multicast group. Thus the proposed scheme increases the lifetime and increases the QOS in terms of throughput and delay.

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