# Mastering the Enhanced Energy Optimization Routing in MANET using Multi Objective Genetic Algorithm

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*Abstract :* Mobile ad hoc networks (MANET) are self-establishing network that contains range of limited frequency and bandwidth. The technique does not require any specific infrastructure. The ad hoc network changes its topology suddenly. Establishing an optimal route from source to destination plays a crucial role in designing mobile ad hoc network along with higher energy efficient routing protocols. Genetic Algorithm is used to determine the shortest path between source and destination. The genetic algorithm will take less computational time in sending again the packet to the destination and therefore it results in increasing throughput in the Mobile Ad hoc Network. In this thesis, different routing protocols, its classifications, advantages and disadvantages of the routing protocols and taxonomy of energy efficient routing protocols in mobile ad hoc network are discussed and established genetic algorithm technique is implemented to determine the shortest path between the source and the destination.

*Index Terms* - MANET, routing protocols, energy efficient routing protocols, genetic algorithm

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## I. INTRODUCTION

The use of personal communication devices like mobile phones, mobile computers and personal digital assistants (PDAs), are growing rapidly due to progress in technologies and comparatively low cost. These devices can access the network easily through wireless interfaces [1].The independent nodes combine together form a mobile MANET -ad-hoc network .the communication between the near moveable nodes is through radio wave and far away nodes are communicated through certain routing algorithm.[2].These nodes acting as a host and router have wireless inference for communication among each other node whose topological network changes rapidly. The ad hoc network organization may be a multi hop or point to point depending upon the application as required by the network. The transformation of information from the source to any desired destination through the node is by a store and forward method. The ad hoc networks do not follow any fixed infrastructure for communication. The network connectivity decided the dynamical transfer of the data among the nodes. Router, hubs, switches and firewalls are used to develop an infrastructure of network which performs the task of transferring data from one mobile node to other node. The communication to the other network as decided by the user is a wireless connection. These ad hoc networks are highly energy efficient and cost effective when there is loss of infrastructure and deploying it. The movement of packet from source to require destination in a network is through a path known as routing. The selection of path for transferring these packets involves processes such as deciding a best routing path and delivering the packets of information to the internetwork. There are basically three types of Routing protocol, firstly proactive protocol, secondly Reactive protocol and lastly Hybrid Routing Protocol.

Proactive is also known as table driven as each node maintains a routing table containing updated information of neighboring nodes. Such as Optimized Link State Routing **(OLSR)**, Global State Routing **(GSR)**, Destination Sequenced Distance Vector Routing **(DSDV)** etc. Reactive Protocols is also known as "On Demand Routing Protocol" as each node not maintains updated information of routing. Reactive protocol can be off many types they may be DSR-Dynamic Source Routing, AODV- Ad hoc on Demand Vector, LAR -Location Aided Routing, TORA -Temporally Ordered Routing Algorithm etc. Combination of reactive and proactive routing protocol is called hybrid routing protocol. it more efficient than both routing protocol. routing done by proactive and flooding by reactive protocol such as Zone Routing Protocol (ZRP), etc.

## II. RELATED WORK

Asma Anjum [3] suggested an efficient energy routing algorithm that maximized the life span of the MANET. The optimization of the algorithm was done by analyzing two metrics like total transmission of engery and maximum number of hops (1) Total transmission energy of a route (2) Maximum number of hops.

Sangeeta Kurundkar and Apoorva Maidamwar [4] proposed an improvised AODV routing protocol for MANET. In this a stability factor was taken which records the energy of all the nodes, stabilizes them and reduces the average end-to end delay of the network. To achieve this delay reduction mechanism was also used.

Sonia Ahuja and Sukhpreet Kaur [5] making use of the genetic algorithm and ACO Ant Colony Optimization proposed an energy efficient approach for routing in mobile ad hoc networks. In this GA and ACO are used for multicast routing in MANET.

P. Prasanna et.el. [6] Proposed an energy efficient multicast routing based on genetic algorithm for mobile ad hoc networks. The optimization algorithm done by End to End delay and Minimum energy cost of the multicast tree

Priti Gaur [7] suggests an implementation of multicast routing using genetic algorithm. Author proposes a new kind of path discovery strategy that promises to meet with the dynamic nature of mobile ad hoc networks. Author works on some of the QoS parameters of routing in MANET. Author Arun Biradar [8] has developed a novel approach called GAODV to improve the performance. In GAODV, genetic algorithm search technique is used which searches for population of solutions and not a single solution. In GAODV, the failure of the route is rectified by Genetic Algorithm by finding the alternative path to the

destination only at the node where route error has been generated instead of re-routing from the source. In paper [9], Ravi suggested author ZRp Protocol called as DPSZRP which a minimize the energy consumption , and the analysis of the routing algorithm was suggested for various parameters such as battery power and the performance was done for different nodes. The proposed DPSZRP technique with transmission power control has better overall network performance. It enhances the performance of the network by changing paths based on the battery level of a node. The power is also varied based on the distance. The efficiency of DPSZRP design is more effective as compare to ZRP as the network exist for a longer duration of time.

