ENERGY EFFICIENT DSR PROTOCOL IN MANET USING MULTI-OBJECTIVE ACO

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ABSTRACT

Mobile adhoc network (MANET) has become an important and emerging networking technology because of the rapid emergence of wireless devices.Lifetime of MANET is one of the important parameters which is responsible for the performance. Since, MANET is mainly operated on battery power so lifetime should be enhanced. In a MANET, the energy depletion of a node does not affect the node itself only, but it also affects the overall network lifetime. DSR is a reactive routing protocol which uses source routing technique. A Modified Energy Saving Dynamic Source Routing in MANETs has been proposed which will efficiently utilize the battery power of the mobile nodes in such a way that the network will get more life time. DSR is used as our base model is mainly due to the fact that it is a typical on demand protocol with less bandwidth and energy use. For optimization mechanism,we use Multi-Objective ant colony optimization technique i.e. (MO-ACO).

Keywords—MANET (Mobile adhoc network), Energy Efficient DSR,MO-ACO(Multi-Objective Ant Colony Optimization)

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INTRODUCTION

MANET

Mobile adhoc network (MANET) has become an exciting and important technology in recent years because of the rapid proliferation of wireless devices.A Mobile Ad-hoc Network(MANET) is composed of a group of mobile wireless nodes.These nodes can be PDA,mobile computers,cells and other wireless devices.MANET is an infrastructure-less network which does not have predefined boundaries or Infrastructure which makes it to give structure of dynamic topology in which nodes are free to move.These nodes communicates with each other by forwarding data packets after making suitable connections, according to their current topology.Basically these are the networks which are formed in the position of emergence such as military exercise,disaster relief ,wars ,collaborative computing in business environment and mine site exercise.MANETs are very attractive for the applications where establishment of a communication infrastructure is impossible or even when there is just a need for transient communication.(eg. In conferences).

MANET is a collection of independent mobile nodes that can communicate with each other using transmission bandwidth. The mobile nodes that comes within the bandwidth range of each other can directly communicate, whereas others needs intermediate nodes to route their packets. These networks are fully distributed which means that communication with each other is done by sending messages and can work at any place without the need of any predefined boundaries. This type of nature makes these networks highly exible ,economical and robust. Nodes can perform the roles of routers and these routers are free to move anywhere and anytime based on the collaboration among the individual network nodes.MANET has no centralized management or supervision,autonomous behaviour,dynamic and unpredictive network layout and frequent routing updates. In such a network, topology changes dynamically because nodes are free to move and due to limited transmission range and power, energy consumption becomes an important and challenging issue.

ROUTING IN MANET

Routing is the process of choosing paths in a network along which the source can send data packets towards destination. Routing is an important aspect of network communication because the characteristics like throughput, reliability and congestion depends upon the routing

information. An ideal routing algorithm is one which is able to deliver the packet to its destination with minimum amount of delay and network overhead.

There are mainly two types of protocols which are basically used for routing:

•Proactive Protocols

•Reactive Protocols

Reactive Routing protocols are on-demand routing protocols who makes connection when there is a demand or case of instant emergence of a communication network.This is different from traditional Proactive Routing Protocols in which nodes periodically sends messages to each other in order to maintain routes and keep updated. Only reactive Protocols are considered in this article, as they are extensively studied and used in MANETs

DSR(Dynamic Source Routing)

The Dynamic Source Routing (DSR) protocol is a simple and robust reactive type routing protocol designed specifically for use in multi-hop wireless ad-hoc networks of mobile nodes. The Dynamic Source Routing protocol (DSR) is based on source routing, which means that the originator of each packet determines an ordered list of nodes through which the packet must pass while traveling to the destination. The DSR protocol consists of two basic phases:

