# Application of Soft Computing For Performance Analysis of Routing Protocol in MANET

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***Abstract - Mobile Ad-hoc Network (MANET) has opened a new dimension in wireless networks which means that user want to communicate with each other in absence of centralized administration and it can change position frequently. This paper represent a novel technique for optimizing different parameter like End to End Delay, Jitter, Overhead etc using modified Lagrangian Multiplier Technique. The Modified Lagrangian Multiplier Technique make use of a Penalty Term which is calculated using Fuzzy Sets the solution is then computed using Lagrangian Multiplier Technique and using the computed penalty term thus this technique minimizing the cost of various parameters and the cost of penalty term. The applicability of this technique is shown taken Routing Load and Delay Time. The penalty term is based on three parameter Packet drop rate, jitter, Overhead. The basic genetic algorithm approach for minimizing the value of these parameter is modified using standard deviation. Describing of this GA is also given to find the shortest path in MANET.***

***Keywords: MANET, MATLAB, END to End Delay, Routing Load, Delaytime, Packet droprate, jitter, overhead, modified Lagrangian Multiplier Technique,Penalty terms.***

## I. INTRODUCTION

Mobile Ad-Hoc network is a wireless network and self configuring network of moving routers associated with wireless network. The routers are free to move randomly from one point to another point and organize themselves arbitrarily, thus, the network's wireless topology may change rapidly as well as unpredictably.

A wireless network communication has made a revolution by allowing users to access services and different information anytime and at anywhere, irrespective of their geographical location. In fact, Wireless technology is a new growing technology that has been removed the burden of the wires and give the permission to create networks this property makes these networks highly robust. MANET means Mobile Ad-hoc Network, so they utilize wireless connection to attach with system model network MANET can be a model as Wi-Fi connection, or another standard, like a cellular or satellite transmission,classrooms for education system and in sensor network , mobileoffices, small aircrafts The main aim of Manets are self organizing and restoring and transmission through multiple hopes, , limited power ability, No central controlling authority continuously maintain the information required to properly route traffic. Mostly Mobile Ad-Hoc networks are used in various fields like, tanks .Ad hoc networking allows the devices to maintain connections to the network as well as easily removing and adding devices to and from the network time. The network is not centralized, where message delivery and network organization must be executed by the nodes themselves. Message routing is a problem in a decentralize environment where the topology increases or decreases. While the shortest path from a source to a destination based on a cost function in a static network is usually the optimal route, this concept is difficult to extend in MANET. Various Applications of MANETs are ranging from large-scale, mobile, highly dynamic networks, Military Scenarios, Data Networks, sensor Network.

In Mobile Ad-hoc network to find the best path from source to destination Soft Computing application is used like Fuzzy Logic and Genetic Algorithms etc. Soft Computing is a powerful mechanism in protocol development and routing strategies in Ad-Hoc Networks. Fuzzy Logic is a soft Computing technique for route Optimization in MANET. Fuzzy logic use a simple, rule-based on IF X variable AND Y variable THEN Z variable approach to solve a problem.

## II. PREVIOUS WORK

There are many routing protocols have been proposed, but with few comparisons between different mobile ad-hoc routing protocols have been made. The performance comparison of MANET routing protocols, namely AODV, TORA, DSR and OLSR [1] is done by Ashish Shrestha and FiratTekiner which shows the performance of AODV and OLSR. However, AODV showed the better efficiency to deal with high congestion and provides better in delivering and TORA.

In the year 2012, author Parimal Kumar Giri has proposed the neural network based approach for MANET [2]. He found that using neural networks, namely Hopfield Neural Networks(HNNs), are used to solve an approximate solution to find the Shortest Path problem from the existing possible algorithmic solution,on the Artificial Neural Networks(NNs) parallel architecture.

In the year 2011, authors Siddesh.G.K et al. [3] have been proposed that routing in mobile ad-hoc wireless network using the soft computing techniques like artificial neural networks(ANN), fuzzy logic approach (FLA) and genetic algorithm Technique(GA). In this work, they have performed the simulation of hyper net as well as simulator for various existing protocols like proactive routing protocol, reactive routing protocol, , hybrid routing protocol .Authors also have been concluded that it assume the extra features of artificial neural network with Fuzzy Logic and Genetic Algorithms use a technique to improving the performance of protocol.

Authors Jaspal Jindaletal.[4] in the year 2013 have been proposed other soft computing approach i.e. Fuzzy Improved technique Genetic Algorithm Approach for Route Optimization in MANET. In this work, author proposed that routing algorithm was inspired from the genetic Algorithm Technique .The fuzzy improved genetic approach provides energy efficient path which is helpful for route optimization in Mobile Ad-hoc network.

