# Multiconstraint BAT Algorithm Optimized Efficient Routing Protocol for Wireless Ad Hoc Network

Gurpreet Singh Brar,
M.tech (CSE), Student
Adesh College of Engineering and technology,
Punjab, India.
preetbrar9988@gmail.com

Dr. Gurbinder Singh Brar,
M.tech (CSE), Assistant Professor
Adesh College of Engineering and technology,
Punjab, India.
mattibrar@gmail.com

***Abstract*—Wireless ad hoc networks are self ruling wireless sensor networks s these networks did not follows any fixed infrastructure as the nodes are mobile in nature. Due to the mobility of the nodes, the ad hoc networks suffers from various issues such as low packet delivery ratio, throughput etc. large number of researches had been done in order to enhance the performance of the network in respective terms.**

**For this purpose, the fuzzy system had been applied in order to evaluate the cost function but lacks to generate efficient and effective results. In fuzzy based approach, the fuzzy cost and communication cost is evaluated on the basis limited constraints and parameters.**

**Therefore, the author has developed a new approach with enhanced list of factors for evaluating the cost function by using the BAT optimization technique. The proposed network is simulated on the variable numbers of nodes i.e. 15-300. Then the proposed work is implemented in MATLAB and measured in the terms of delay and packet delivery ratio. On comparing the performance of the proposed work with traditional techniques, the proposed work is proved to be effective than others.**

**Keywords*— Ad hoc Networks, Routing, Cost function evaluation, BAT optimization.***

## I. INTRODUCTION

Ad Hoc Networks are the wireless networks which poses the property of self-organizing or did not follow any physical infra to settle down in the environment. Nodes or hubs in specially appointed systems [1] (Ad Hoc Networks) act as both client and router. A few uses of specially appointed systems could incorporate mechanical and business applications including helpful versatile information exchange [2-3] such as military. As of late, developing advances, for example, remote sensor systems (WSNs), wearable computing, pervasive processing, Internet of Things, have a great extent added to a further push toward application possibilities of specially appointed systems [4]. Ad hoc Networks present the attributes of open connect, dynamic topology, and dispersed operation. Two various types of wireless networks are there. In the first type, each node in the network topology has easy accessibility to all other nodes with the help of a conventional radio relay system with a high range [5-6]. No routing protocols are required in this network type as all nodes are able to see the others. Radio relay system is also used in case of second type of network, but each node has a reduced range [7-9], thus one node has to utilize adjacent nodes in order to reach another node that is not within its range of transmission. Therefore, the intermediate nodes are recognized as the routers [10].

## II. ROUTING IN MANETs

Routing is basically used to forward the traffic among networks to attain less traffic on the network as the speed and performance of the network will be increased [11].That's how routing helps to obtain the best path in a network to send the traffic on that path [12].

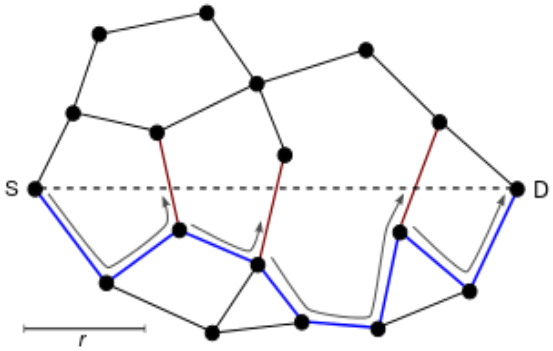


Figure 1: Example of Routing

## III. PROBLEM FORMULATION

The sensor networks are spatially distributed network comprised of autonomous sensors to monitor the physical surroundings such as as temperature, sound, pressure, etc [13]. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity. Due to the characteristics such as openness and dynamic topology, ad-hoc networks suffer from various uncertain issues.

In the tradition approach [1] fuzzy logic was used to calculate fuzzy cost of each node in network so it can be selected for the communication, but fuzzy logic controllers are facing issue of defined work means as fuzzy works on the rules defined in it layer. The rules are defined on the basis of the

number of inputs. If the number of inputs goes higher than the user have to define a large number of rule set for fuzzy system and this makes it complex as it is not easy or possible to define each and every possibility as the rules in fuzzy. Therefore this approach is not much effective where real data is to transmit.

