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Routing Enhancement of MANETs using Hybrid Protocol Combined with PBO

Chamkaur Singh*, Vikas Gupta**, Gurmeet Kaur***
*(M. Tech. Student, Department of Electronics and Communication, Adesh College of Engineering and Technology, Faridkot, India.)
** (H.O.D. and Assistant Professor, Department of Electronics and Communication, Adesh College of Engineering and Technology, Faridkot, India.)
*** (Assistant Professor, Department of Electronics and Communication, Adesh College of Engineering and Technology, Faridkot, India.)

ABSTRACT
Mobile ad hoc Networks (MANETs) show an astonishing qualities in the concept of networks which are used without wires. MANETs experience numerous communication medium restrictions such as constrained storage of memory and development of effectual routing protocols. Furthermore, multihop routing mechanism employed in MANETs gives rise to the contention in the channel and jamming within the network. This limits the effectiveness of the network which reduces the energy efficiency of the network and also lessens the routing performance of MANETs. Hence, the major matter in MANETs is to minimize the congestion and contention in order to enhance the routing mechanism. Hence, in this paper, a novel protocol is put into practice having an enhanced route discovery mechanism which is implemented in order to avoid the congestion during the routing. The proposed protocol chooses the route for the transference of information on the basis of load within the traffic on the node and then resets the route with the change in topology. The protocol is then integrated with the proposed algorithm Pollination Based Optimization (PBO) algorithm. This is an efficient technique for transmission that requires a link for longer period of time. The simulator used for the simulation of the work is Network Simulator-2 (NS-2). Simulation results have been carried out showing that the route optimization and enhancement in the route discovery using Pollination Based Optimization (PBO) algorithm.

Keywords **–** Destination-Sequenced Distance Vector (DSDV) Protocol, Dynamic Source Routing (DSR) Protocol, Mobile Ad-hoc Networks (MANETs), Pollination Based Optimization (PBO) Algorithm.

I. INTRODUCTION

Mobile Ad-Hoc Networks (MANETs) is a wireless network integrated with the abilities to organize themselves incessantly. These networks are infrastructure reliant networks which are made up of numerous nodes having mobile properties. These nodes are linked to each other in a wireless behavior. MANET is an independent network where the nodes are positioned in a haphazard manner [1]. The momentum of nodes in the MANETs is not similar to each other. Therefore, the connectivity of nodes with other devices changes more often [2]. The primary issue in the construction of MANET is that each device has to be equipped properly for the continuously routing of data. These types of nodes are associated with each other straightforwardly[3][4]. The perception of MANET is dissimilar from other sensor networks because of the use of multihop routing technique. In MANETs, the nodes always employ an intermediate node for the transference of information from one node to another[5]. There are various advantages of MANET which are clarifies as follows.

A. Self-Configuring and self-governing Networks

MANET is made up of several nodes having the capabilities to assemble themselves. These types of networks do not depend on the infrastructure of nodes which are mobile in nature. Because of this concept, the central administration is not necessary in MANETs [3].

B. Routing system

The multihop routing technique plays a proficient responsibility. Each node deployed in MANET has to play the role of host as well as router to process the information. The node which exhibits the properties of as a host and router is named as intermediate node [4].

C. Type of Topology

MANETs show the Dynamic topology system because of the independent activities of numerous nodes which get positioned in a random manner. The nodes can connect to the network or depart from the network at any instant of time [6][7].

D. Energy Efficiency Issue

As, all the nodes in ad-hoc manner or in sensor networks get integrated with a restricted battery storage space. Thus, for this explanation, the life of a network get reduces while the processing of information from one to another node. Therefore, the restriction in the processing power of mobile nodes occurs while implementing these types of networks. For this reason, energy efficiency is an important concern in MANETs [8].

MANETs are those networks which can configure themselves again after the regular intervals of time. Therefore, the change in topology in MANETs changes more often in a rapid behavior which can be unpredictable in nature. The routing protocols in these types of networks have their own characteristics and constraints. Hence, for this reason it becomes imperative to search for a new technique in which the routing protocols shows an efficient behavior [9].

Therefore, in this paper, a new protocol is being proposed having an enhance route discovery mechanism which is implemented in order to avoid the congestion during the routing. The proposed protocol chooses the route for the transference of information on the basis of load within the traffic on the node and then resets the route with the change in topology. The protocol is then integrated with the proposed algorithm Pollination Based Optimization (PBO) algorithm.

After the introduction on MANETs in the section 1 the rest of the paper is organized in six sections where section 2 focuses on the protocols used. Section 3 explains the idea of PBO algorithm and section 4 presents the proposed methodology. Section 5 explains the simulated results and discussion part and section 6 gives the conclusion and future scope of the scheme proposed.

