Enhancement of Mobile Ad-Hoc Network Lifetime by Energy Efficient Dynamic State Routing Algorithm

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***Abstract*: Wireless ad-hoc network is a fast-developing research area with vast variety of applications. Wireless ad-hoc network also called Mobile ad-hoc network (MANET). Energy efficiency continues to be a key factor in limiting the deploy ability of ad-hoc networks. Deploying an energy-efficient system exploiting the maximum lifetime of the network has remained great challenge for years. The major concern in the wireless network in recent days is energy consumption. There are numerous algorithms proposed to overcome this issue. The Energy Efficiency Dynamic State (EEDS) algorithm is proposed. In EEDS the intermediate nodes are participating in routing and node energy is monitored all the time. Whenever there is an energy drop of 10% occur in intermediate node, new neighboring node will assign its work. Like this we save energy in the individual node. This will use to increase the network consistency also improves the lifetime of network. Our result is better than existing methods.**

***Keywords*: Mobile Ad-Hoc networks, energy-efficient routing protocols, simulation analysis, network lifetime, energy efficiency dynamic state, grid formation.**

1. Introduction

MANET Stands for "Mobile Ad Hoc Network." MANET is a type of ad- hoc network that can change locations and configure itself on the fly. Because MANETS are mobile, they use wireless connections to connect to various networks. This can be a standard Wi-Fi connection, or another medium, such as a cellular or satellite transmission. Wireless ad-hoc network or MANET nodes are mobile, the link between the nodes breaks and re-establishes. Some nodes may enter the network and some may leave. In MANET communication is established by forwarding the packets from source to destination through the intermediate nodes. MANETs can operate in standalone fashion or they can be part of larger internet. They form highly dynamic autonomous topology with the presence of one or multiple transceivers between the nodes. According to a survey, [9] for energy consumption and save energy in individual nodes, by providing load balancing. To cope up with the dynamic nature of MANETs and memory and energy constraints of mobile nodes, use hierarchical concept, [2]. LEACH- Low Energy Adaptive Cluster Hierarchy, in LEACH it will randomly distributes the energy among the nodes in the network. In MANET each nodes have wireless receiver and a transmitter. Ad-hoc Network is built for Special Purposes It Does not rely on the Base Stations. Every individual node participating in routing to forward the data to other nodes. To improve the quality of service & lifetime of network, we need to improve mainly 2 parameters that are "Throughput" is defined as the amount of data can be sent by source node per unit time, measured by bit per second & "Network Lifetime" is the most essential parameter, It is the time taken by the node at which it starts participating in routing until the node running out of energy, we can achieve this using proposed method.[5] MANETs can be used in many applications ranging from sensors for environment, vehicular ad hoc communication, road safety, health, home, peer-to-peer messaging, disaster rescue operations etc.

2. Proposed Methodology

This work proposes Energy Efficiency Dynamic State (EEDS) algorithm. The network is divided into virtual grids based on the location, each virtual grid assigned with some nodes based on their current location. The nodes which are in same virtual grid can assign their works to the neighboring node within the same virtual grid. The proposed work describes three states Active state, Night mode state, Discovery state, and using these 3 states we can improve lifetime of network and its simulation is regulated by using Network simulator NS 2.35.

A. Network formation

The network is divided into virtual grids based on the location. In 500x 500 square area is used to increase average hop length of a route with mobile nodes exist. Each virtual grid assigned with some nodes based on their current location. Every mobile node is moving based on the mobility data files In figure 2 shows the representation of virtual grid of the network, shows total 6 grids with 50 nodes. When the node energy drop of 10 percent occur, node assign it's work to the neighboring node within the same virtual grid.

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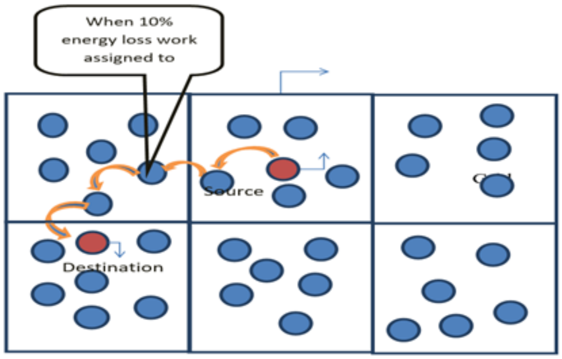

Fig. 1. Grid formation

B. *EEDS algorithm*

Following figure 2 shows that after grid formation based on location. The nodes which are actively participating in routing will be in Active state, when the energy of the node consumed up to 10 percent energy then the node will have assigned it's work to neighbor node present in same grid and is moved to night mode state. In night state the node will be idle or inactive for a certain timestamp, the node will be idle and consume its energy so that it can be active in the network more than a stipulated time also here nodes energy will remain constant as it does not involve in any kind of process. The buffer size of each state is set to 5, this implies that any state can accommodate 4 nodes simultaneously since a free space should be for a new node entering the state, when the fifth node enters the buffer, the first node that entered the buffer will move towards the discovery state indicating that it is ready to participate routing process.