- Route Discovery
- Route Maintenance

Route Discovery is used to discover the path between the nodes which are interested to communicate with each other and the sender has no knowledge of the path upto the destination in advance. In this mechanism, the sender broadcasts a ROUTE REQUEST message which contains Source Address Id, Destination Address Id, Unique Identifier for each request.Each intermediate node appends its address in ROUTE REQUEST message and rebroadcast it and checks wheater it knows of a route to be destination,by checking last cache records. With this controlled broadcast,it limits the number of route request propagated, the ROUTE REQUEST will reach to the specified destination.The destination nodes obtain the required information from list of intermediate nodes in ROUTE REQUEST message and after verify that it sends a unicast ROUTE REPLY message in reverse direction to the source as an acknowledgement. When the ROUTE REPLY packet arrives to the source, it checks and record the route contained in it and saves in its cache for the specific destination and for future references also. For better

performance, intermediate nodes also record this route information from the two route messages. All nodes get the updation message and add meaningful route entries in their caches and keep updated themselves. Finally, Route Maintenance phase is used to maintain the route after successful route discovery to notify source and potentially fires new route discovery events when changes in the network topology invalidates a cached route.

MO-ACO

Ant colony optimization (ACO) uses the characteristics of the real ants.These ants deposit pheromone on the ground in order to mark some favorable path that should be followed by other members of the colony. Ant colony optimization (ACO) is a population-based meta- heuristic approach.This technique was inspired by the behavior of ‘‘real’’ ants. Ant colonies are able to find the shortest path between their nest and a food source by depositing and reacting to the trail of pheromone which provide help to future ants towards optimal paths to food.Ants on reaching the destination; start a new route backward towards the source nest by following the same path and biases the path by depositing more pheromone on the shorter path. As time progresses, the pheromone on non-optimal paths evaporate while the pheromone on near-optimal paths is reinforced. The basic principle of ACO algorithms can also be applied to many other combinatorial optimization problems.ACO solves single-objective combinatorial optimization problems and soon extended to tackle problems with more complex features.Multi objective ACO is different from conventional ACO.It is not a heuristic approach.MO-ACO is multi objective approach which works for multi-colonies instead of one colony.In this we divide whole region into multiple colonies and by considering two parameters i.e transmission as number of data received by nodes and lifetime of nodes by calculating their dead or alive counts of each colony and will improves the overall lifetime of MANET.

POWER AWARE DSR

In a conventional DSR routing algorithm, which is unaware of energy budget, connections between two nodes are established between nodes through the shortest path routes. The battery power of mobile nodes is a limited resource, and there is no way to allow a device to live forever, hence techniques to maximize battery life are relevant. It however results in a quick depletion of the battery energy of the nodes along the most heavily used routes in the network. A power-aware DSR routing protocol is the one that balances the traffic load inside the network so

as to increase the battery lifetime of the nodes and hence the overall useful life of the ad hoc network.

LITERATURE SURVEY

[1] Javad Vazifehdan, R. Venkatesha Prasad, Ignas Niemegeers proposes two novel energy-aware routing algorithms for wireless ad hoc networks, called Reliable Minimum Energy Cost Routing (RMECR) and Reliable Minimum Energy Routing (RMER). RMECR addresses three important requirements of ad hoc networks: energy-efficiency, reliability, and prolonging network lifetime. It considers the energy consumption and the remaining battery energy of nodes as well as quality of links to find energy-efficient and reliable routes that increase the operational lifetime of the network. RMER, on the other hand, is an energy-efficient routing algorithm which finds routes minimizing the total energy required for end-to-end packet traversal. RMER and RMECR are proposed for networks in which either hop-by-hop or end-to-end retransmissions ensure reliability. Simulation studies show that RMECR is able to find energy-efficient and reliable routes similar to RMER, while also extending the operational lifetime of the network. This makes RMECR an elegant solution to increase energy-efficiency, reliability, and lifetime of wireless ad hoc networks. In the design of RMECR, they consider minute details such as energy consumed by processing elements of transceivers, limited number of retransmissions allowed per packet, packet sizes and, the impact of acknowledgment packets. This adds to the novelty of this work compared to the existing studies.

