# Route Optimization to make Energy Efficient MANET using Vishal Fuzzy Genetic Approach

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*Abstract*—In any network QOS is one the basic requirement and when we talk about the MANET(mobile AD-HOC network) this is the highly constraint requirement of a user. To improve the quality of service we use different changes in MANET protocols, its parameter, routing algorithm etc. In this proposed work we are also improving the QOS by modifying the routing algorithm. The proposed routing algorithm is inspired from the genetic approach. The proposed algorithm will follow all the basic steps of routing algorithm in the sequence. As in initializing phase we will select the shortest path and one alternative aggregative path. The shortest path selection always returns the congestion over the network. Instead of using the shortest path we will select a genetic inspired path. In this work, the selection of the next cross over child path will be identified based on cyclic fuzzy logic. The whole process will optimize the routing algorithm to improve the QOS. In this work, the fuzzy-improved Genetic algorithm will be implemented on MATLAB 7.1 for the route generation.

*Key words:* QOS (quality of service), MANET (mobile ad-hoc network), ROUTE, Fuzzy, MATLAB (Matrix in Laboratory)

## I. INTRODUCTION

A MANET (mobile ad-hoc network) may be introduced as an infrastructure- less dynamic network which is a collection of independent number of mobile nodes that can communicate to each other via radio wave. A MANET is a self-configuring infrastructure, fewer networks of mobile devices connected by wireless. It is a set of wireless devices called wireless nodes, which dynamically connect and transfer information. Each node in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently; each must forward traffic unrelated to its own use, and therefore be a router.

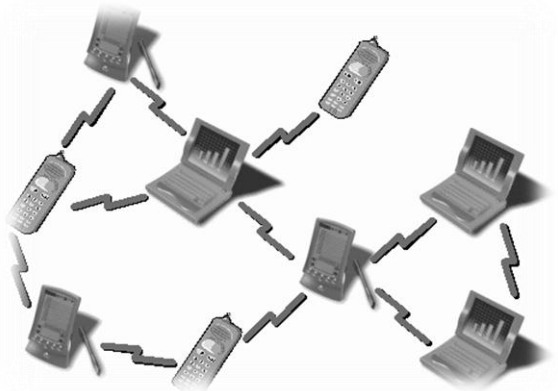

Fig. 1: Basic MANET

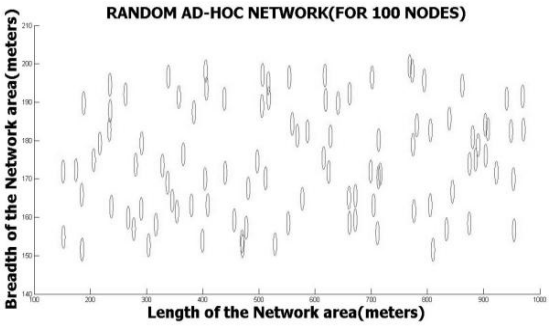


Fig. 2: A random network of 100 nodes.

The MANET network enables servers and clients to communicate in a non-fixed topology area and it's used in a variety of applications and fast growing networks. With the increasing number of mobile devices, providing the computing power and connectivity to run applications like multiplayer games or collaborative work tools, MANETs are getting more and more important as they meet the requirements of today's users to connect and interact spontaneously. The figure1 below shows the basic network with different nodes for MANET. Figure 2 shows the MATLAB generated random network of 60 nodes.

## II. LITERATURE WORK

In Year 2009, Ming Yu performed a work, "A Trustworthiness-Based QoS Routing Protocol for Wireless Ad Hoc Networks". In this paper, Author present a new secure routing protocol (SRP) with quality of service (QoS) support, called Trustworthiness-based Quality Of Service (TQOS) routing, which includes secure route discovery, secure route setup, and trustworthiness-based QoS routing metrics. The routing control messages are secured by using both public and shared keys, which can be generated on-demand and maintained dynamically.

In Year 2009, Stephen Dabideen performed a work*,"* The Case for End-to-End Solutions to Secure Routing in MANETs". Author argues that secure routing in MANETs must be based on the end-to-end verification of physical-path characteristics aided by the exploitation of path diversity to find secure paths. Author apply this approach to the design of the Secure Routing through Diversity and Verification (SRDV) protocol, a secure routing protocol that Author show to be as efficient as unsecure on-demand or proactive routing approaches in the absence of attacks.