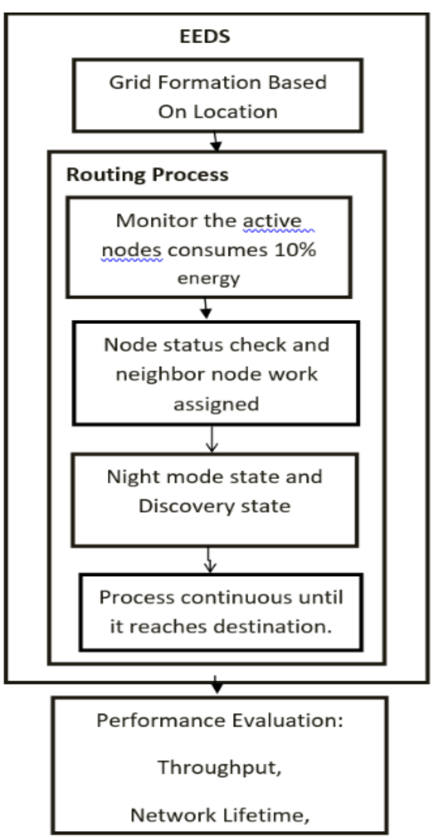

Fig. 2. Flow diagram of EEDS algorithm

In discovery state, the node consumes half of the energy when compared to the energy consumed by the active state since it triggers an alarm periodically indicating that it is ready to enter the active state. Similarly, when a node in active state loses 10 percent of it's energy and want to move to the night mode state, it sends request message to discovery state for a node to enter the active state. This process continues although the simulation for efficient energy management of each node in the network which in turn increases the overall network lifetime. EEDS algorithm is designed to enhance the network lifetime by continuously monitoring the individual nodes in the network.

C. *Simulation Model Parameters*

In table no.1 shows, simulation is regulated by using ns 2.35. As we know that the network is divided into virtual grids based on the location, in 500 x 500-meter square area is used for grid formation to increase average hop length. Communication range is 100 m, packet size 512 bytes, number of nodes 50 etc.

Table 1
Simulation parameters

SIMULATOR	Network Simulator 2.35
NUMBER OF NODES	50
AREA	500m x 500m
COMMUNICATION RANGE	100m
PACKET SIZE	512 bytes
INTERFACE TYPE	Phy/WirelessPhy
MAC TYPE	IEEE 802.11
QUEUE TYPE	Drop Tail/Priority Queue
QUEUE LENGTH	50 Packets
ANTENNA TYPE	Omni Antenna
PROPAGATION TYPE	Two-Ray Ground
TRANSPORT AGENT	UDP
APPLICATION AGENT	CBR
SIMULATION TIME	100s, 200s, 300s, 400s, 500s

3. Experimental Analysis

In figure 3, shows the Network animator is animation tool for viewing network simulation for 50 nodes, node 0 is Source node & node 1 is destination node also shows 6 grid with 6 different colors, grid 1 nodes shows in 'Steelblue color' with total 8 nodes, grid 2 nodes shows in 'blue color' with 8 nodes, grid 3 nodes shows in 'Dark green color' with 5 nodes, grid4 nodes in 'Magenta color' with 9 nodes, grid 5 nodes in 'dark red color' with8 nodes, grid 6 nodes in 'orange color' with 12 nodes, like this we did grid formation for total 50 nodes in ns2.35. As we know Simulation is regulated using Network simulator NS2.35.

Following figure 4 & 5 shows that, in EEDS sourcs node is 0 which forwards the data to destination 1. When an energy loss occur in any of the routing nodes the node will assign it's work to neighbor node within the grid. In figure 5 the energy of the routing node is reduced new neighbor node with maximum energy is selected. Node 0 forward data to node 9, node 9 energy reduced and new node 36 is selected. The data packets forward through the new path.