[2] Giampaolo Bella, Gianpiero Costantino , Jon Crowcroft, Salvatore Riccobene introduces a power-aware route maintenance protocol for Mobile Ad Hoc Networks (MANETs) . Termed Dynamic Path Switching (DPS), the new protocol puts an overloaded node to sleep before a route link breaks because that node runs out of energy, and brings other suitable nodes into play instead. When the battery charge of a node reaches a stated level, the node can advance a request to change to a sleep state for a while. The request is honored unless survival of some path rests on the forwarding activity of that very node. All nodes are assumed to be collaborative. The DPS protocol is fully backward compatible, as it can be implemented within existing routing protocols such as Dynamic Source Routing (DSR). The new protocol has been extensively simulated with the established network simulator NS2. The findings indicate a much improved power awareness

of the updated routing protocol with respect to the unadorned one. Power saving is particularly effective during long-lived sessions.

[3] S. Soundararajan, R. S. Bhuvaneswaran said that in mobile ad hoc networks, the on demand multi-path routing protocols addresses certain issues such as more message overheads, link failures and node's high mobility. More message overheads are caused due to increased flooding. Packets are dropped by intermediate nodes due to frequent link failures. Moreover the overall throughput and the packet delivery ratio is reduced in high mobility scenarios. In order to overcome the issues an efficient multi-path routing protocol ABMRLBCC (Ant Based Multi-path Routing for Load Balancing and Congestion Control) based on Ant Colony Optimization is proposed. The best path for each ant is selected based upon the number of hops and travel time.

[4] Bibhash Roy,Suman Banik,Parthi Dey,Sugata Sanyal,Nabendu Chaki introduces that the complexity increases due to various characteristics like dynamic topology, time varying QoS requirements, limited resources and energy etc. QoS routing plays an important role for providing QoS in wireless ad hoc networks. The biggest challenge in this kind of networks is to find a path between the communication end points satisfying user's QoS requirement. Nature-inspired algorithms (swarm intelligence) such as ant colony optimization (ACO) algorithms have shown to be a good technique for developing routing algorithms for MANETs. In this paper, a new QoS algorithm for mobile ad hoc network has been proposed.

[5] N.Umapathi,N.Ramaraj,R.Adlin Mano describe, AntHocNet an algorithm for routing in mobile adhoc networks. It is a hybrid algorithm which combines proactive and reactive behavior to compute packet delivery ratio, end to end delay and overhead by varying the speed of the mobile nodes. The algorithm is based on proposed nature inspired, self organized algorithm of ANT colony optimization (ACO). The bit error rate of ANT algorithm in accordance with other algorithms (AODV, DSDV, DSR, ……) is computed including power consumption, time delay and packet loss.

[6] Young-Min Kim,Eun-Jung Lee, Hong-Shik Park proposes an ant colony optimization (ACO) based energy saving routing, referred to as A-ESR, for energy efficient networks. The proposed A-ESR algorithm firstly re-formulates the energy-consumption minimized network (EMN) problem, which is NP-complete, into a simpler one by using the concept of traffic centrality. After that, it solves the re-formulated problem by 1) letting the flow to autonomously be aggregated on some specific heavy-loaded links and 2) switching off the other light-loaded links.

Simulation results show that the A-ESR algorithm can get better performance than previous works in terms of energy efficiency.

[7] Javad Vazifehdan , R. Venkatesha Prasad, Ertan Onur, Ignas Niemegeers proposes several energy-aware routing algorithms for such ad hoc networks. The proposed algorithms feature directing the traffic load dynamically towards mains-powered devices keeping the hop count of selected routes minimal. They unify these algorithms into a framework in which the route selection is formulated as a bi-criteria decision making problem. Minimizing the energy cost for end-to-end packet transfer and minimizing the hop count are the two criteria in this framework. Various algorithms that is proposed differ in the way they define the energy cost for end-to-end packet traversal or the way they solve the bi-criteria decision making problem. Some of them consider the energy consumed to transmit and receive packets, while others also consider the residual battery energy of battery enabled nodes. The proposed algorithms use either the weighted sum approach or the lexicographic method to solve the bi-criteria decision making problem. They evaluate the performance of algorithms in static and mobile ad hoc networks, and in networks with and without transmission power control.