So there is need to update the system with the algorithm which can handle the multiple parameters for the selection of effective transmission node.

## IV. PROPOSED WORK

Ad hoc network is a system of wireless nodes that dynamically self-organize in arbitrary and temporary network topologies. It consists of large number of nodes.

Many researches had done work to resolve this issue but as discussed in above section the traditional fuzzy system was not capable to handle them. So there is a need to propose a new algorithm that is that will able to perform by considering list of parameters to overcome the issues of traditional work. So a new approach is to be proposed that will increase the number of parameters along with the implementation of BAT optimization based decision model. The proposed cost evaluation function by using the delay, energy, and bandwidth as weight function is formulated as follows:

$$W_1 * E + W_2 * B + (W_3/Delay) \dots \dots \dots (1)$$

The Methodology of proposed work is as follows:

1. First of all the network is designed in which the nodes have to be deployed.
2. After designing the network the nodes are deployed in the network.
3. After that the procedure of route selection is initiated once the nodes are deployed in the system. In this procedure basically the shortest route is selected to deliver the packets from source to the destination.
4. The Energy, Delay and Bandwidth are the main parameters that are used as weight values to evaluate the cost function by which in turn the shortest route is selected. The equation number 4.1 is used to evaluate the cost function.
5. After that the BAT optimization based decision model is used to increase the number of parameters as well as for the selection of the node.
6. Ultimately the final route selection is performed and the performance evaluation of the parameters is accomplished.

The proposed network set up is as follows:

Table 1: Proposed Simulation Setup

| Parameter | Value |
|---|---|
| Network Area | 800*800 $m^2$ |
| Number of nodes | 15-300 |
| Mobility Speed | 1-100 m/s |
| Initial Energy | 50 joule |
| Mobility Model | Random Waypoint Model |
| Data Packet Size | 512 byte |
| Traffic Type | Constant Bit Rate (CBR) |

The proposed network is covers the area of 800*800 $m^2$, the number nodes in the network is variable i.e. it is from 15 to 300. The proposed BAT algorithm based routing algorithm is applied for the purpose of routing and data transmission.

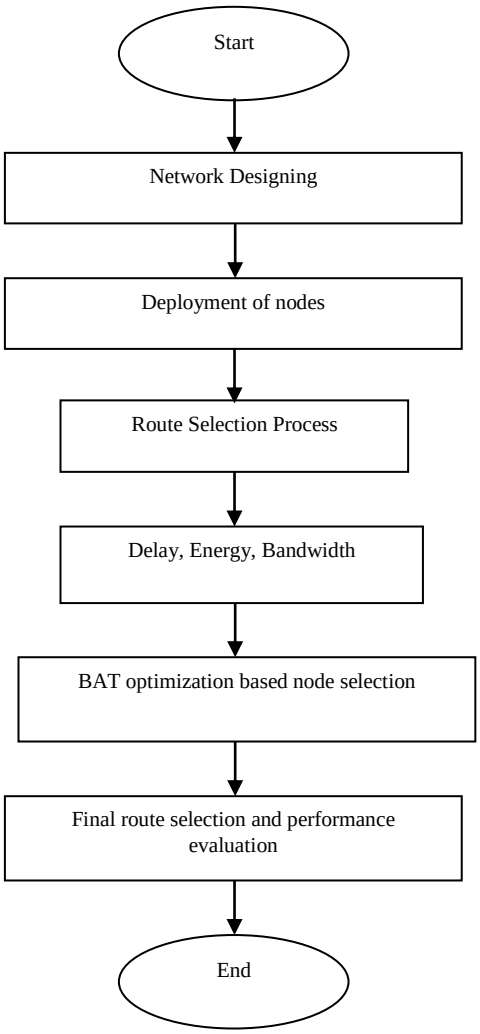


Figure 2 Proposed Framework

## V. EXPERIMENTAL RESULTS

This section serves the results that are attained afterwards implementing the proposed work. The implementation is done in MATLAB. The performance of the proposed work is evaluated in the terms of Packet delivery ratio and Packet delivery delay with respect to number of nodes and mobility. There are some graphs in this section that confirm the adequacy of proposed technique that are explained below. The graph of Figure 3 shows the packet delivery delay of the proposed method that is BAT to the mobility of the nodes. The packet delivery delay ranges from 0 to 0.02 and the delay is represented in seconds whereas the mobility of the nodes ranges from 5 to 35. In this graph it is shown that the packet delivery delay is increased with the increase in mobility.

