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Ant Colony Optimization Technique

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Abstract: ACO as a man-made Intelligence (AI) based search technique mostly relies on the past search leads to order to seek out a path between the specified source and destination nodes during a MANET. Artificial ants getting used for this purpose may cause reinforcement which will consequently end in a premature convergence of the trail finding procedure which may be overcome using randomization techniques so as for deciding during route discovery. In ACO technique, a gaggle of artificial ants work collaboratively so as to seek out an optimal solution to a given optimization problem by virtue of their communication that mimics the communication behavior of real ants. An optimal path between source and destination are often achieved on the idea of concentration of pheromone deposited by the ants along the trail of their traversal.

In this paper we study and review ACO technique and various aspects related to it. Its implementation with MANET, Security issues and Concerns, various QoS based mechanisms.

Keywords: AntColony Optimization, MANET, Security, QoS

1. INTRODUCTION

Security in MANET has grown as serious concern and has come out as a vital research area. In Wireless networks, MANET's are used like a susceptible for intrusion which is for the malicious components in a wired network. In Wired network, the physical access is used to restrict the access to the network infrastructure which reduces the risk of intrusions. However, the ideas to physically secure the area don't show as much impact as limiting the access to wireless sources.
Validation mechanism is expected to avert unapproved access to the MANETs. Likewise,we have to guarantee the trustworthiness of the messages exchanged from the underlying point tothe goal. There are chances that the noxious hub could change the message and pass it on in thesystem which may either result into loss of information and at times no information is beenexchanged. Along these lines there is a need to execute security parameters so as to shieldMANETs from noxious clients [1].

1 MOBILE AD HOC NETWORKS AND ROUTING:

Route identification and route configuration are the basic functions required by MANETs in every single one routing protocols. A minimum of one route is necessary between couple of nodes. A route between any pair of nodes is identified as a prerequisite by the route identification function.Unexpected events like various kinds of host or link failure and traffic congestions within a sub network may require the invoking of route reconfiguration functions. It goes without saying that detecting such modifications in the topology of the network forms a vital part of the route reconfiguration functions.In order to estimate if all network resources are available, a separate class of resource management functions is also seen to the greatest possible extent to support certain special objectives including those in association with QoS or security. Various classification schemesare used by different authors for these basic functions of routing [9].

2 QUALITY OF SERVICE:

Distinguishing payback and adaptability for assured environments and warranted applications is provided in MANET. Providing a hard and fast infrastructure contains base stations that aren't necessary,

MANET will be positioned and secondhand ‘‘anytime, anywhere’’. Mobile ad-hoc networks would be characteristically fault-tolerant subsequently they are responsibility not to function beneath the limitations of a solid and reckless topology. To be undisputable, the configuration of such webs is in essence time certain, for the reason that of the actual datum those nodes are permissible to be mobile. Adding up and removal of nodes will happen exclusively by interactions with diverse mobile nodes; no diverse outfit is disturbed.

QoS intends to obtain a particular network behavior in order to aggregate better the facts that can be implemented through the network, and the assets can be used higher. In troubled networks, there are four popular

standards for QoS, namely bandwidth, variance delay, and packet loss. Within the coverage area of MANET, the amount of electricity may be entered.

In Physical networks, there are widely used QoS models: IntServ (Compact Presentations) that provide QoS, but with low scalability and DiffServ (mixed services) used within the Internet. Unfortunately, each one is not suitable for MANET because of its specific features. When the QoS version for MANETs is designed, consider the exact capabilities of ad networks on mobile devices.
In particular, skills such as dynamic societal topology, limited bandwidth, and limited contract power make MANETs almost apparent. Because of this, it is not always possible to use traditional QoS models for wired networks. The design also had to take into account the fact that many MANETs were connected to the system.

3 CHALLENGES OF QOS IN AD-HOC NETWORKS:

Frequent Topology Changes: WSN topology often changes because of the wireless signal fading, low power, and hardware failure.

