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Navdeep kaur
M.Tech (CSE) Guru Kashi University, Talwandi Sabo, Bathinda, Punjab, India

Dinesh Kumar
Associate Professor & Head Department of CSE Guru Kashi University, Talwandi Sabo, Bathinda, Punjab, India

Correspondence:
Navdeep kaur
M.Tech (CSE) Guru Kashi University, Talwandi Sabo, Bathinda, Punjab, India

Modified Bio Inspired Technique to Improve Performance of MANETs

Navdeep kaur, Dinesh Kumar

Abstract
The nodes in the mobile ad hoc networks are also equipped with limited batteries. These networks most often use the reactive protocols, which require broadcasting process. Most of their batteries are consumed in the process of flooding the RREQ packets to find route to destination node. Therefore, preserving their batteries for longer time is the requirement. This paper presents hybrid bio inspired routing technique to optimize the performance of the network. Ant colony optimization along with firefly algorithm is used to find the optimal path. The scheme was implemented in NS2.35. The performance was computed on the basis of packet delivery ratio, remaining energy and routing overhead. These parameters showed an improvement over the existing scheme.

Keywords: MANETs, bio inspired packet delivery ratio, routine overhead, and firefly

Introduction
Mobile Ad hoc networks (MANETs) are mix of mobile nodes without presence of any brought together control or previous foundation. Such sort of networks for the most part utilize multi-hop ways and wireless radio communication channel. Therefore, communication between nodes is set up by multi hop routing. Likewise, new nodes join or leave the network whenever. Owing to the dynamic nature, topology is frequently evolving. Consequently, execution of network disintegrates quickly. In this way, the advancement of a safe routing convention is a basic concern. Ad hoc is a sort of exceptional wireless network mode. An ad hoc wireless network is a gathering of at least two devices linked with wireless correspondences and networking ability. Such devices can speak with another gadget that is quickly inside their radio range or one that is outside their radio range not depending on get to point. A wireless ad hoc network is self-sorting out, self-restraining, and self-adaptive.

Firefly Algorithm
Firefly algorithm is a current meta-heuristic established by Yang that has been used to explain optimization difficulties [8]. An evolving swarm intelligent procedure exploits bioluminescence activities of fireflies in nature. A firefly in the exploration space interconnects with the neighboring fireflies/prey using its brightness, which affects mate selection and prey desirability. The possible use of this procedure for defining the shortest route in a network has been taken into consideration by many authors in the past. The application of firefly procedure for the network optimization problem to decide an optimal pathway from a source node to a destination node has been presented as following:
A. Firefly's Performance in nature displays societal performance that uses combined intellect to achieve their crucial actions like species acknowledgement, foraging, self-protective mechanism and mating. A firefly has a superior style of communiqué with its bioluminescence [45]. The light configuration of the firefly indicates the swarm with info about its species, position, attractiveness, etc. The two imperative properties of the firefly's flashing light are as follows:

i. Brightness of the firefly is proportional to its attractiveness
ii. Brightness and attractiveness of pair of fireflies is inversely proportional to the distance between the two.

These properties are accountable for brightness of fireflies which pave manner to converse with each other. This communiqué characteristic of fireflies can be used to

resolve shortest route finding issue in network optimization.

Literature Survey

Hridya V Devarajet. al., [2016] proposed ECDSR convention. To increase the lifetime of the network, routing must be energy efficient. Routing conventions like DSR, ESDSR, ECDSR, AODV, TORA, EEAODR, and EPAR are proposed for MANET. Outline of energy efficient routing convention is the key issue for mobile ad hoc networks. ECDSR convention chooses nodes on the premise of minimum edge energy. As ECDSR convention has overhearing and stale course issue, which leads to parcel misfortune and over vitality utilization. In this paper author proposed the answer for address overhearing and stale course issue by suggesting change in ECDSR convention. MANET is utilized as a part of ongoing basic applications. [1].

W. K. Kuoet. al., [2016] investigate EE optimization as measured in bits per Joule for MANETs in light of the cross-layer outline paradigm. They show this issue as a non-arched blended integer nonlinear programming (MINLP) definition by jointly considering routing, activity scheduling, and power control. Since the non-raised MINLP issue is NP-hard by and large, it is exceedingly hard to all-inclusive upgrade this issue. They, in this way, devise a modified branch and bound (BB) calculation to productively take care of this all around ideal issue. The oddities of our proposed BB calculation include upper and lower bounding plans and branching standard that are composed using the qualities of the nonconvex MINLP issue. Numerical outcomes demonstrate that our proposed BB calculation plot, individually, diminishes the optimality hole 81.98% and increases the best achievable arrangement 32.79% contrasted and the reference calculation. Besides, our outcomes not just give insights into the plan of EE amplification calculations for MANETs by employing cooperation between various layers additionally serve as execution benchmarks for distributed conventions produced for genuine applications [2].