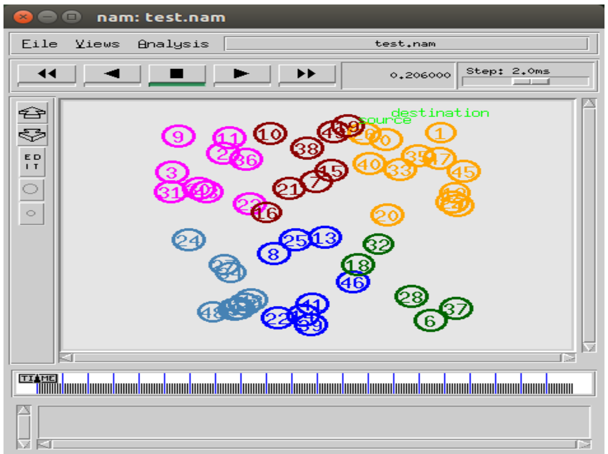

Fig. 3. Network animation tool in NS2

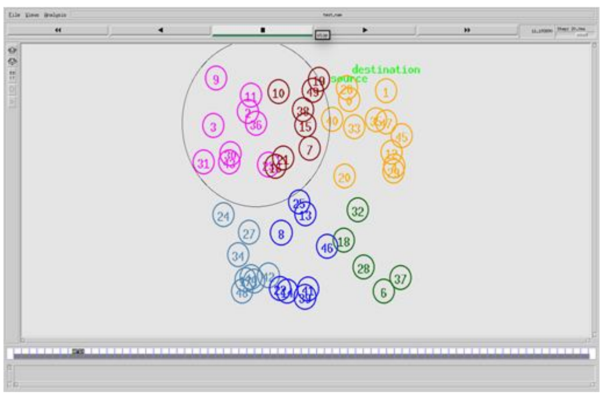

Fig. 4. New next hop selection

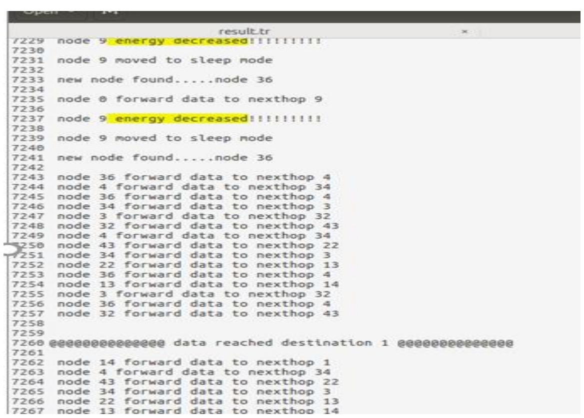

Fig. 5. Result.tr file

A. Performance Parameters

The performances of proposed work based on Throughput and Network lifetime. Simulation time varies by 100, 200, 300, 400, 500 seconds, for simulation time Vs Throughput & simulation time Vs Network lifetime.

Throughput: is the rate of successful data delivered to the destination per unit time, (typically it measured by bit per second(bps)).

Network lifetime: is the time taken by the node at which it starts participating in routing until the node running out of energy. Network life increases as we save energy in the individual nodes.

B. Performances Evaluation

Performance of proposed algorithm "Energy Efficient Dynamic State Routing Algorithm" (EEDS) compared with existing AODV and DSR protocols also compared with 'Energy-Efficient On-Demand Routing Algorithm (EEODR) and 'Hierarchical Routing Algorithm' (HR).

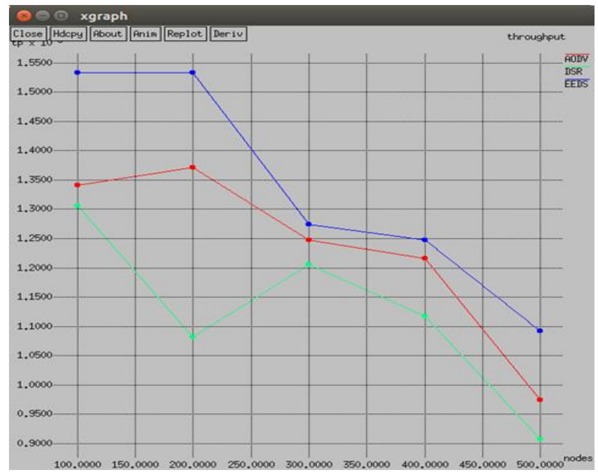

Fig. 6. Simulation time vs. Throughput

In figure 6, shows simulation time vs Throughput, simulation time in second & throughput in kbps. For increasing simulation time, the EEDS provides high throughput which is 1.53324 kbps as compared to AODV and DSR routing protocols, throughput is 1.34044 kbps & 1.30574 kbps respectively, for 100 seconds period of simulation time.