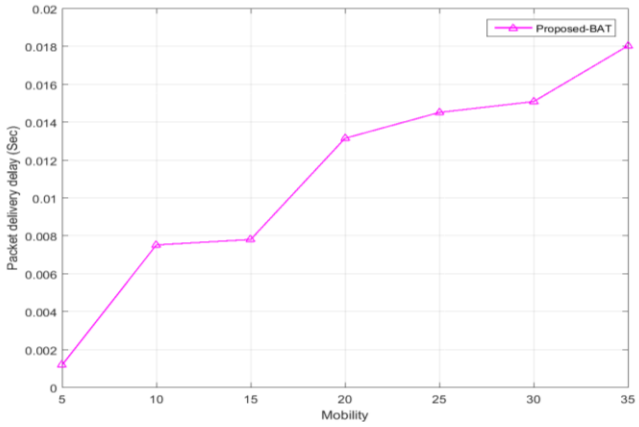


Figure 3 Packet delivery delay of proposed method.

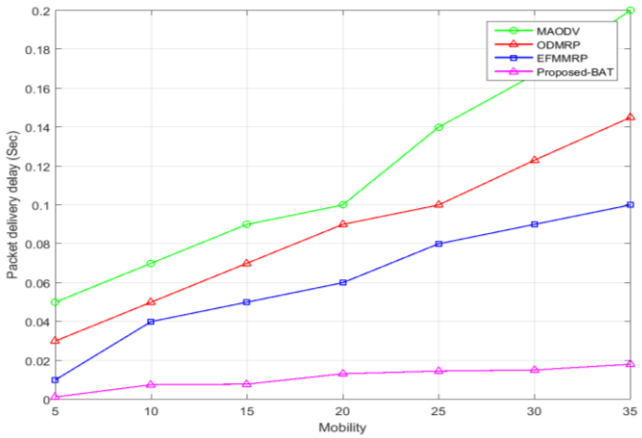


Figure 4 Comparison of Packet delivery delay of traditional methods to the proposed method.

The Figure 4 shows the comparison of the packet delivery delay of the traditional methods that are MAODV, ODMRP, EFMMRP to the proposed method that is BAT. This graph shows that the value of Packet delivery delay ranges from 0 to 0.2 and the mobility varies from 5 to 35. The packet delivery delay of the proposed method is shown in pink color and represents that the packet delivery delay of the proposed method is very less comparative to the traditional methods.

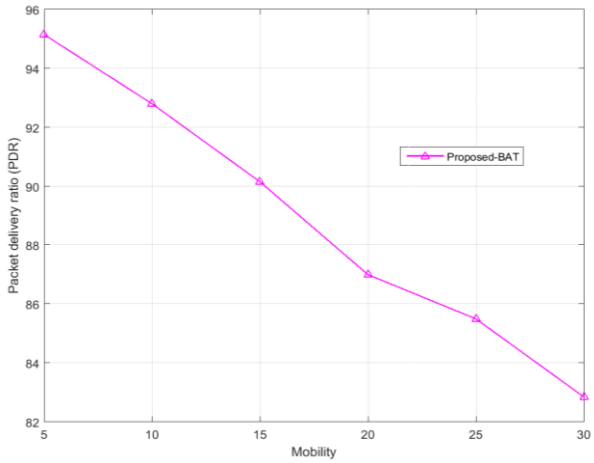


Figure 5 Packet delivery ratio with respect to mobility of proposed method.

The packet delivery ratio is the ratio of the number of received packets at the destination to the total number of transmitted packets. In this graph the range of packet delivery ratio varies from 82 to 96 whereas the mobility varies from 5 to 30. The graph of Figure 5 shows that the Packet delivery ratio of the proposed method is decreased by increasing the mobility of the nodes in the network.