In year 2013, Gupta V, Jindal J performed a work, "Fuzzy improved Genetic Approach for the route optimization in MANET". We performed a work which optimizes the route in the MANET. We described our work in terms of path cost, depending upon the distance travelled

 

from source to destination. In the paper, we proposed a fuzzy improved genetic approach for the optimization of route to construct a network which results in the minimum distance.

## III. TRADITIONAL APPROACH FOR DATA TRANSFER IN UNICAST TRANSFERRING

According to a standard approach of communication between 2 nodes it is always based on the shortest path. The shortest path gives no of benefits like Easy implementation, fast and reliable data transfer between nodes. But with all these benefits, the shortest path results in congestion. Here, we first discuss the algorithm for the shortest path and show the result analysis then later in this paper the fuzzy improved genetic algorithm is discussed and its result analysis in terms of sum of distances is compared with the existing algorithm.

One of the common algorithms for selecting the path is given below:

Path (A, n) /* A is the Weighted graph of n size to represent the Adhoc Network*/

{

*Step. 1 :* Generate the neighbor list for the source node and put it in the matrix.

*Step. 2 :* Starting from the first neighbor generate the next neighbor.

*Step. 3 :* Check if that neighbor already exist in the list if yes than it is a loop back and go to end;

*Step. 4 :* Generate the route from all the neighbors for the destination and continue on that path.

*Step. 5 :* Generate the route to destination from all neighbors where ever possible.

*Step. 6 :* Compare the route length generated by all the possible routes. Compare all the routes in the distance matrix and choose the path to destination which has the lowest path length.

}

### *A. GRAPHs USING THE EXISTING WORK*

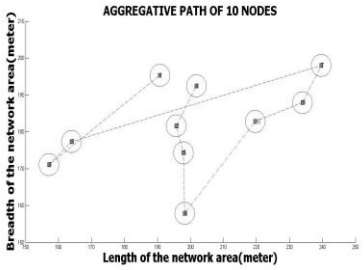


Fig. 3 (a)

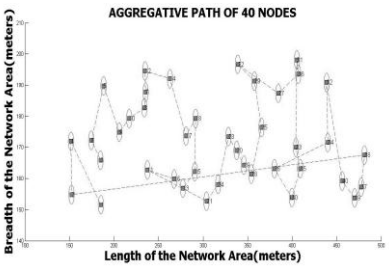


Fig. 3 (b)

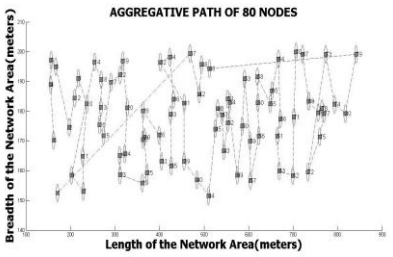


Fig. 3 (c)

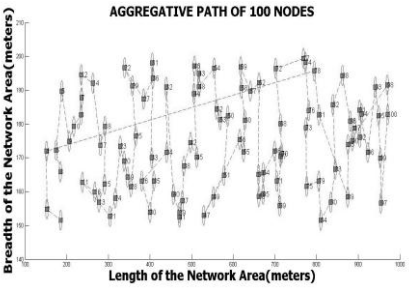


Fig. 3 (d)

Fig. 3: (a) Path for no. of nodes=10 (b) Path for no. of nodes=40 (c) Path for no. of nodes=80 (d) Path for no. of nodes=100

The above algorithm shows the common method for the route optimization in MANET. Here in this algorithm the aggregative path is chosen from the source node to the destination node. The graphs analysis shows the different path for the different number of node. Here in this method the path generated is less energy efficient because the sum of distances obtained has a large values and it does not follow a definite pattern.

## IV. PROPOSED METHOD

The proposed work is a genetic based approach to build the network path for the route construction in an optimize way. As the selection process is done we will perform the crossover to select the most promising nodes. Finally mutation will be performed. In this work, the selection of the next cross over child path will be identified based on fuzzy logic. The fuzzy logic will be implemented under the parameters of energy and the distance specification. In this work, the fuzzy-improved Genetic algorithm will be implemented for the route generation.