Mohammed Aashkaar and Purushottam Sharma [2015] proposed an improvement in an AODV convention, which is an upgrade in the current AODV convention. The convention computation, which is gotten by Energy Efficient Ad Hoc Distance Vector tradition (EE-AODV), has upgraded the RREQ and RREP taking consideration of system to save the essentialness in phones. In this paper AODV convention is executed by using 30 nodes. The goal of this paper is to quantify the efficiency of protocol at 30 nodes. The execution estimations used for evaluation are conveyance proportion, throughput, framework lifetime and typical energy expended. The recreation will be done using NS2 [3].

Sushilet. al., [2014] presents routing protocols in terms of energy efficiency for Mobile Ad-Hoc Network (MANET). Since the nodes in MANET are mobile, the routing and power administration get to be distinctly basic issue. Constrained power supply is the greatest test of an Ad-hoc network so in the event that we need to build the network lifetime (time span when the main node of the network comes up short on energy) to the node lifetime then we should have an effective energy administration protocol. An Ad-hoc routing protocol meet every one of these difficulties to give the normal execution for each situation. Medium Access Control (MAC) protocols significantly affect the capacity and execution of networks. At present, most MAC protocols utilize a similar transmission power when nodes send packets. The sending of the nodes is not symmetric in mobile ad hoc networks, which will bring more energy utilization and unwanted collisions [4].

Niranjan et al, [2012] presents energy efficient strategies in remote specially appointed networks, incorporating different issues and difficulties to give a major picture around there. This section addresses energy administration strategies in remote specially appointed networks, particularly in decentralized ad hoc situations. Energy efficiency is issue of worry in remote specially appointed networks as mobile nodes depend on batteries, which are restricted wellsprings of energy, and, in numerous situations, it is a difficult to energize them. In spite of the advance made in battery innovation, the lifetime of battery-powered gadgets keeps on being a key test, requiring extra research on effective outline of stages, protocols, and networks [5].

Nilamet. al., [2016] proposes an Energy Aware Routing Protocol (AODVEA) in light of AODV that incorporates nearby sending choice with node vitality edge for transitional nodes and routing in light of max min vitality calculation to expand the lifetime of the network. Likewise extend proposes Modified AODV (AODVM) which joins same nearby sending choice for middle nodes however routing depends on blend of max min vitality calculation and most limited separation [6].

Andrews et. al., [2016] proposed Mobility and Direction Aware Ad-hoc On Demand Distance Vector routing protocol (MDA-AODV) intends to deal with the versatility and course factors in ad hoc networks. MDA-AODV guides the route revelation and route answer upon the speed of the taking part nodes and their headings. Simulator utilizing two offered options (packet-rate and CBR associations), was utilized to examine the impact and the upsides of MDA-AODV over AODV protocol. The changes come about demonstrate that the proposed plot diminishes control overhead [7].

Proposed Work

The application of firefly algorithm would require the timestamps for pair of connecting nodes in the network. If the normal firefly algorithm is applied and broadcasting is done in the entire network to formulate the timestamp table, the result is always a single path from source to destination node. Since nodes in the mobile ad hoc networks are changing their positions regularly, therefore, that single path would no longer be available.

For formulating the multiple paths, the proposed scheme will apply the ant colony optimization in the area determined by factor of spread. The factor of spread is the inverse of tangent angle formed with locations of source and destination node.Therefore, in the proposed scheme, RREQ packets will be sent to neighbors within the factor of spread area. If any node is lying outside this concerned area, then the neighbor will not be sent the route request

message. For all the nodes, which receive the route request packet, the timestamps will be calculated simultaneously. These timestamps would decide the attractiveness of the node while selecting the path.

When the route request reaches the destination node, the pheromone values for the nodes in the paths will be calculated by applying the ant colony optimization algorithm.For all the paths, the source will check on the attractiveness of the nodes in the paths, which will be obtained using the timestamps calculated in the first process. Lower the value of the timestamp would mean higher attractiveness of the nodes. Thus, that path will be chosen by the source node, which would have highest attractive nodes.

Results

The proposed and the existing schemes were implemented in NS2.35. The performance of the network was analyzed based on three parameters namely packet delivery ratio, routing overhead and remaining energy in the network.