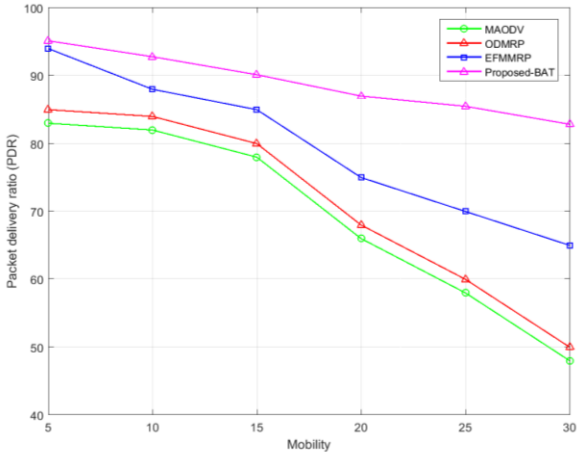


Figure 6 Comparison of PDR with respect to mobility between traditional and proposed method.

The packet delivery ratio of the proposed method is shown in pink color whereas the PDR of the traditional methods like ODMRP, EFMMRP and MAODV is shown in Red, blue and green colors. The packet delivery ratio of the BAT mechanism is very much better than the traditional methods that are shown in the graph of Figure 6.

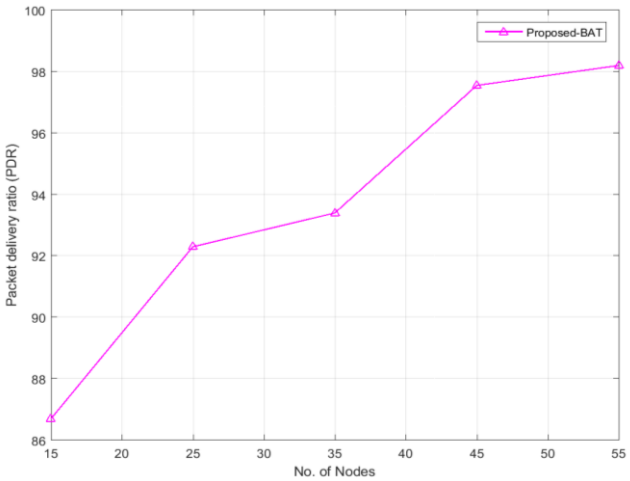


Figure 7 Packet delivery ratio of the proposed method with number of nodes.

The graph of Figure 7 depicts the Packet delivery ratio of the proposed method with respect to the number of nodes. By increasing the number of nodes the Packet delivery ratio is also increased as shown in the graph. The range of packet

delivery ratio varies from 86 to 100 whereas the number of nodes varies from 15 to 55.

Comparative to the traditional mechanisms the Packet delivery ratio of the proposed method that is shown in pink color is high than the traditional mechanisms that are MAODV, ODMRP and EFMMRP. The packet delivery ratio ranges from 70 to 100 whereas the number of nodes varies from 15 to 55 as shown in Figure 8.

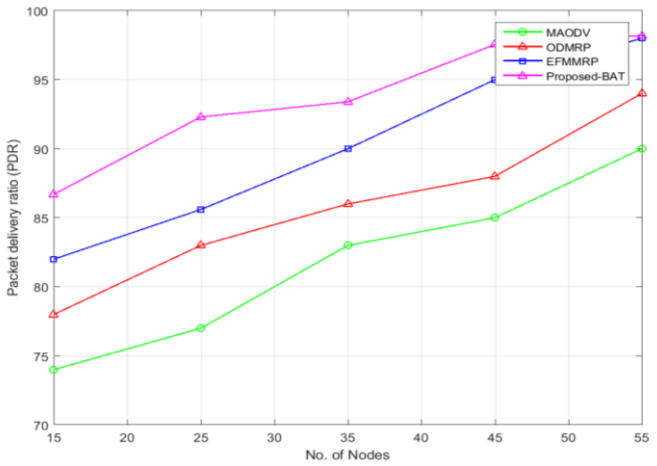


Figure 8 Comparison of PDR of traditional and proposed method.