## III. PROPOSED WORK

The highly dynamic nature of a mobile ad hoc network results in frequent and unpredictable changes of network topology, adding difficulty and complexity to routing among the mobile nodes. The complexities and the challenges, in the communication of the routing protocol with mobile nodes ,thus making it a more effective among researchers within the MANET domain.

Numerous routing protocols and algorithms have been proposed. The performance of these protocols has been studied and compared under different types of networks or network environments and also under different traffic conditions. Number of different survey papers and comparative analyses of different mobile ad hoc routing protocols have been published.

Routing of the packets in the MANET has several issues to be cope up with, like host mobility, rate of frequent link failures, rate of link repairs. The rate of link failures and repairs may be high when nodes move fast [37].

## IV. BASICS OF GENETIC ALGORITHMS

Genetic Algorithm (GA) is a technique for optimization to solve problems which are difficult to be solved by traditional approaches. It uses special operators such as selection; reproduction and mutation are implemented for solving problems. GA works basically on some optimization function which may be a minimization function or a maximization function. The basic idea of genetic algorithm has been taken from medical science where characteristics of one population forwarded into next population. Before applying the genetic algorithm a problem is represented in genetic form so that application of genetic operators can be done. Figure 4.1 shows the evolution flow of genetic algorithm.
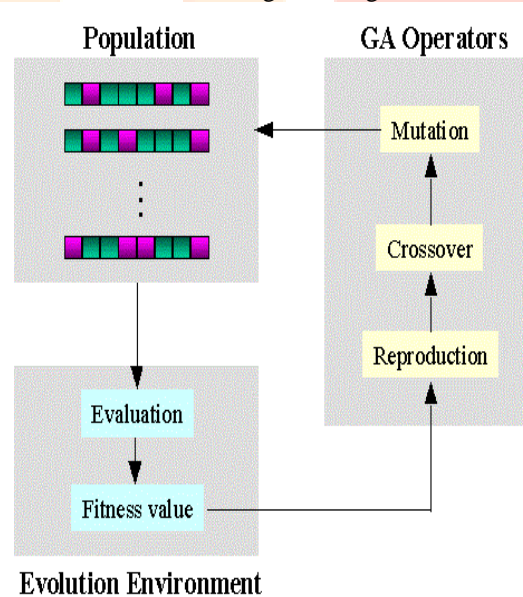


Figure 4.1 Evolution flow of Genetic Algorithm

The basic genetic algorithm is as follows [35]:
1. [Initial Population] Generate random population of n chromosomes (suitable solutions for the problem)
2. [Fitness] Evaluation of the fitness, f(x) for individual chromosome x within the population
3. [New population] Creation of new population by repeating following sequential steps until the new population is generated
 a) [Selection] Depending upon the chromosomes fitness the two chromosomes with better fitness is to be selected as parents.
 b) [Crossover] the crossing over the parents will lead to the generation of a new offspring (children). Without crossing over offspring would be an exact identicalof parents.
c) [Mutation] the mutation of the new offspring that is at each locus (position within chromosome) whenever there is probability of mutation.
d) [Accepting] the new offspring is placed in a new population
4. [Replace] the newly generated population must be used to run the algorithm
5. [Test] If the end condition is satisfied, stops, and returns the best solution in current population
6. [Loop] Go to step 2
The genetic algorithm is a special, generate and test algorithm. A sample solutions of a particular called the initial population is initially taken. This initial population can be generated randomly. On this initial population genetic operators such as selection, recombination and mutation are repeatedly applied till terminating criteria is met. Genetic Algorithm is an optimization

technique and best solution for a given time is not guaranteed. Generally, GA works on approximation to provide an optimal result in the given time. The convergence of the GA specifies the amount of time which is required to generate a solution. Thus there are various ways to enhance the convergence of GA.

Features of genetic algorithm are listed below:

1. A set of candidate solution is used as population.

2. Genetic operations are used to generate new population.

3. It stochastic in nature

## V. COMPARATIVE ANALYSIS

Table 6.1 shows a comparative study of various routing protocols on 7 different factors. It can be observed that GA based routing protocol has all the properties similar to table driven routing protocol. As the name suggest in the table driven rounting protocol the information about the network is completely is stored in the table. The nodes are searched by referring the table when a route is to be found.

| Sr. No. | Protocol Property | DSDV | DSR | AODV | Proposed GA Based protocol |
|---|---|---|---|---|---|
| 1 | Table driven/ Source Routing | Table Driven | Source Routing | Table driven and Source Routing | Table Driven |
| 2 | Route Discovery | Periodic | On Demand | On Demand | Periodic |
| 3 | Network Overhead | High | Low | Medium | High |
| 4 | Multiple Routes | No | Yes | No | Yes |
| 5 | Reactive/ Proactive | Proactive | Reactive | Reactive | Proactive |
| 6 | Routing Overhead | Medium | Low | High | Medium |
| 7 | Network Suitable For | Less number of nodes | Up to 200 nodes | Highly Dynamic | Highly Dynamic |