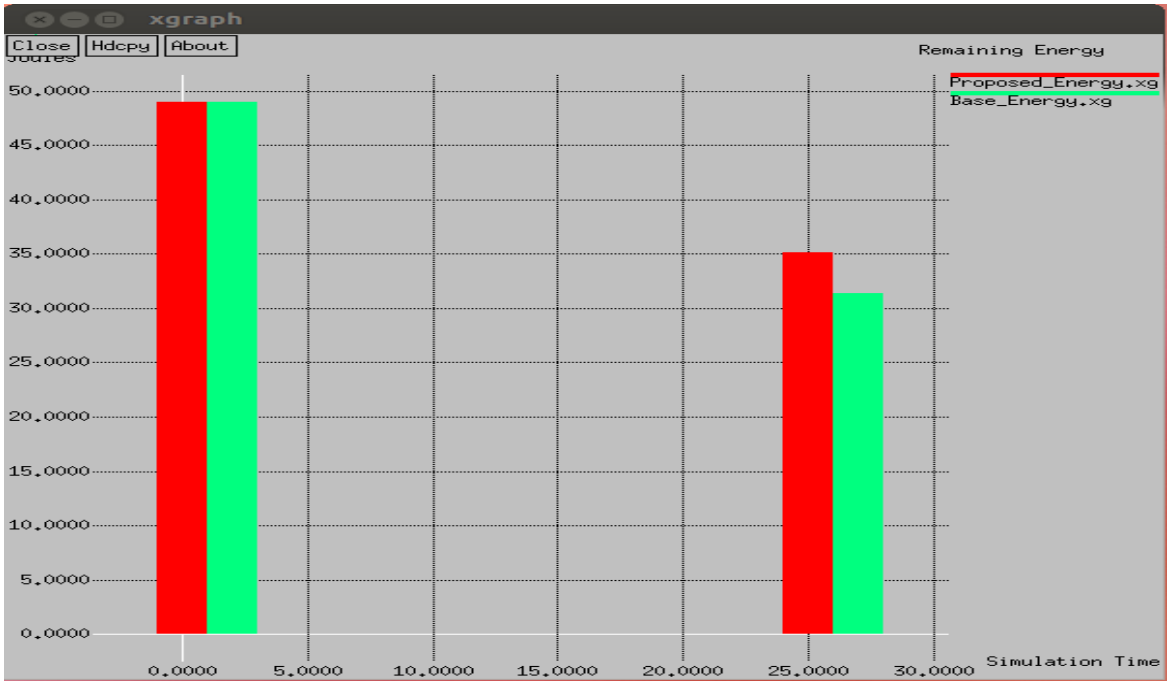

Fig. 1: Comparison of Remaining Energy

This graph shows the comparison of the average energy remaining in the network at the end of the simulation time. Initially the average energy was 49 Joules at the starting of the simulation time. At the end of the simulation, the remaining energy for the proposed scheme was 35 Joules approximately and 31 Joules for the existing scheme. Thus, it clearly indicates better network lifetime.