[8] Sarala.P,Kalaiselvi.D uses the Multipath dynamic so source routing protocol (MPDSR) to discover multipath route under MANET nodes. The MPDSR protocol uses the local link information for the route discovery process. The MPDSR protocol is enhanced with ant colony optimization method to provide multipath route information using global link information. EMPDSR provides QoS factors such as end to end reliability. Network traffic, bandwidth and battery power factors make an influence over the route discovery process. Cost enabled route discovery is one of the considerable routing method that enable the cost estimation with different metrics. The multipath routing protocols concentrates on the route discovery with end to end reliability factors. The EMPDSR protocol is integrated with fuzzy cost estimations techniques. Distance, network traffic, bandwidth and battery power metrics are used in the fuzzy cost enabled multipath dynamic source routing protocol.

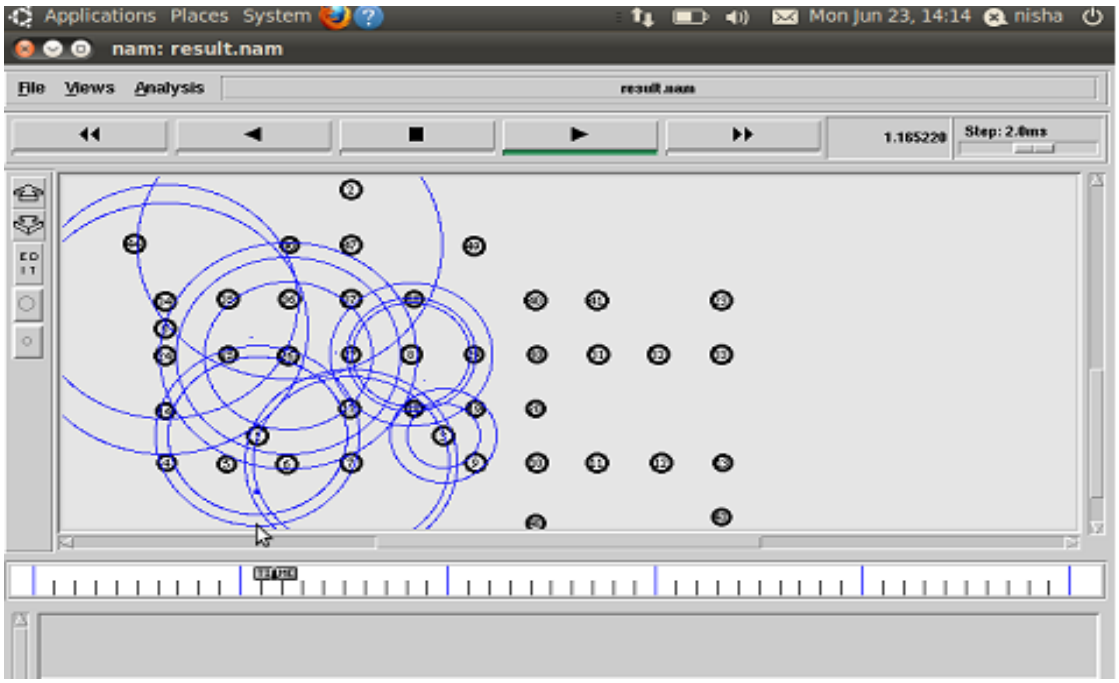
[9] Renu Dalal, Manju Khari and Yudhvir Singh [3] They provide a number of ways to achieve confident in MANET (Mobile Ad-hoc Network) is hot spot for research due to its various advantages and disadvantages. Providing secure communication between mobile nodes,to maintain the exact position of nodes, reducing overhead due to link formation and breakage, handling misbehavior and varying topology updates are such a difficult and challenging task in

MANETs, so providing trustworthy schemes is an important issue in these network. MANET provides routing, maintains route cache, end to end data delivery by packet forwarding etc over autonomous network. Because MANET has dynamic topology, in which mobile nodes are free to make and break its old and new connections within a random period of time. It effects energy, power,bandwidth and memory computations of network. Providing gurantee in MANET is such a crucial task because it doesn't having centralized management who manages the network.

