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Analysis of swarm intelligence algorithms for mobile ad hoc network: Survey

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Abstract - Mobile ad hoc network is a self independent, self configured network which provides the connectivity without the help of physical media. It is based on the mobile nodes and wireless fidelity. In this network all nodes are dependent on each other to transmit the data packet. The main issue in the mobile ad hoc network is the security. It is vulnerable due to the network connectivity. There are many meta-heuristic or swarm intelligence techniques which is used to configuration, route minimization and routing analysis in ad hoc network. In this paper we analyze the different swarm intelligence algorithms which are used in the mobile ad hoc network and compare these algorithms with respect to their characteristics.

Key Words: MANET, PSO, Artificial Bee Colony, Ant Colony Optimization, Bacteria forging, Swarm Intelligence

1. INTRODUCTION

Swarm Intelligence (SI) is a novel conveyed worldview for the arrangement of difficult issues taking knowledge from biological models, for example, states of ants, honey bees, and termites, schools of fish, herds of winged creatures [7]. The most fascinating property of SI is the inclusion of numerous people that cooperate with one another and nature, display an aggregate clever conduct, and can take care of complex issues. Despite the improvement in execution, such frameworks are generally significantly more versatile, adaptable and strong than those dependent on a solitary, exceptionally proficient, operator. Because of the versatile and dynamic nature of MANETs, the swarm intelligence approach is viewed as a abundant structure worldview to explain the routing and the IP address auto-design issues.

2. VARIOUS SWARM ALGORITHMS

2.1 Particle swarm optimization (PSO)

Particle swarm optimization (PSO), created by Eberhart and Kennedy, is a populace based optimization device which imitates the social conduct of species that live as swarms in nature. These swarms are equipped for trading significant data, for example, sustenance areas in the natural surroundings. Like a hereditary calculation, PSO has a populace of arbitrarily instated competitor arrangements. Unique in relation to developmental calculations, swarm particles don't mate nor change to make posterity. Rather, they swarm, utilizing singular speed vectors, over the pursuit space while speaking with others in their neighborhood (the social factor) and utilizing the data from their very own best situations previously (the insight factor). The estimations of their positions are assessed by the goal work. The particles "live" perpetually, that is, there is no creation or expulsion of particles during the optimization. A heuristic way to deal with dynamic optimization is relied upon to find and track the changing ideal at each time step. PSO is particularly appropriate for tackling dynamic optimization issues because of its ability in controlling populace decent variety and assembly.

Algorithm phases

Initialization phase
Calculate fitness function
Update particle positions

2.2 Ant Colony Optimization (ACO)

In the 1990's, Ant Colony Optimization was presented as a novel nature propelled strategy for the arrangement of hard optimization issues [10]. Ants, in the same way as other social bugs, speak with one another utilizing unstable synthetic substances known as pheromones, whose bearing and force can be seen with their long, versatile antennae. The expression "pheromone" was first presented by Karlson and Lüscher, in view of the Greek word pherein (intends to move) and hormone (intends to animate). There are various kinds of pheromones utilized by social creepy crawlies. One case of pheromone types is caution pheromone that squashed ants produce as an alarm to close by ants to battle or get away from perilous predators and to secure their colony. ACO, being a multiagent has a methodology that reproduces the scavenging behavior of ants for taking care of troublesome combinatorial optimization issues. ants store a substance, considered pheromone on the ground and structure a pheromone trail. Ants smell pheromone while picking their direction; they will in general pick, with high likelihood, ways set apart by solid pheromone fixations (shorter ways). Likewise, different ants can utilize pheromone to discover the areas of nourishment sources found by their home mates. Truth be told, ACO reproduces the optimization of ant scavenging behavior.