## III. PROPOSED METHODOLOGY

This research work is used to find the best optimization path in Manet where Modified Lagrangian Multiplier Technique is used with Penalty Term which have three parameters such as Packet Drop, Jitter, Overhead . These parameters are used to know their performance by considering the fuzzy logic for the various numbers of weights.

### 3.1 Lagrangian Multiplier Technique

Lagrangian multiplier technique is used to find the optimal solution. The Lagrangian multiplier are usually determine in a recursive process and decrease the number of recursive is a importance to given systems with computational complexity The parameters are taken as random variables. Thus, expected values are taken in solution.
Expected value (x) = Mean-value of x
Coefficient of variation = Standard deviation/ Mean value.
The algorithm of the proposed Lagrangian Multiplier Technique is as follows:

Step1: First Initialization the following parameters.

a[i], b[i] and c[i] : cost-coefficients.

Pd : Load Demand (MW).

Optimal Fuel cost is represented by optimal_total_cost.

pg is output of a generator

alpha and ep: parameters used in Lagrangian technique.

it and in indicates iteration counters.

Lagr and Lagrnew are Lagrangian Multipliers.

$It_{max}$ and $In_{max}$ are maximum number of iterations.

Step 2: Read the values of input parameters:
a[i], b[i], c[i], $B_{ij}$, $pg_{min}$ and $pg_{max}$.

Step 3: Assign the values of parametrs used:

Pd= 220

alpha= 0.005

ep= 0.0001 and $ep_2$= 0.001

$ep_2$ is used for inner loop.

Step 4: Guess the value of Lagrangian Multiplier.

Step 5: Initialize the values of generator output $P_1$, $P_2$ and$P_3$

Let $P_1$= $P_2$ = $P_3$ = 0.0
Initialize it = 1.

Step 6: Test whether it < $It_{max}$?

If yes then go to step 7 else display the message ‘solution not converging in 100 iterations’ and stop

Step 7: Initialize in=1.

$P_1$[it-1]=$P_2$[it-1]=$P_3$[it-1]=0.0

Step 8: Test whether in < $In_{max}$?

If yes then go to step 9 else go to step 13.

Step 9: Calculate the value of pg[i][it] for i=1 to 3 using the following equation:

pg[i][it]= Term1/ Term2.

Term1= Lagr × ( 1 – Term3) – b[i]

Term2= 2 × (Term4 + Term5 + Term6)

Term3= $\sum_{j \neq i}$ (2×$B_{ij}$× $P_j$[it-1])

Term4= a[i]+ (a[i]×$cvp_i^2$)

The parameter $cvp_i$ is the coefficient of variation for $i^{th}$ generator.

Term5= p × $cvp_i^2$

The parameter p is a penalty term that represents risk.

Term6=Lagr × $B_{ii}$ × ( 1 + $cvp_i^2$)

Step 10: Check for upper and lower limits of pg[i][it].
If pg[i][it] < $pg_{min}$ Then pg[i][it]=$pg_{min}$.
If pg[i][it > $pg_{max}$ Then pg[i][it]=$pg_{max}$.

Step 11: Find the value of Deltai.
Deltai= | pg[i][it]-pg[i][it-1]|
max = max (Delta1, Delta2, Delta3)

Step 12: Test whether max $\leq ep_2$ ?

If yes Then go to Step 13 else increment the value of in and

pg[i][it-1]=pg[i][it], go to Step 8.

Step 13: Calculate transmission losses ($P_L$):

$P_L$= Term7 + Term8

Term7=$\sum_{i=1to3}(B_{ii} \times P_i)$

Term8=$\sum_{i=1to3}\sum_{j=1to3,j\neq i}(P_i \times B_{ij} \times P_j)$

Step 14: Calculate Deltap.

Deltap= | Pd + $P_L$ - $\sum_{i=1to3}(P_i)$|

Step 15: Test whether Deltap $\leq$ ep?

If Yes Then calculate the optimal_total_cost, display the value and stop else go to Step 16.

$F_T$ = a[i]× Pg[i]$^2$ + b[i]× pg[i] + c[i]

The parameter $F_T$ is the optimal_total_cost and is calculated using the equation given above [2].

Step 16: Calculate Lagrnew.

Lagrnew= Lagr + (alpha × Deltap)

Lagr= Lagrnew

Step 17: Increment the value of counter it by 1 and go to step6.

