IMPROVED ENERGY EFFICIENT ANT COLONY OPTIMIZATION ALGORITHM TO ENHANCE NETWORK SECURITY

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Abstract: Growing exceptionally proficient steering conventions for Mobile Ad hoc NETworks (MANETs) is testing undertaking. So as to satisfy numerous directing necessities, for example, low bundle delay, high parcel conveyance rate, and successful adjustment to organize topology changes with low control overhead, et cetera, In Mobile Ad Hoc Networks, hubs don't have settled foundation, adequate capacity, vitality to work for longer hours and radio transmission range to impart among hubs for far away separations. Likewise, conventional directing conventions come up short or don't give wanted nature of administrations required for clients in the region of sending of these hubs. These impediments have made testing issues for specialists. Various steering conventions are being proposed, yet they either come up short amid continuous usage or their execution parameters degrade. The paper aims to design hybridized ACO system consisting of the three parameter - pheromone value, residual energy of the nodes and the Euclidean distance between the node and the destination. Experimental results demonstrate that proposed technique outperforms existing techniques from various parameters.

Keywords: Mobile Adhoc network, Ant colony optimization, pheromone value, Euclidean distance,

I. INTRODUCTION

In the course of the most recent couple of decades there has been such huge development in the field of systems that it has cleared a path for a remote time from a wired one. Wireless cell frameworks have been being used since 1980s and have persistently advanced to start with, second and third era's remote frameworks. These frameworks work with the help of an incorporated supporting structure, for example, an entrance point. The remote clients can be associated with the remote framework by the assistance of these entrance focuses, when they wander from one place to the next. A wireless system is a developing new innovation that will enable clients to get to administrations and data electronically, regardless of their geographic position. Impromptu systems continue evolving progressively, which brings about unsettling influence of the system. Henceforth a need emerges to have consistent correspondence. One sort of systems where the requirement for autonomic control is inherently essential are Mobile Ad Hoc Networks (MANETs). Mobile Ad-hoc Network (MANET) is a decentralized independent remote framework which comprises of free hubs and a self-arranging capacity. Hubs can join or leave whenever. There is no settled foundation. All hubs are equivalent and there is no focal control or outline. There are no assigned switches: hubs fill in as switches for each other, and information parcels are sent from hub to hub in a multi-jump mold [1]. Hubs inside each other's radio range impart straightforwardly by means of remote connections, while those that are far separated depend on middle hubs to forward their messages. MANETs can be utilized as a part of extensive variety of future applications as it has the ability to build up systems at whenever, anyplace without the guide of any settled framework [2].

Ant Colony Optimization: The fundamental thought behind insect based directing calculation is sustenance seeking system of real ants. They review unmistakable courses as they begin looking sustenance from their home and stroll towards the nourishment. A state of ants has an extensive variety of obligations like gathering sustenance, building/guarding the home, expelling the dead ants, and so on and has straightforward coordinated correspondence. Ants utilize a synthetic substance pheromone for correspondence among them which they store on the ground while wandering around for hunt of sustenance. Ants have capacity to notice this pheromone. They can create couple of various sorts of pheromones – normally one each to mean distinctive work classifications like gathering sustenance trails, implying crisis, moving dead ants, and so forth. The wellspring of ACO is the pheromone trail laying and following conduct of ants which utilize pheromone as a correspondence medium.

There are chances that when ants fan out to discover nourishment, any insect finds a short way to another sustenance source. It at that point takes some nourishment with it and advances back to the home. Since it is pulled in by its own particular pheromone trail, it is likely that the subterranean insect takes after its own way back to the home, consequently leaving a moment pheromone trail. In the event that different ants happened to take a more extended way to the sustenance source, they land after the primary subterranean insect and, when attempting to advance back to the home, there is a decent shot for them to be pulled in by the short way, where officially two pheromone trails have been laid. This strengthens the short way considerably more and makes it more appealing. Concerning the more drawn out way, pheromones have a tendency to vanish after some time, so over the long haul the long ways will be overlooked and all ants will take the short way. The attributes of ants are like the qualities of MANETs. This encourages us to apply the nourishment scanning qualities of ants for steering parcels in MANETs.