ACO algorithm phases

Initialization
Solutions generation
Procedures
Pheromone update

2.3 AntNet

The first ACO routing calculation, AntNet was intended for wired packet-switched networks. It is a proactive calculation where every node occasionally sends a forward ant to an irregular goal. The forward ant records its way just as the time expected to land at each middle of the road node. The planning data recorded by the forward ant, which is sent with a similar need as information traffic, is come back from the goal to the source by methods for a high need in reverse ant. Each middle node refreshes its routing tables with the data from the retrogressive ant. Routing tables contain per goal next-jump inclinations so quicker courses are utilized with more noteworthy probability. The calculation displays various intriguing properties which are likewise alluring for MANET: it can work in a completely appropriated way, is exceptionally versatile to network and traffic changes, utilizes portable operators for dynamic way testing, is powerful to specialist disappointments, gives multipath routing, and naturally deals with information load spreading. In any case, the way that it essentially depends on rehashed way inspecting can cause significant overhead.

2.4 Artificial Bee Colony

The Artificial Bee Colony (ABC) is a swarm based meta-heuristic that was presented by Karaboga in 2005 for improving numerical issues. It was enlivened by the savvy scavenging conduct of honey bees. The calculation is explicitly founded on the model proposed by Tereshko and Loengarov (2005) for the scavenging conduct of honey bee settlements. The model comprises of three basic parts: utilized and unwaged searching bees, and food sources. The initial two segments, utilized and unwaged scrounging bees, look for rich food sources, which is the third segment, near their hive. The model additionally characterizes two driving methods of conduct which are vital for self-sorting out and aggregate knowledge: enrollment of foragers to rich food sources bringing about positive input and relinquishment of poor sources by foragers causing negative criticism. To apply ABC, the considered enhancement issue is first changed over to the issue of finding the best parameter vector which limits a goal work. At that point, the artificial bees haphazardly find a populace of introductory arrangement vectors and afterward iteratively improve them by utilizing the methodologies: moving towards better arrangements by methods for a neighbor search system while deserting poor arrangements.

ABC Algorithm phases

Initialization phase
Employed BEES Phase
ONLooker BEES phase
SCOUTs BEES Phase
Memorize Best Solutions

2.5 Bacterial Foraging Optimization Algorithm (BFOA)

Bacterial Foraging Optimization (BFO) is an as of late created nature-enlivened optimization calculation, which depends on the foraging conduct of E. coli bacteria. Up to now, BFO has been applied effectively to some building issues because of its effortlessness and simplicity of usage. Be that as it may, BFO has a poor combination conduct over complex optimization issues when contrasted with other nature-enlivened optimization methods.

Basic algorithm structure

Intialization paratmeters
Elimination Dispersal looping phase
Reproduction looping phase
Chemo tasis loop phase
Reproduction
Elimination Dispersal probability

3. LITERATURE SURVEY

3.1 Chunlin Ji , Yangyang Zhang ,Shixing Gao , Ping Yuan, Zhe Li:

In this work, propose a changed Particle Swarm Optimization (PSO) to one clustering algorithm, Weighted Clustering Algorithm (WCA), in specially appointed systems. In the first place, reexamine the WCA to be reasonable for thickly populated territories. At that point, Divided Range Particle Swarm Optimization (DRPSO) algorithm was applied to this amended WCA optimization. The people (particles) were separated into bunches running in four neighborhood hubs at the same time, expanding the algorithm in a dispersed figuring way. Reenactment study demonstrated that our methodology is proficient and successful, particularly when the circulation of versatile hubs is thick.

3.2 Orhan Dengiz a , Abdullah Konak b, Alice E. Smith

In this paper, another model is proposed to conceptualize a self-sufficient topology optimization for portable specially appointed systems utilizing various versatile operators. A particle swarm algorithm was created to take care of the displayed dynamic optimization issue. Computational examinations indicated that the particle swarm algorithm is promising and appropriate to this issue. The PSO algorithm outflanked the MIP plan, particularly as for the arrangement time. The proposed approach, while created for dynamic topology optimization, effectively adjusts to a static situation by expanding the operator speed limitations. The static situation is helpful when clients need to improve a current

arrangement of sensors or correspondence center points previously situated in the field, or when structuring another static framework.