GA based proposed routing protocol also maintain a table similar to table driven routing protocols. The main advantage is that it found many routes for transferring data from source node to destination node. So multiple route property is "yes" for GA based routing protocols. The system gets reliable by sendig the data through the best alternate route as provided by GA.
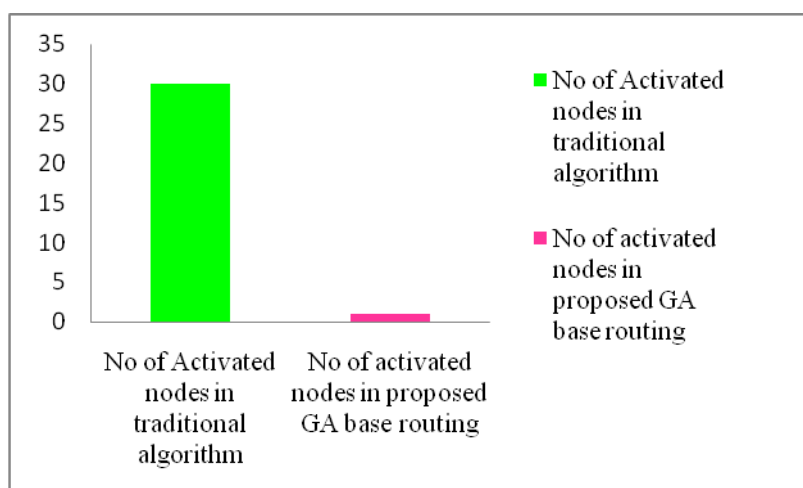
## VI. CONCLUSION AND FUTURE SCOPE

In this thesis work, a new algorithm for energy efficient routing protocol using Genetic Algorithm has been proposed and implemented. The initial population of the path is used to transfer data between the source and the destination. The initial population gets improved after every iteration. The proposed algorithm gives us a set of paths to transfer packet from source node to destination node. The genetical algorithm optimally find the path by using the power of the nodes effiencly for transferring the packet in the MANET. This algorithm a part from finding the optimal path also finds other path which consume energy nearer to the optimal path. the dynamic nature of the MANET leads to the breakage of linkage between the node. In that case, the alternate paths can be used to transfer packets making it more reliable.

The following algorithm may be improve in nearer future to implement on network having more than 100 node and the better performance could be expected. the improvement in the algorithm can be improved by the better selection technique including tournament , roulette wheel , ranked selection. the improvement in the algorithm can also be check by two point and multi point crossing over.

### REFERENCES

[1] Utkarsh and Mukesh Kumar Mishra "ESAR: Energy Saving Ad Hoc Routing Protocol for Mobile Ad Hoc Networks" in May 2012.

[2] N. Kumar and Dr. C. Suresh Gnana Dhass "Power Aware Routing Protocols in Mobile Adhoc Networks-Survey" in International Journal of Advanced Research in Computer Science and Software Engineering, Volume 2, Issue 9, September 2012.

[3] Anjum Asma "Energy Efficient Routing Algorithm for Maximizing Network Lifetime of MANET" in International Journal of Innovative Research in Computer and Communication Engineering, Vol. 1, Issue 8, October 2013.

[4] Mrs. Sangeeta Kurundkar and Apoorva Maidamwar "An Improved Aodv Routing Protocol For Mobile Ad-Hoc Networks" in International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 2, Issue 7, July 2013.

[5] Sonia Ahuja and Sukhpreet Kaur "An Energy Efficient Approach for Routing in MANET using GA and ACO" in International Journal of Science and Research, Volume 3 Issue 8, August 2014.

[6] P.Prasanna, D.Saravanan and RM.Chandrasekaran "An Energy Efficient Multicast Routing Based On Genetic Algorithm for MANET" in International Journal of Innovative Research in Computer and Communication Engineering, Vol.2, Special Issue 1, March 2014.

[7] Priti Gaur "An Efficient Routing Implementation Using Genetic Algorithm" in International Journal of Computer Science and Mobile Computing, Vol. 2, Issue. 7, July 2013, pg.250 – 257.

[8] Arun Biradar, Ravindra C. Thool and Vijaya R. Thool "Genetic Algorithm Based Unipath and Multipath Intelligent Routing for Mobile Ad-hoc Networks" in International Journal of Advances in Computer Science and Technology, Volume 3, No.4, April 2014.

[9] Ravi G and Reemlus Jacob D "Energy Aware Routing For Adhoc Networks Using Dynamic Path Switching" in International Journal of Ad hoc, Sensor & Ubiquitous Computing, Vol.5, No.3, June 2014.