3.2 Fuzzy Logic Approach

Fuzzy sets are introduced by LOTFIZADEH in 1965 Berkley university of California Now a days it has been used in many Engineering and Industrial application. Fuzzy Logic is a soft Computing technique for calculating penalty in MANET. Fuzzy Logic is a simple but strong methodology in logic building. From the history fuzzy logic was developed to context of building control systems based on micro-controllers. Fuzzy logic use a basic simple, rule-based IF X AND Y THEN Z approach to solve a appropriate problem[5].

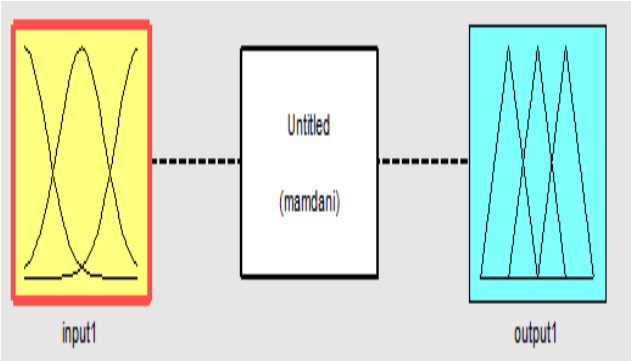


Fig1: Basic Of Fuzzy Logic

Fuzzy sets are different from crisp sets because a crisps sets member has two sets 0 i.e it is not a member of crisp set, 1 i.e it is a member of crisps set while in fuzzy sets every member is assign a membership value between 0 and 1.

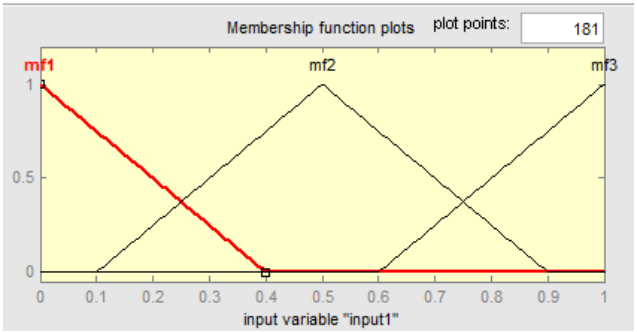


Fig2: Membership function between 0 and 1

In Fuzzy we introduce the penalty term which has three parameter i.e packet droprate,jitter,overhead according to this we implement some fuzzy rules we implement some rules.

Table1: Rule set

| Serial number | Packet droprate | Jitter | Overhead | Penalty |
|---|---|---|---|---|
| 1 | small | small | small | small |
| 2 | medium | high | small | medium |
| 3 | medium | high | medium | large |
| 4 | large | very high | large | large |
| 5 | large | very high | medium | medium |

3.3 Genetic Algorithm Technique

Genetic algorithm is also a soft computing technique for Optimization in MANET. The basic concept of genetic algorithms is optimization. Since optimization problems arise continuously, in this way Genetic Algorithm quite useful for a great variety of tasks[6]. In all optimization problems, we are faced with the problem of minimizing/maximizing an objective function over a given space of arbitrary dimension.

Table2:Comparative study of GA approach in MANET

| S.N | Features | Genetic Algorithms |
|---|---|---|
| 1 | Quality | Flexible in regard of solution. Quality adjusted as function population. |
| 2 | Hardware | Scales well to the networks that may not even fit within the memory. Real computation size doesn't increase very much as the net Network size expedites |
| 3 | Hybrid Forms | GA is combined with another algorithm to solve the shortest path routing problem. |

## IV. SIMULATION RESULT

We have to evaluated the optimization path from the various softcomputing like Fuzzylogic ,Genetic Algorithm. Simulations were performed on the MATLAB and C. To find the best optimal solution in mobile Ad-hoc using the soft computing some graph shown in below