In this present work, while generating the path, the mobility of the node is also considered. The analysis will be driven in the form of energy consumed as well as the total path length. The presented work is about to perform the optimize path generation. The work is implemented in MATLAB 7.1 environment.

### *A. Parameters of Calculation*

Distance formula to calculate the distance between two nodes:

$$Distance(i) = \sqrt{\left(XCoor\left(path1(i+1)\right) - \left(XCoor(path1(i)\right)^2 + \left(YCoor\left(path1(i+1)\right) - \left(YCoor(path1(i)\right)^2}$$

Sum formula to calculate the distance between sources to destination:

$sum1 = sum1 + distance\ (i)$

(% in meters %)

 

Energy formula to calculate the consumed energy between sources to destination:

$Energy\ (i)\ = (distance\ (i))^2 * sending\ factor\ + receive\ factor$; **(%in joules %)**

Where
Sending factor= (512*12*0.001);
Receive factor= (512*50*0.0001);

*B. Flow Chart of Fuzzy based Genetic Approach for Route Optimization*

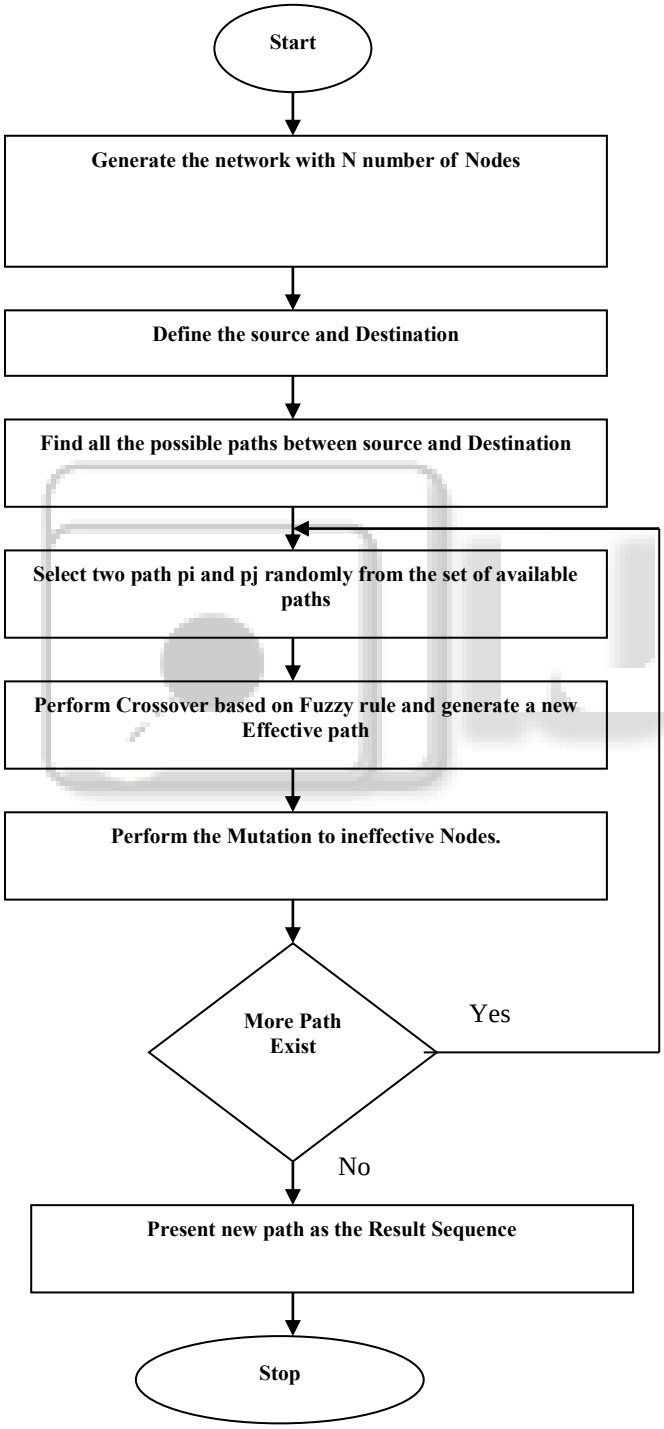


Fig. 4: Flow Chart of Fuzzy based Genetic Approach for Route Optimization

*C. Graphs of GENETIC INSPIRED PATH*

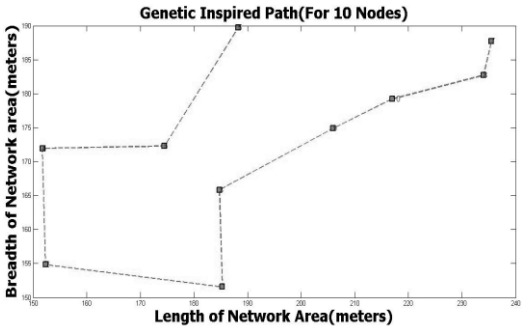


Fig. 5(a)

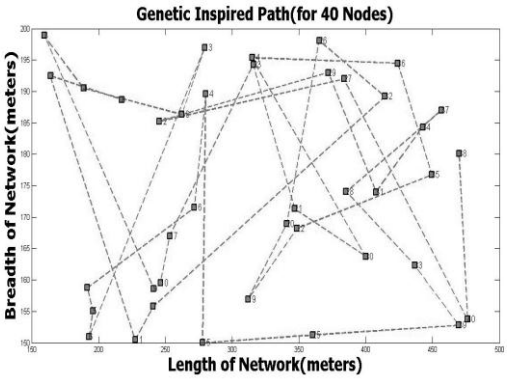


Fig. 5(b)

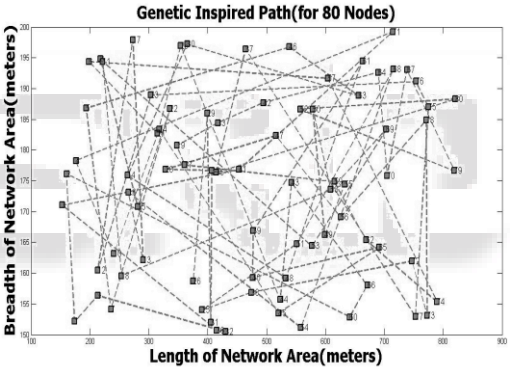


Fig. 5(c)

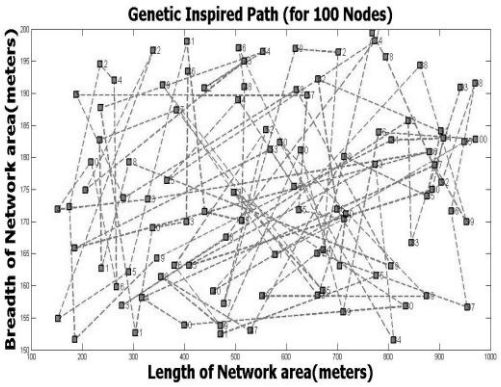


Fig. 5(d)

Fig. 5: Graphs of GENETIC INSPIRED PATH for (a) 10 nodes (b) 40 nodes (c) 80 nodes (d) 100 nodes.

| No Of Nodes | Existing Work(distance in meters) | Proposed Work(distance in meters) |
|---|---|---|
| 10 | 249.5841 | 29.2053 |
| 30 | 815.0851 | 173.187 |

 

| | | |
|---|---|---|
| 50 | 1.2946e+003 | 477.237 |
| 60 | 1.2233e+003 | 717.813 |
| 90 | 2.5129e+003 | 1749.03 |
| 100 | 2.4233e+003 | 1876 |

Table. 1: Analysis of Existing and Proposed Method

*D. Simulation Result Analysis of Existing V/S Proposed Work*

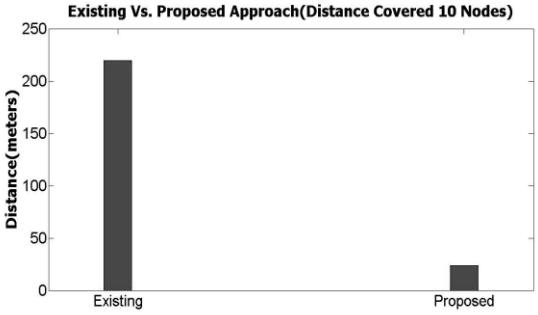


Fig. 6(a)