II. BACKGROUND

2.1Ant Agents for Hybrid Multipath Routing in Mobile Ad Hoc Networks by Frederick Ducatelle, Gianni Di Caro and Luca Maria Gambardella (2004)

This paper depicts AntHoc Net, a calculation for steering in versatile specially appointed systems in light of thoughts from the Nature-roused Ant Colony Optimization structure. The calculation comprises of both responsive and proactive segments. In a responsive way setup stage, numerous ways are worked between the source and goal of an information session. Information are stochastically spread over the distinctive ways, as per their evaluated quality. Throughout the session, ways are persistently observed and enhanced proactively. Connection disappointments are managed locally. The calculation makes broad utilization of insect like versatile operators which test full ways amongst source and goal hubs in a Monte Carlo form. The consequences of reenactment tests are accounted for in which we have considered the conduct of AntHoc-Net and AODV as a component of hub versatility, territory size and number of hubs. As per the watched comes about, AntHoc Net out performs AODV both as far as end-to-end postpone and conveyance proportion [1].

2.2A Survey on Artificial Intelligence for Network Routing Problems by HaoBai

With the expanding interest and entrance of the Internet, clients presently expect Quality of Service (QoS) and execution, in settled systems as well as in remote systems. High proficient directing is a vital issue in the present Internet. Numerous procedures have been proposed for this issue. As of late, numerous new systems utilizing Artificial Intelligence to address the system directing issues, particularly in remote sensor systems, have been proposed. This paper intends to give a review of system directing issues, the present condition of innovation and past Artificial Intelligence commitments to the issue territory [3].

2.3Mobile Ad Hoc Networks Routing Optimization Techniques Using Swarm Intelligence by Arun Kumar, Rajeshwar Singh (2011)

A productive system administration arrangement is required that are versatile and can adapt to vast, and expanding, activity volumes. Likewise, it ought to give decentralized and versatile steering methodologies that adapt to the progression of the system topology. Steering techniques are an essential part of system administration, as they affect the general system execution. This paper presents the preparatory investigations for Mobile Ad Hoc Networks (MANETs), and a rising directing advancement method roused by the organic idea of Swarm Intelligence (SI) [4].

2.4Intelligent Routing Techniques for Mobile Ad hoc Networks using Swarm Intelligence by CH. V. Raghavendran, G. Naga Satish (2013)

The paper presented the nature propelled steering calculations for MANETs got from the subterranean insect settlements and honey bee states. The paper gives a thought that SI has as of late caught much consideration in arrange steering looks into. Other than the nearness of customary methodologies, various new investigations have proposed Swarm Intelligence for MANET directing. The fundamental systems is Ant state and it ends up becoming a fascinating arrangement where directing is an issue. Subterranean insect based steering is getting more well known as a result of its versatile and dynamic nature [5].

2.5A Survey on Ant Colony Optimization Based Routing Protocols for Mobile Ad Hoc Networks by Hang Zhang, Xi Wang, Parisa Memarmoshrefi, and Dieter Hogrefe (2017)

This paper shows a far reaching overview and examination of different ACO-based directing conventions in MANETs. The fundamental commitments of this overview include: 1) presenting the ACO standards as connected in steering conventions for MANETs; 2) arranging ACO-based steering approaches investigated in this paper into five primary classifications; 3) reviewing and looking at the chose directing conventions from the point of view of plan and reproduction parameters; and 4) examining open issues and future conceivable outline headings of ACO-based routing conventions [6].

2.6An Efficient Routing Algorithm based on Ant Colony Optimisation for VANETs by Santanu Majumdar, Shivashankar, Rajendra Prasad P, Santosh Kumar S, Sunil Kumar K N (2016)

This paper proposed a bio-enlivened meta-heuristic and scientifically probabilistic procedure of the Ant Colony Optimization (ACO) where productive way foundation and data exchange can be accomplished. Way accessibility and the postpone time have been utilized for the assessment of found ways. However, here the constant ecological changes were considered and the execution was estimated as per ACO [7].

2.7Ant Colony Optimization based Modified AOMDV for Multipath Routing in MANET by Chintan Kanani, Amit Sinhal (2013)

This paper introduced changed impromptu on-demand multipath distance vector (AOMDV) for multipath directing utilizing subterranean ant colony for MANETs. For this reason, Ant-AODV is utilized for examination with Ant-AOMDV. The thought behind the working of Ant-AODV and Ant-AOMDV is that the RREQ message parcels are sent to single way if there should be an occurrence of Ant-AODV based directing and to different ways if there should arise an occurrence of Ant-AOMDV based routing. RREQ message parcels can be named as pheromone regarding standard calculation of ACO utilized by the ants. Choosing the transmission way progressively through normal refreshing of pheromone of transmission way hopes to enhance directing execution. Reenactment comes about demonstrate that Ant-AOMDV calculation beats Ant-AODV adequately as far as bundle conveyance part, ordinary steering burden and parcel drop contrasted and AODV and AOMDV. The principle objective is to decrease the directing overhead, blockage and increment the execution [8].