3.3 YongQiang Li, Zhong Wang,QingWen Wang, QingGang Fan and BaiSong Chen

To improve the unwavering quality of routing protocol in wireless ad hoc networks, a solid insect settlement calculation for double channel frameworks was proposed. In the DSAR calculation, the twofold layer component of control layer and information layer partition was built up, which decreased parcel crash and channel handoff delay and expanded system data transmission. At the same time, when the information layer had enough inactive assets, it moved the blocked routing administration over the control layer to the information layer progressively, finishing the joint planning of the twofold layer system and decreasing the congestion rate. Besides, the dependability forecast system was proposed, which improved connection unwavering quality and decreased the likelihood of routing restart. Likewise, for the dynamic difference in topology in ad hoc networks, the subterranean insect state calculation was utilized to adapt the dynamic changes of system topology.

3.4 Ahmed M. Abdel-Moniem , Marghny H. Mohamed , Abdel-Rahman Hedar

In this paper, authors present a modified on-demand routing algorithm for MANETs. The proposed algorithm is based on in cooperation the typical AODV protocol and ant colony based optimization. The modified routing protocol is highly adaptive, proficient and scalable. The main goal in the design of the protocol was to reduce the routing overhead, response time, end-to-end delay and increase the performance.

3.5 K.G.Santhiya , Dr.N.Arumugam

In this paper, an investigation on the presentation of the Artificial Bee Colony algorithm and Clustering techniques were made. Based on their highlights a novel versatile Artificial Bee Colony improvement structure with the cluster-based condition was proposed to give adaptability and assurances QoS by limiting the cluster support overhead by utilizing worker and Onlooker bees with hubs in the cluster. The above system can be upgraded and executed for continuous conditions.

3.6 Mustafa Tareq, Raed Alsaqour, Maha Abdelhaq, and Mueen Uddin

The abundant utilization of ABC algorithm in numerous MANET applications roused this examination to adjust a similar algorithm to improve the DSR steering convention. This investigation gives the enhancement of the current DSR steering over MANET. The proposed BEEDSR steering convention is motivated from the regular bee nourishment chasing conduct to defeat the vitality issues caused from over-burden parcel from source to goal MANET hubs. The BEEDSR steering method centers around deciding the ideal directing way. The benefit of BEEDSR is its straightforwardness; this steering convention can be effectively coordinated into existing specially appointed directing algorithms without influencing other correspondence convention layers.

3.7 Vandana, Navdeep Kaur

Author shows a hybrid routing algorithm of AODV and TORA steering conventions. The proposed convention uses both the structures where when the hub crosses as far as possible it requests else it requests TORA convention. To build up the proposed algorithm, hub disappointment or bending was additionally executed. For backup way to go revelation and choice procedure, ABC algorithm was actualized.

3.8 Preeti Gulia, Sumita Sihag

This paper investigation the presentation of BFAODV strategy in MANETs The hubs developments resembles bacteria development. The procedure is applied for location and anticipation from blackhole assault. By applying this method on MANETs show signs of improvement results than Existing MANETs conventions. This improves the exhibition as far as bundle conveyance proportion, overhead and throughput.

4. SWARM INTELLIGENCE ALGORITHM ANALYSIS

Table -1: Summary of Various Swarm Intelligence Algorithm

S.no	ATTRIBUTES	ABC	ACO	PSO	BFOA
1.	Proposed By	Karaboga	Dorigo	Eberhart & Kennedy	Passino
2.	Inspired By	Honey Bees	Ants	Species form of Swarms	E.Coli Bacteria
3.	Solutions For	Complex Problems	Combinatorial optimization problem	Dynamic Problems	Engineering Problems

4.	Optimization tools	Foraging behavior of Honey Bee	Ant Foraging	Population Based	Bacterial Foraging
5.	Advantages	Explore local solutions	Guaranteed Convergence	Quality Solution	Global Convergence
6.	Drawbacks	Maximum objective function evaluation	Difficult theoretical analysis	Stochastic Variability high for some problem	Vulnerable to local extreme perception

5. CONCLUSIONS

The swarm intelligence algorithms are the metaheuristic algorithms which inspired by different nature insects, animals, birds, fishes etc. the swarm algorithms are employed on artificial intelligence. They deals different combinatorial and dynamic problems. Numerous applications, for the most part with regards to wireless networks, conveyed processing and mechanical technology are these days being structured utilizing Swarm intelligence. The essential thought behind this worldview is that numerous undertakings can be all the more productively finished by utilizing various basic self-ruling operators rather than a solitary advanced one.

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