II. DSDV AND DSR PROTOCOLS

Destination–Sequenced Distance Vector (DSDV) Protocol has come from the concept of location based routing mechanism where the use of Routing Information Protocol (RIP) comes into consideration. The idea of DSDV protocol is one of an effective idea where the addition of a novel attributes and sequence number is provided to each of the route. In DSDV, each mobile device or node within an ad hoc network sustains a routing table consisting the complete and detailed lists all of the available destinations [10]. By using these types of routing table accumulated in each node, the transmission of packets between the nodes within an ad hoc network takes place. Each and every node inside the ad hoc network revises the routing table continuously [10]. In DSDV protocol, when the router get any of the new data or information, then it utilizes the most recent chain number. In case, if the chain number becomes similar as one of the previously existing value the table, then the route will be used having the best metrics. Dynamic Source Routing (DSR) Protocol [11] is an on-demand routing protocol which are used for the working of wireless mesh networks. Thus protocol is somewhere shows the similar properties to that of Ad hoc On Demand Vector Protocol in which it constructs a route on the basis of on-demand movements when the user at transmission end request for a route [12][13]. However, this protocol utilizes the concept of source routing rather than that of dependence on the routing table at each intermediary node [14][15][16].

III. POLLINATION BASED OPTIMIZATION ALGORITHM

Pollination Based Optimization is one of the most significant algorithms which are derived from the concept of Bio-Inspired Algorithm. Optimization has becomes a vital problem which occurs mainly to solve the mathematical concerns in all of the engineering branches. It primarily means to find out the best possible or desirable resolution. Pollination is a significant segment which occurs mainly in the creation of the largest part of specialty crops. Bees play one of the most imperative liberation medium for pollen. Their movements make sure that the stigma of flower obtains the adequate pollen for the process of fertilization which has to be occurred. Speculation in pollinators is an indispensable issue to reach the potentials of many crops such as fruits. Optimization is a process which is purely natural and integrated in the real life routine of living beings. Pollination is a procedure implemented for the transference of pollen from the side of male flower which is called anther to the female portion named as stigma of a flower. Stigma is a portion of a female flower which is always showing the sticky behavior and hence for this reason the pollen gets stick to it. Self-pollination and Cross-pollination are the two main types of pollinations used in the flowers. Some flowers are intended to grow the seeds because of self-pollination process where the pollen and pistil are belongs to the same plant. This also belongs often from the similar flower. The plants which are of residual nature follow the properties of cross-pollination. In the concept of cross-pollination the pollens and pistils belongs to the diverse set of plants. In the natural phenomenon, the pollinators are put into practice to supply much significant services to the blossoming plants. The plants have to recompense with food for the pollinators and their progenies. The floral display, fragrance and nectar lure pollinators' takes to the pollination. Some of the superior species of plants optimize the nectar contained in it then display the resources and also

fragrance the generating resources. The concept of pollination basically composed of steps including the smooth process and the process which going on smoothly above and below the normal level. The condition under which the process of pollination is going on smoothly the plants spends average resources. If pollination process exceeds above the normal value then the plants diminishes expenses on the resources which are used to produce the nectar, floral display and fragrance in the flowers. If the level of pollination goes underneath the normal level, then the interrelating plants boost up their resource expenses. The success rate of pollination increases or goes high with the increase in the number of visits.

The Various Steps for Algorithm of PBO are:

Step 1: Initialize PBO Parameters.

a=1.2, A=0.9, D=1.2, N=41.9, P=2,

Number of Plants = 8,

Number of weeks = 14,

Number of seasons = 8, (number of iterations)

Pollination weekly goal= [0.10 0.25 0.50 0.75 0.90 1.00]

Step 2: Randomly generate vectors.

For season = 1: number of seasons (iterations)

For week = 1: number of weeks

For k = 1: number of plants

Step 3: Evaluate Reproduction Vector:

$$R = \frac{(A \times D)}{(\alpha + A \times D)} + \frac{\left(\frac{a}{\alpha + A \times D}\right) \times N^P}{A^P + N^P} - C(N + D)$$

Step 4: Based on R, update number of seasons.

Evaluate Error = Goal - R

Step 5: Based upon error update N, D, A

Step 6: Exit, if Error acceptable.

The flowchart showing the behavior of PBO algorithm is shown in the figure 1 which is represented as follows.