2.8ACODeRA: ANovelACO Based on Demand Routing Algorithm for Routing in Mobile Ad Hoc Networks by Khushneet Kaur Batth and Rajeshwar Singh (2017)

This paper proposed an ACO directing calculations named ACODeRA for steering in MANETs. Creators mimic the proposed calculation utilizing NS-2 and contrast the outcome and customary AODV directing convention. The proposed ACODeRA is multi-way routing calculation and enhances the execution parameters, for example, bundle conveyance factor. Additionally, this

paper contrasted end with end delay for AODV and ACODeRA. The proposed ACODeRA performs better to rout in Mobile Ad Hoc Networks [9].

2.9Ant Colony Optimization Based Approach for the Detection of Black Hole Attack in WANET by Er. Navdeepak Kumar, Er. Lipsa Walia (2015)

This paper implemented dynamic Source Routing (DSR) and Optimized Link State Routing (OLSR) Protocols. The goal of this paintings is to design and implement OSLR and DSR protocol with Black hole attack and prevent the system from threat the usage of Ant Colony Optimization with both protocols. The simulation is carried on MATLAB and the simulation consequences are examined on various community overall performance metrics [10].

III. PROPOSED TECHNIQUE

Because of the dynamic topology and lack of an existing fixed infrastructure, routing in a MANET has become challenging task. The studies done so far however show that number of protocols have been developed for ad-hoc mobile networks to achieve high throughput, end to end delay, delay jitter, packet delivery fraction and low normalize routing load and energy. The main aim is to find the optimize path to send the packets and further increase the lifetime of network. This is achieved by balancing the residual energy of all nodes in network. The main goal of the work is to implement energy efficient Ant Hoc net and to extend the performance.

The mobility is one of the factors that must be given importance while optimizing the route between source and destination. Furthermore, the link breakage leads to more routing overhead as the nodes have to again go for the route maintenance which requires broadcasting of the control messages again.

The four main factors to be considered in optimizing route between source and destination are as:

- Pheromone value which is stored at each intermediate node by the forward ant agents. The node having the highest pheromone level is chosen to optimize the route towards the destination.
- Residual energy of the nodes which represents the lifetime of the node. The more remaining energy a node has, the longer it will continue to be active in the network.
- Mobility of the nodes- important in optimizing the route in mobile ad hoc networks. If the highly mobile nodes are chosen while forming the route, the nodes will move away to a new place very soon resulting in the link breakage. The optimized path must contain relatively less mobile nodes in the network.
- Euclidean distance between node and destination- Fourth parameter that will be deciding the optimized route is the Euclidean distance between the nodes and the destination. The route between source and destination must be short in length.

The paper aims to design hybridized ACO system consisting of the three parameter - pheromone value, residual energy of the nodes and the Euclidean distance between the node and the destination. Further mobility has been taken into consideration and an effort has been put to enhance the developed ACO system.

The common feature in hybridized ACO and mobility driven hybridized-ACO will be the reward and penalty system.

In the hybridized ACO system, the reward penalty system is as:

- The highest pheromone value path will be rewarded with more points as compared to others.
- The path with nodes having highest residual energy levels will be rewarded with more credit points.
- The shortest path will be given more credit points.
- Reverse will follow: for the paths having less pheromone value, less residual energy and longer paths, they will penalized.

In Mobility driven hybridized-ACO the reward penalty system works same way as the hybridized ACO system with the additional factor that the path having less mobile nodes will be rewarded with more credit points.

The path with more credit points is meant as the best optimized path and chosen for transmitting the data from source to destination node. In addition to this, the mobility based hybridized-ACO will be based upon the assumption that location information of the destination is available with the source node so that it broadcasts the forward ant agents only towards the destination node rather than broadcasting in every direction.