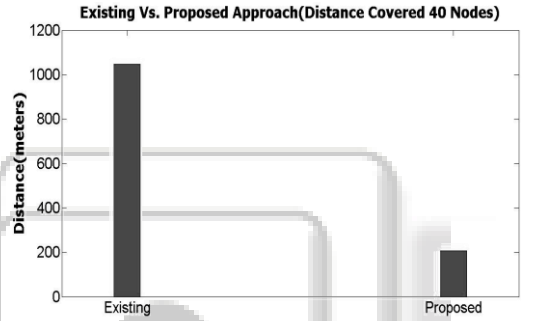


Fig. 6(b)

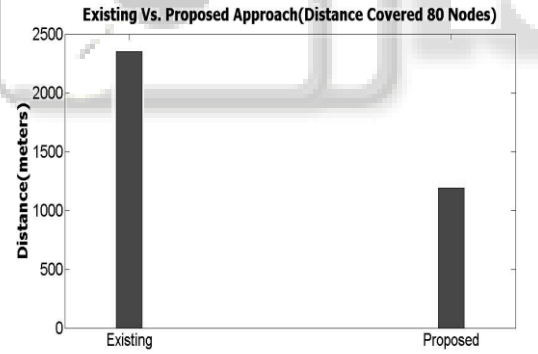


Fig. 6(c)

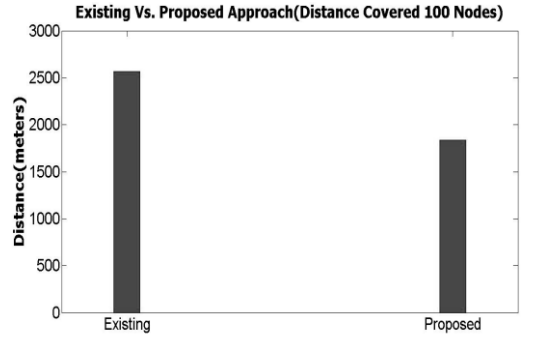


Fig. 6(d)

Fig. 6: Simulation Result Analysis of Existing V/S Proposed Work for (a) 10 nodes (b) 40 nodes (c) 80 nodes (d) 100 nodes.

*E. Consumed Energy Graph*

The graphs analysis in section 4-B shows the genetic inspired path for different number of nodes which is based on the fuzzy improved genetic algorithm. The table analysis in section 4-C which also shows the results based on fuzzy improve genetic approach. From the table we can analyze that for the same number of nodes fuzzy improved genetic approach gives better result in term of distance and path optimization which can be summarized as an efficient energy form. For the same number of nodes the sum of distance using the proposed approach is less as compared to the previous method. Using this approach the energy level for the different number of nodes follows a definite pattern. The bar graphs in section 4.4 shows the analysis of existing work with the proposed method, which indicates the optimization level achieved using the two techniques. From the bar graph it is clearly estimated that the proposed work has better prosperity for the route optimization. Section 4.4.1 shows the consumed energy graph between proposed and the existing approach and it can be analyzed from the graph that the proposed approach gives the better result in terms of energy consumption from source to destination. Hence the QOS can greatly be improved using the fuzzy improved genetic approach as proposed.

## V. CONCLUSION AND FUTURE WORK

A fuzzy improved genetic approach has been studied and the simulation results have been analyzed. The results obtained from genetic based approach in which fuzzy is applied at the crossover show better path optimization. The analysis tables from the two different approaches show the distance and random path generation. From the table1 it can be concluded that the results obtained using fuzzy genetic approach are better than the previous algorithm which is based on the arbitrary shortest path. The fuzzy improved genetic approach provides energy efficient path which is needed for route optimization in MANET.

For the future work the same algorithm can be implemented using NS2 and the more energy efficient path can be obtained. The optimization level can be improved further for large number of nodes. A PSO algorithm which is more reliable can further be used in place of GA for more energy efficient path. The same algorithm can be simulated with the considerations of time response.

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