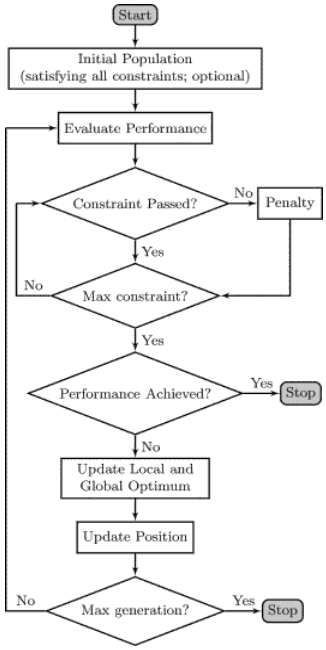

Figure 1. Flowchart of PBO Algorithm

IV. PROPOSED METHODOLOGY

In this section, the proposed methodology regarding the proposed work is explained. The whole of the work is done on the Network Simulator-2 by the implementation of DSDV and DSR protocols by using PBO algorithm.

Figure 2 shows the representation of flow of work in six steps. In step 1, the generation of environment takes place by using the NS-2 simulator software. The step 2 is used for the implementation of combined behavior of DSDV and DSR protocols. The load is being calculated in the step 3 and PBO algorithm is applied in the step 4. The route optimization takes place in the step 5 and hence at step 6 the simulations are taken out so that the performance can get evaluated.

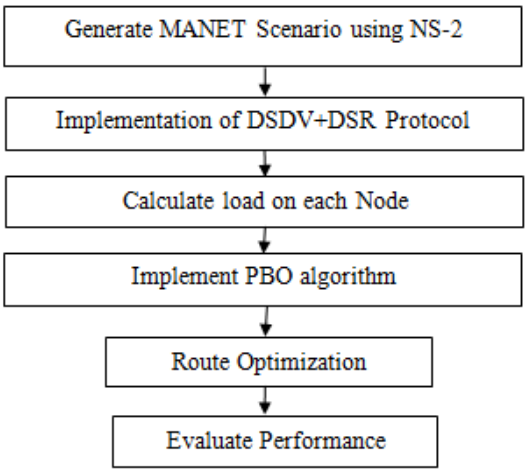

Figure 2. Flow of Work

V. SIMULATED RESULTS AND DISCUSSION

In this section, the results have been taken out by the use of DSDV and DSR protocols along with PBO algorithm. All the simulations have been done on NS-2 simulator. The parameters used for the simulation are shown in Table 1.

TABLE I

Parameters	**Values**
Number of Nodes	20
Simulation Area	1000m × 1000m
Radio Propagation Model	Two Ray Ground
Network interface	Wireless
Routing Protocols	Hybrid(DSDV+DSR)
Simulation time	100 seconds
Maximum Packet in ifq	50
Link Layer Type	Logical Link (LL) Type
MAC Type	Mac/802_11
Interface Queue Type	Drop Tail
Antenna Model	Omni Antenna
Packet Size	512b/s
Data Traffic	CBR

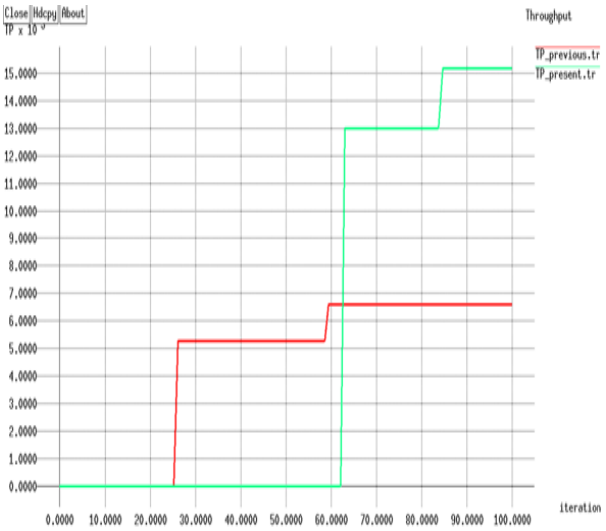

Figure 3. Throughput v/s iteration for PBO and AODVLM

Figure 3 shows the average throughput performance of PBO based hybrid protocol in contrast to AODVLM protocol. In the graph green line showing throughput for present work and red line showing throughput for previous work. The average value of throughput in proposed work is 77 kb/s which is higher than the average throughput value of previous work which was 66 kb/s. Higher the average throughput better the system. It can easily be shown that the PBO based hybrid protocol having good throughput so system is gets enhanced.