IV. EXPERIMENTAL RESULTS

The proposed system has been implemented using NS2. Network Simulator (Version 2), widely known as NS2, is simply an Open-source event-driven simulation tool that has proved useful in studying the dynamic nature of communication networks. Simulation of wired as well as wireless network functions and protocols (e.g., routing algorithms, TCP, UDP) can be done using NS2. It has various standards and features including collection of various protocols at multiple layer - Ad-hoc Routing (DSDV, DSR, AODV), MAC(802.11, 802.3, TDMA) and Visualization tool (NAM), Tracing etc.

Results of proposed technique is evaluated on the basis of various parameters:

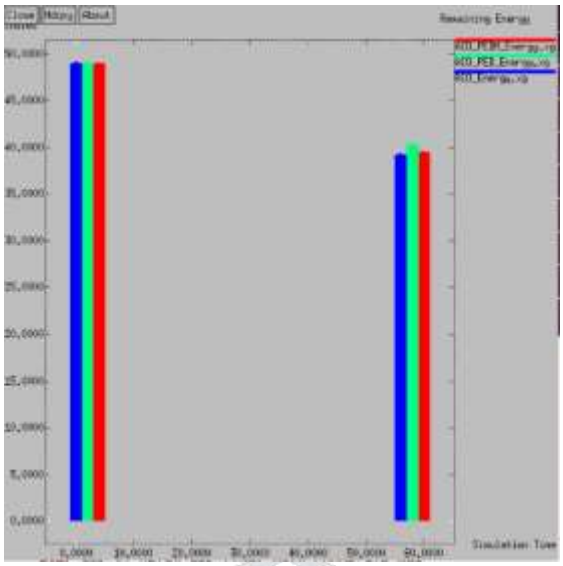

Figure 1: Comparison of proposed technique with existing techniques on the basis of remaining energy

Remaining energy is the estimation of the energy left from the total energy of the network. Above figure shows the comparison of proposed technique with existing techniques on the basis of remaining energy. It is clear from above figure that remaining energy of the proposed technique is more than that of existing techniques.

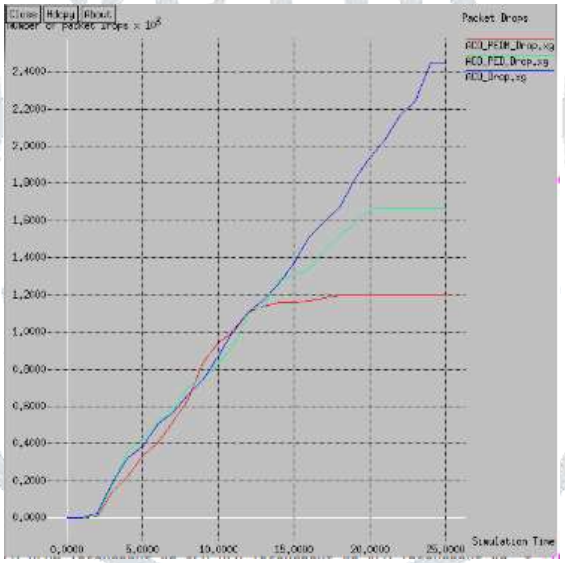

Figure 2: Comparison of proposed technique with existing techniques on the basis of packet drops

Above figure shows the comparison of proposed technique with existing techniques on the basis of packet drops. It is clear from above figure that proposed technique drops fewer packets than existing techniques.

Table 1: Showing comparison of proposed technique with existing techniques on basis of packet drops

Simulation times (ms)	Packet Drops		
	PEDM-ACO	PED-ACO	ACO
5.0000	0.3500	0.3800	0.4100
10.0000	0.8500	0.8500	0.9000
15.0000	1.1600	1.3100	1.3900
20.0000	1.2000	1.6800	1.1800
25.0000	1.2000	1.6800	2.4500

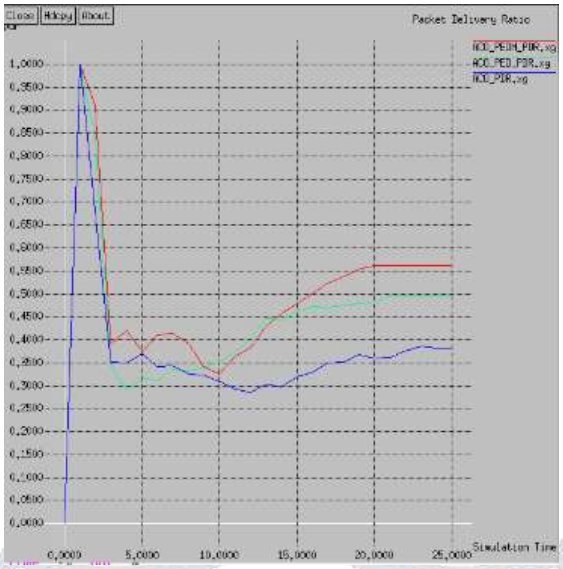

Figure 3: Comparison of proposed technique with existing techniques on the basis of packet delivery ratio