RESULTS AND DISCUSSION

Simulation And Results

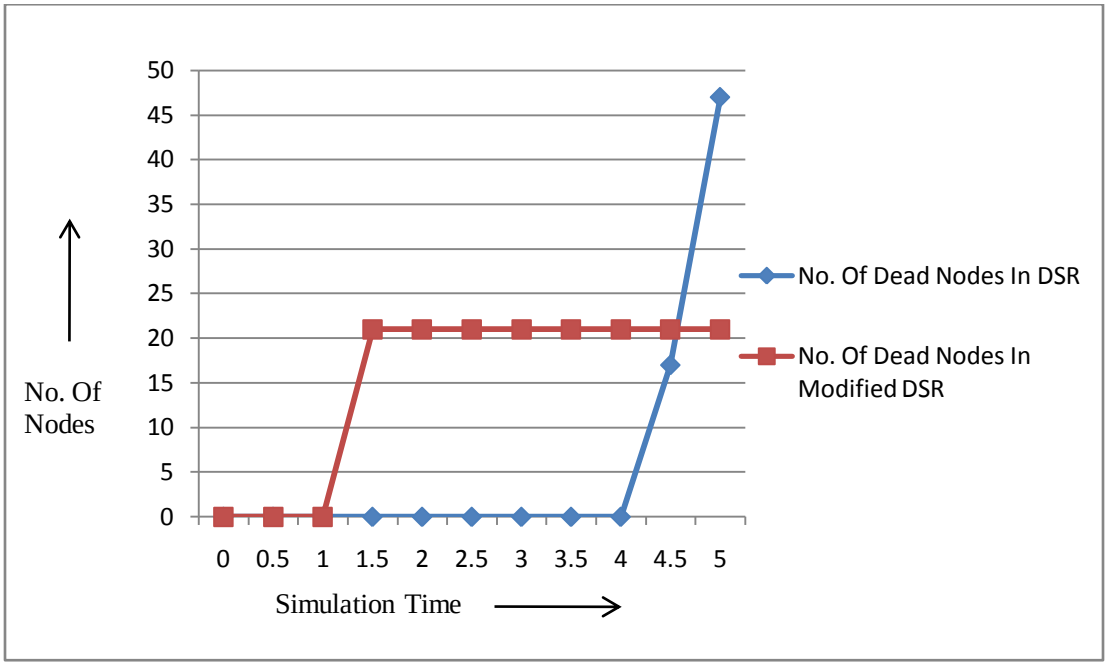
We are using NS-2 simulator for simulation technique.In this simulation we use DSR routing protocol with 50 no.of mobile nodes, 4 channels having CBR over TCP traffic type using 802.11 MAC Protocol having X,Y co-ordinate of the range of 1500. Finally the result achieved in Modified DSR routing protocol in the network will be accessed in NAM using NS-2.24.