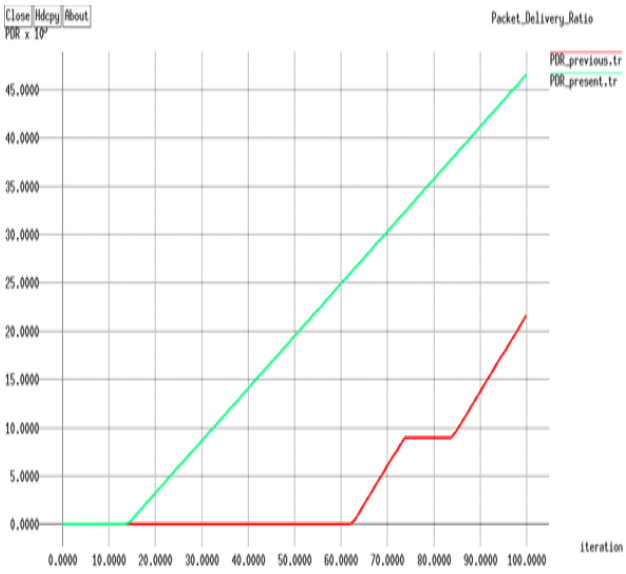

Figure 4. Packet Delivery Ratio v/s iteration for PBO based hybrid and AODVLM

Figure 4 shows that the average PDR performance of PBO based hybrid protocol which shows the better results than that of AODVLM protocol. In above graph green line shows PDR for present work and red line showing PDR for previous work. The average PDR in proposed work is 94% which is higher than the average PDR in previous work which was 91%. Maximum the PDR better the system. In graph PBO based hybrid protocol having maximum PDR so system is gets enhanced.

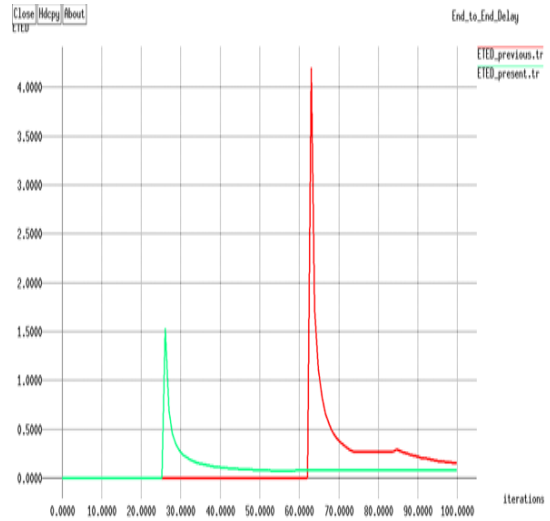

Figure 5. ETED v/s iteration for PBO based hybrid and AODVLM

Figure 5 demonstrates the overall end to end delay is less in PBO based hybrid protocol as compare to AODVLM protocol. In this graph green line showing End to End Delay for present work and red line showing End to End Delay for previous work. The average value of end to end delay in proposed work is 5ms which is less than 7ms that was the average value of previous work. Minimum the delay betters the system. In the graphical representation, the PBO based hybrid protocol shows the minimum delay which results in enhancing the system.

The result of the Jitter Factor that is shown in the figure 6. Figure shows that the Jitter Factor value of PBO based hybrid protocol is lesser than AODVLM protocol. Here, red line is for AODVLM and Green line is for PBO based hybrid protocol and green line showing that jitter with PBO based hybrid protocol having lower value which shows that PBO is better. The average jitter value of PBO based hybrid protocol is 12ms which is less than the average jitter value of AODVLM protocol that was 19ms.

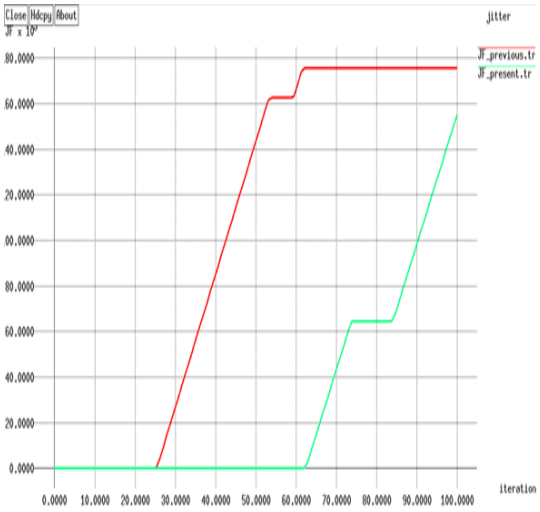

Figure 6. Jitter v/s iteration for PBO based hybrid and AODVLM

VI. CONCLUSION AND FUTURE SCOPE

In this section, we can conclude that the proposed work works in the way to enhance the routing strategies so as to improve the behavior of MANETs. The protocols DSDV and DSR both get integrated to each other and give rise to hybrid protocol behavior. The proposed protocols then again used with PBO algorithm which helps in increasing the throughput of whole of the network by minimizing the congestion and contention. The proposed work along with PBO algorithm can be get extended in the field of various applications like 802.16 as well as Wireless Sensor Networks.

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