## VI. CONCLUSION

Ad Hoc Networks are the wireless networks which poses the property of self-organizing or did not follow any physical infra to settle down in the environment. Nodes or hubs in specially appointed systems (Ad Hoc Networks) act as both client and router. A few uses of specially appointed systems could incorporate mechanical and business applications including helpful versatile information exchange such as military. As of late, developing advances, for example, remote sensor systems (WSNs), wearable computing, pervasive processing, Internet of Things, have a great extent added to a further push toward application possibilities of specially appointed systems.

Ad hoc Networks present the attributes of open connect, dynamic topology, and dispersed operation. In this work the author had proposed a new algorithm that is able to perform by considering list of parameters to overcome the issues of traditional work. Therefore the number of parameters is increased by implementing the BAT optimization based decision model. The delay, energy, and bandwidth parameters are used as weight function in order to evaluate the cost function that is in turn used to select the shortest route. The packet delivery delay and packet delivery ratio is calculated with the number of steady nodes and mobile nodes of the proposed method that are also compared with the traditional methods. Hence, it is proved from the simulation results that the packet delivery delay of the proposed method is less whereas the packet delivery ratio is high comparative to the traditional mechanisms.

The proposed work offers better results but in future more amendments can be done in this study by working on its security. And also the BAT algorithm can be replaced by the hybridization of a couple of optimization techniques.

## REFERENCES

[1] Ajay Kumar Yadav , SantoshKumar Das, Sachin Tripathi, "EFMMRP: Design of efficient fuzzy based multi-constraint multicast routing protocol for wireless ad-hoc network", ELSEVIER, Pp 15-23, 2017

[2] Shuaishuai Tan et al, "A Trust Management System for Securing Data Plane of Ad-Hoc Networks", IEEE Transaction on Vehicular Technology, Vol 65, No 9, Pp 7579-7591, September 2016

[3] Dajun Zhang et al, "Software-defined Vehicular Ad Hoc Networks with Trust Management", DIVANet, Pp 13-17, November 2016

[4] Francesco Saverio Proto, "A Framework for Packet-Droppers Mitigation in OLSR Wireless Community Networks", IEEE, Pp 1-6,July 2011

[5] Jean Marc Robert et al, "RBC-OLSR: Reputation Nased Clustering OLSR protocol for Wireless ad hoc Networks", ELSEVIER, Vol 35, No 4, pp 487-499, February 2012

[6] Zhexiong Wei et al, "Security Enhancements for Mobile Ad Hoc Networks With Trust Management Using Uncertain Reasoning", IEEE, Vol 63, No 9, Pp 1-12, April 2014

[7] Heena(2014) "Battery Power and Trust Based Routing Strategy for MANET" IEEE International Conference on Advanced Communication Control and Computing Technologies (ICACCCT) ,Pp 1559-1562

[8] Hui Xia (2014), "Trust-Enhanced Multicast Routing Protocol Based on Node's Behavior Assessment for MANETS ", IEEE , Pp 473 – 480

[9] Zheng Yan et al, "A Survey on trust management for Internet of Things", ELSEVIER, Vol 42, Pp 120-134, June 2014

[10] Danai Chasaki et al, "Attacks and Defenses in the Data Plane of Network", IEEE, Vol 9 No 6, Pp 798-810, December 2012

[11] Y Yang et al, "Broadcast encryption based non-interactive key distribution in MANETs", ELSEVIER, Vol 802, No 3, Pp 533-545, May 2014

[12] Seema, Reema Goyal, "A Survey on Deployment Methods in Wireless Sensor Networks", ijarcsse, vol 3 (7), Pp540-544, 2013

[13] Amith Khandakar, " Step by Step Procedural Comparison of DSR, AODV and DSDV Routing protocol ", ICCET, vol 40, Pp 36-41, 2012

[14] Vibha Yadav, "Localization Scheme For Three Dimensional Wireless Sensor Networks Using Gpsenabled Mobile Sensor Nodes",ijngn, vol 1(1), Pp 60-73, 2009

[15] Rajesh Sharma, " Dynamic Source Routing Protocol (DSR) ", ijarcsse, vol 3 (7), Pp 239- 241, 2013