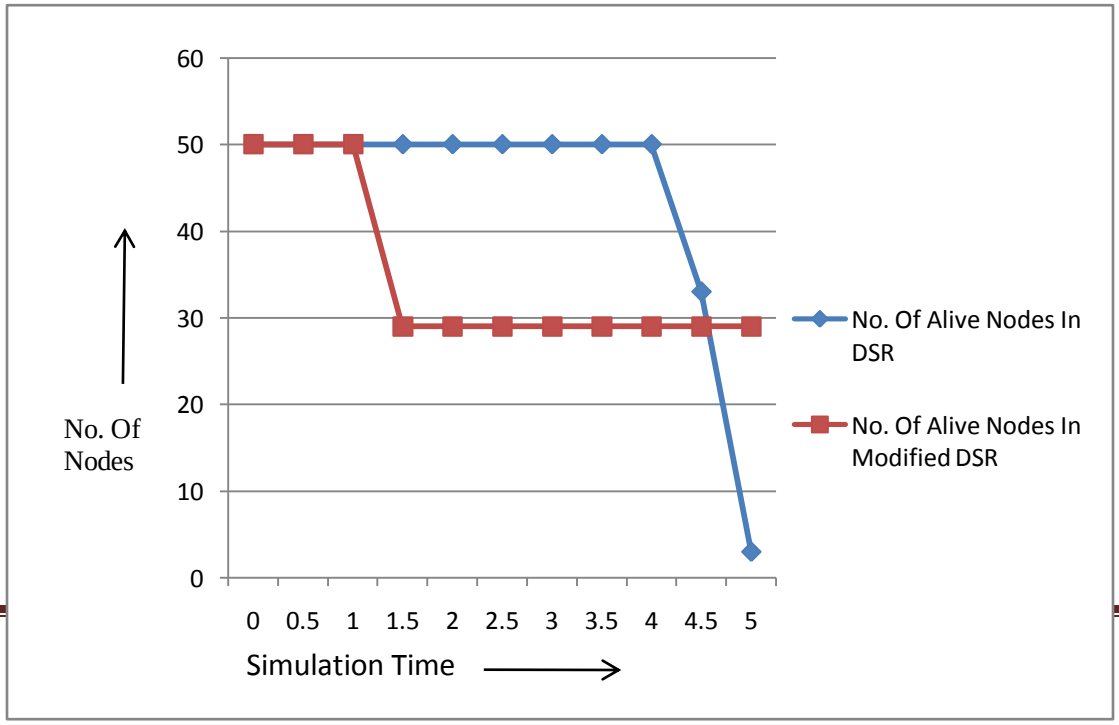
Performance Metrics :-

- **Dead Nodes :-** Dead nodes defines the no.of nodes which are dead in DSR and in Modified DSR.These dead nodes shows the nodes who has not residual energy left for

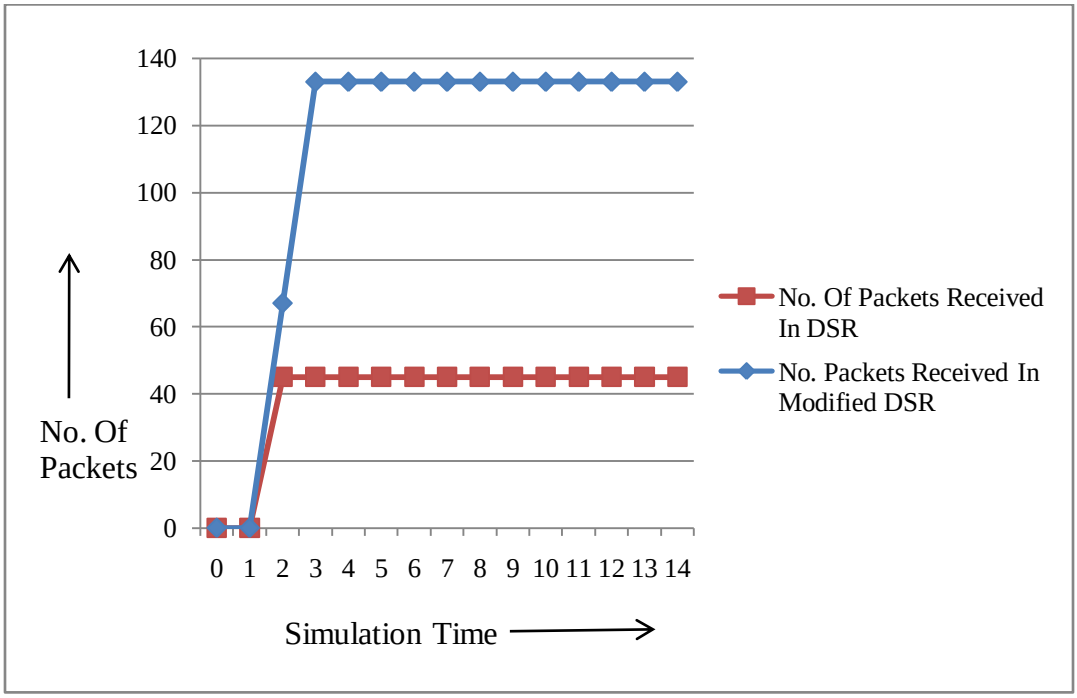
future communication.We can see in the graph that no. of dead nodes decreases effectively in Modified DSR and improving the energy aware DSR.