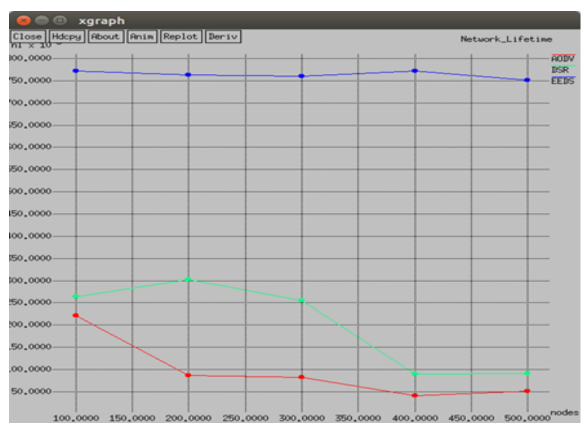

Fig. 7. Simulation time vs. Network lifetime

In figure 7, the network lifetime of EEDS is 772.39 KJ (kilojoules) much better than that of AODV and DSR routing protocols, having 220.94 & 264.67 respectively, for 100 seconds period of simulation time. In EEDS, energy reduced node assign its work to high energy neighbor node and the neighbor node involves in routing. So the energy of the nodes are preserved, hence network lifetime improved.

In figure 8 the EEDS provides high throughput compared to

EEAODR and HR algorithms, at 100 seconds EEDS shows 1.53324 kbps which is higher throughput as compared to HR and EEAODR. And in figure 9, the EEDS algorithm shows network lifetime better than that of EEAODR and HR routing algorithms. EEDS shows 772.39 at 100 seconds, better network life time as compared to HR and EEAODR.

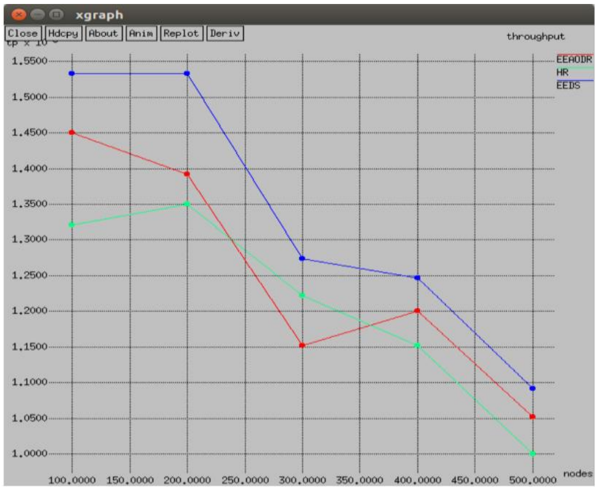

Fig. 8. Simulation time vs. Throughput

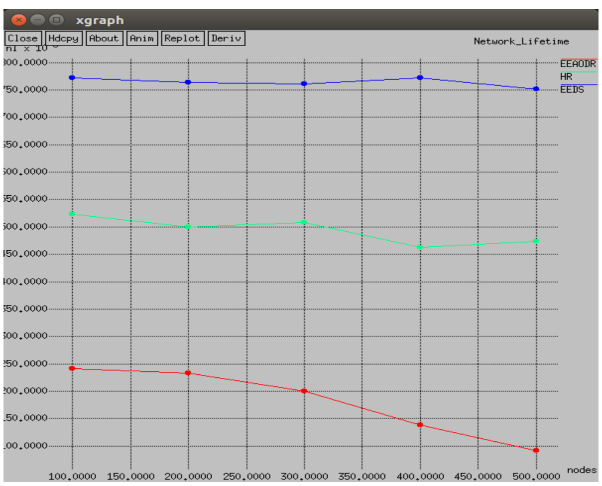

Fig. 9. Simulation time vs. Network lifetime

4. Conclusion

The proposed algorithm "Energy Efficiency Dynamic State" (EEDS) routing algorithm enhances the node's performance throughout the simulation by maintaining the energy of the node. When intermediate nodes in the routing process consume 10% energy, the node will go to night mode state and new neighbor node assigns the work. Like this we can save energy in the individual nodes. In simulation results, EEDS provide higher 'throughput' which is 1.53324 kbps as compared to AODV, DSR Protocols and EEAODR, HR Algorithms. Also improved 'lifetime of network' which is 772.39 for EEDS, its shows much better results than AODV, DSR, HR and EEAODR network lifetime.

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