Above figure shows the comparison of proposed technique with existing techniques on the basis of packet delivery ratio. It is clear from above figure that proposed technique has more packet delivery ratio than existing techniques.

Table 2: Showing comparison of proposed technique with existing techniques on basis of packet delivery ratio

Simulation times (ms)	Packet Delivery Ratio		
	PEDM-ACO	PED-ACO	ACO
5.0000	0.3700	0.3200	0.3600
10.0000	0.3300	0.3500	0.3100
15.0000	0.4700	0.4600	0.3200
20.0000	0.5600	0.4700	0.3600
25.0000	0.5600	0.5000	0.3800

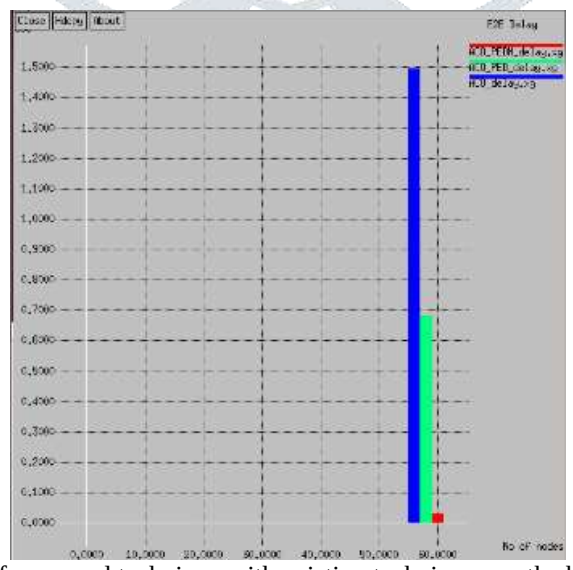

Figure 4: Comparison of proposed technique with existing techniques on the basis of end to end delay

Above figure shows the comparison of proposed technique with existing techniques on the basis of end to end delay. It is clear from above figure that proposed technique has less end to end delay than existing techniques.

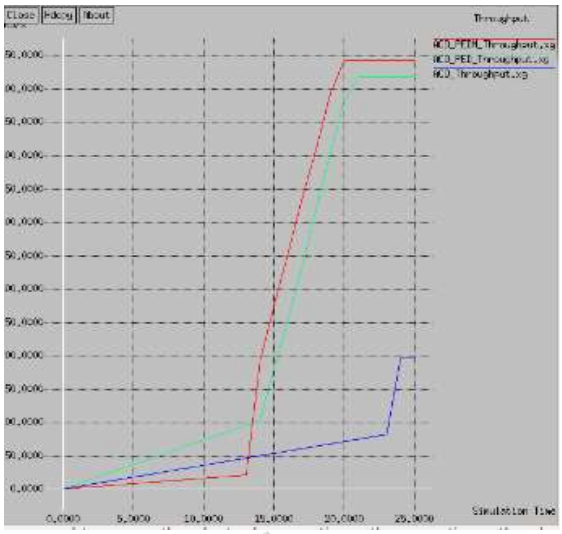

Figure 5: Comparison of proposed technique with existing techniques on the basis of Throughput

Above figure shows the comparison of proposed technique with existing techniques on the basis of throughput. It is clear from above figure that proposed technique has more throughput than existing techniques.

V. CONCLUSION

This research work design the energy efficient and Quality of Services Parameters-ACO algorithm. The main goal of the work is to implement energy efficient Ant Hoc net and to extend the performance. The paper aims to design hybridized ACO system consisting of the three parameter - pheromone value, residual energy of the nodes and the Euclidean distance between the node and the destination. The proposed system has been implemented using NS2. Results of proposed technique is evaluated on basis of throughput, number of packet drops, packet delivery ratio, end to end delay, and remaining energy. Experimental results demonstrate that the proposed technique gives better throughput, packet delivery ratio, remaining energy and less packet drops & end to end delay.

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