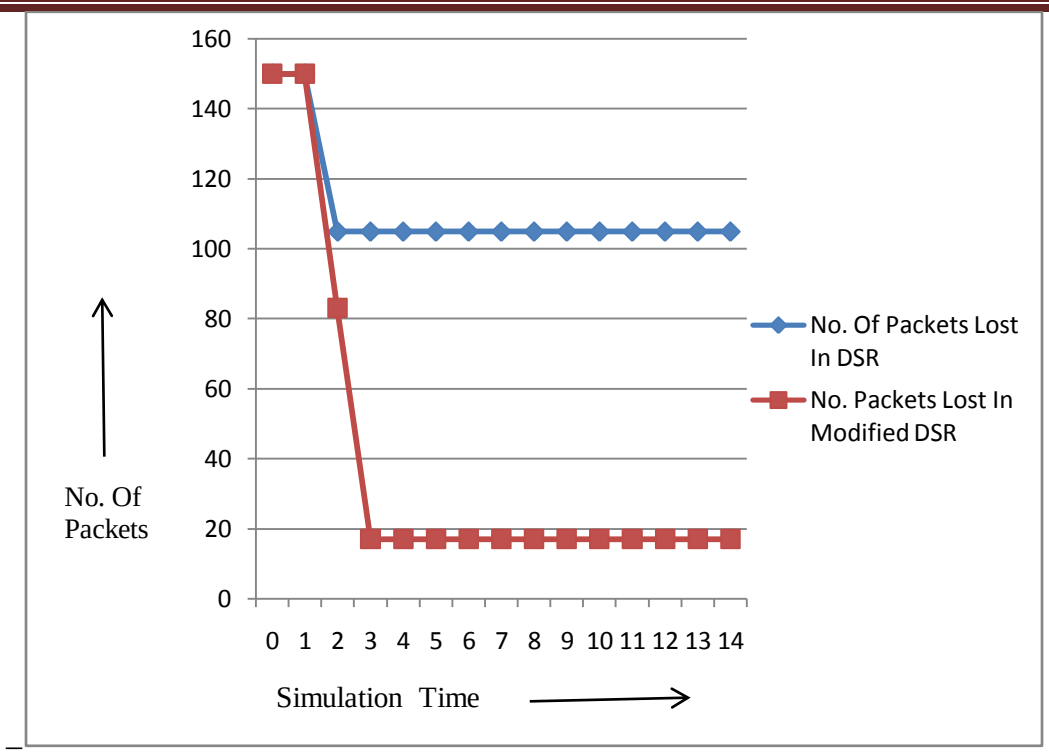
- **Alive Nodes** :- Alive nodes defines no. of alive nodes by subtracting dead nodes from total no. of nodes.This shows no. of Alive nodes in DSR v/s Modified DSR which compares the no. of alive nodes which are very less in DSR as compared with Modified DSR.



No. Of Packets Received :- This graph shows no. of packets received in DSR and in Modified DSR.



- **No.of packets Lost:-** This graph shows no. of packets lost in DSR and in Modified DSR.



CONCLUSIONS

In this paper we concluded that the conventional technique of DSR using ACO routing provides shortest route without considering the concept of remaining energy and used energy power of nodes for routing which diretly or indirectly affects the lifetime of the network.Energy Efficient DSR using MO-DSR maximize lifetime by using route discovery algorithm based on cost function,transmission and improved lifetime of routes and this prevents overuse of small set of nodes and reduce the energy level variance among nodes in the whole network.

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