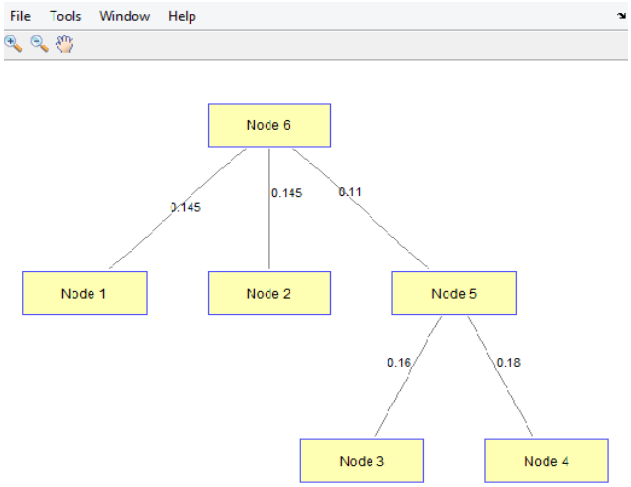


Fig3:Normal Technique to find the optimization route

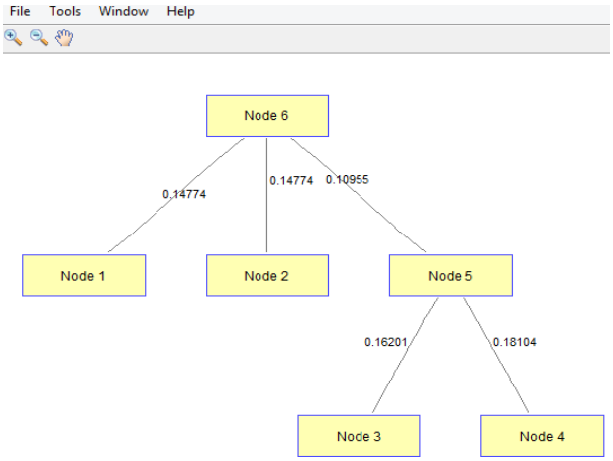


Fig4: Modified Technique to find the best optimization route.

From these two figures i.e fig3 and fig4 it shows that modified technique given a optimal solution.

| Nodes | Normal technique | Modified technique |
|---|---|---|
| Node6 to 1 | .145 | .147 |
| Node6 to2 | .145 | .147 |
| Node6 to5 | .11 | .10 |
| Node5 to3 | .16 | .16 |
| Node5 to4 | .18 | .18 |

Table3: This shows the range between the normal and modified technique

To Calculate the Penalty term we use three parameter i.e packet droprate,jitter,overhead and from these three parameter we calculate penalty term from three input values(0.6,0.35,0.58) then output of penalty term is 0.85

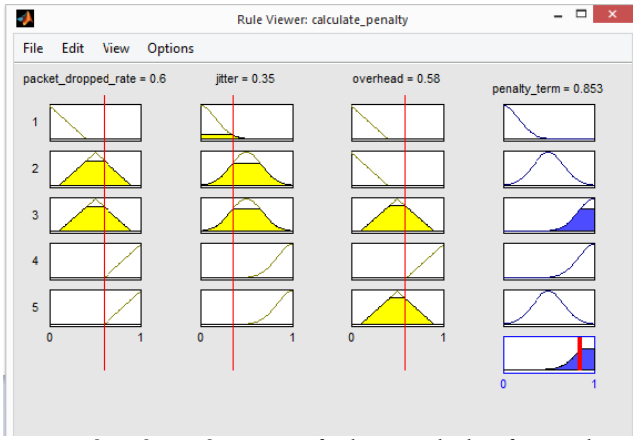


Fig5: This shows the output of rules set calculate for penalty

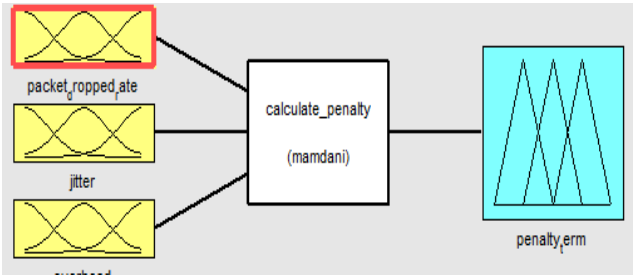


Fig 6: This shows the parameters of calculate penalty

## V. CONCLUSION

In this paper,we analyse that a mobile Ad-hod network with modified soft computing technique is introduce. we analyse that not a mobile Ad-hoc routing protocol can adapt to all environments with soft computing, to find the best result in mobile Ad-hoc network we apply modified Larangian technique with penalty term.In conclusion it assume that the essential features of Fuzzy Logic technique and Genetic Algorithms technique is a way to improving the performance of protocol. Analysis of these routing protocols for MANET,which might take security and optimization as the major concerns.

The study of the above graphs are shown that a performance of our protocol is establishing a route over a shorter periods of time and the results are well suited.

## VI. FUTURE SCOPES

In further, we study of various protocol and we can analyze these protocols with varying area with different nodes with different time interval and different mobility and further go into depth of the routing protocols.

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