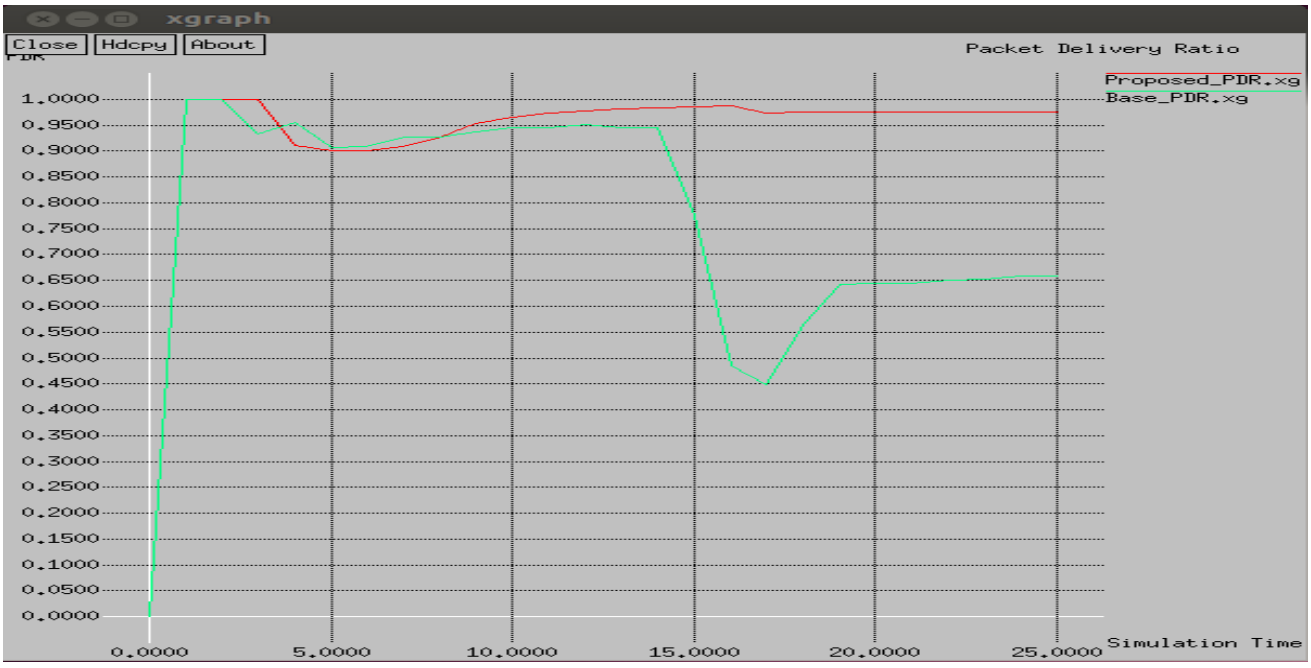

Fig. 2: PDR comparison

This figure shows the comparison of the packet delivery ratio for both the schemes. The proposed scheme has found to give better values for this parameter. The values for the proposed scheme is found to be hovering near 97 percent and for the existing scheme it was found to be near 65 percent.

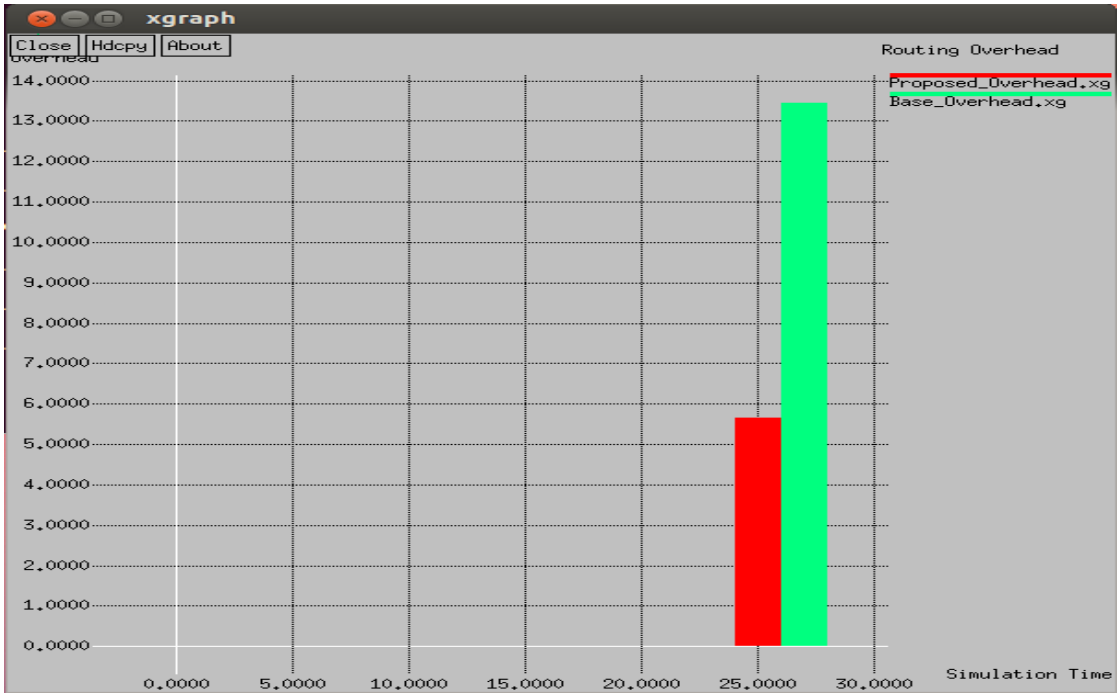

Fig. 3: Routing Overhead Comparison

The above figure shows the comparison of the routing overhead values for both the schemes. The value of this parameter for the proposed scheme was approx. 5.8, and for the existing scheme were 13.5.

Conclusion

The proposed work aimed at saving the energy of the nodes in the mobile ad hoc networks. The existing scheme requires the calculation of the timestamps for every pair of the nodes in the network. For this, initially the broadcasting is performed in the entire network and the timestamps are saved. The proposed scheme calculates the timestamps for the area defined by the factor of spread but not in the entire network.

Thus, it results in higher network lifetime. Thus, we can fairly conclude that the performance of the network has increased by using the proposed scheme.

In future, this hybrid bio-inspired modified technique can be compared against various genetic algorithms to check its effectiveness. This scheme can also be modified to detect and prevent the network against various attacks that mobile ad hoc networks are prone to.

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