Resource limitation: WSN consists of SN with small hardware configurations and energy resources. For example, the MICAz sensor node [2] is combined with AtmelATmega128L controller with programmable flash memory of 128KB and 4K EEPROM, 512KB flash memory, IEEE 802.14.5 radio frequency Transceiver, and power supplied by two AA batteries.

Remote deployment: WSN is often deployed in remote and hostile environments, such as nodes prone to physical capture and reprogramming by anyone arriving in the publishing area.

Lack of tamper proof bodies: In general, (Sensor Nodes) SNs is not coated with evidence of tampering Bodies to provide manufacturing costs. It leads to the intruder to pick up physically and Handle the code from the node.

Unreliable Channel

The biggest problems that arise due to unreliable wireless channel are bit errors. Higher bit errors occur due to wireless channels which in turn lead to better interference, thermal noise, multipath fading effects, [V. Violet et. al., 2015] which further leads to low packet delivery ratio.
A leakage of the information into the surroundings may also occur in case of MANETs because the medium is completely wireless.

Route Maintenance

There can be difficulties in maintenance of network state information because of the dynamic network topology and altering behavior of the medium to communicate in wireless channels. The common routing paths can be easily broken during data transfer. Hence, there is a need to maintain and reconstruct routing paths with minimal overheads and delays. Reservation of resources at intermediate nodes is also required by QoS aware routing. A change in topology makes it difficult to maintain the reservation.

Node mobility

We need to update the topology information frequently to give routing to reach the final destination because we are using mobile nodes i.e., they move independently and randomly at any way. This also results in low packet delivery ratio [S. Tanwar et al., 2015].

Power Constrained Operation

When compared with the nodes present in the wired networks, mobile nodes in MANETs are usually power constrained. QoS might quickly drain the node's power because they consume great power due to overhead from mobile nodes.

Channel contention

To provide the configuration, the painter nodes communicate with one another on a standard wireless channel. But, the matter of interference and channel continues competition to exist. We will use the TDMA primarily based system wherever all nodes might transmit at a predefined time or might try worldwide clock synchronization during a peer to see communication. Lack of a central management doesn't approve these. We tend to might use a unique band or a separate code like CDMA for every transmitter that needs each a distributedchannel choice mechanism and also the

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dissemination of channel info [Ping Duan, Yong AI, 2016] as another choice.

Security

Security is additionally one in all the foremost vital attributes of QoS. The physical medium being insecure medium for communication, it's vital to style security routing algorithmsfor such networks.

4 ANT COLONY OPTIMIZATION (ACO):

The basic concept of ant colony is based on ants feeding behavior. Many ants can also travel through special routes to a symmetrical food supply. Ants, which travel shorter routes, improve the direction of more pheromones that help other ants to comply. This quick stimulus behavior determines the shortest direction. Ants are self-sufficient traders who interact through indirect communication known as stigmatization. Stigmergy is a slanted form of verbal exchange as retailers move away from indicators in the vicinity and other traders are aware of their behavior. This kind of conversation is local so easy Retailers interact locally without global statistics.

Intelligence Squadron is the ACO rule group that respects the behavior of ants to solve complex problems through collaboration. Ants do not want any direct verbal exchange of the solution process, as an alternative to talking about stigma (Singh et al., 2012). Pheromones provide a form of slant communication between ants, allowing them to identify the shortest path between the penetration and food area (Singh et al., 2012).

Pheromone, an explosive actinine, is the main channel used to create the shortest colony-based orientation. The ants that move along the passage, which is located between the burrow and the meal source, are placed down on the pheromone, preferably traveling next to the passage with greater density than the pheromones (Yong AI et al.,2016). The use of mobile resellers and stigma in ant colony mechanisms offers more advantages in terms of scalability, fault tolerance, node mobility and link breaking.

In the colony of ants, the characteristic of the agent was parallel. ACO is currently applied in packages, along with graphics coloring problems, scheduling problems, roaming vendor problems, community routing problems, clustering, robots, etc. (Sharvani et al., 2012). On the other hand, one of the complexities with the ant colony mechanism is the use of many constraints that repeatedly cause the guiding problem to be observed (Debajit Sensarma 2013). The depth of pheromone was reduced in all non-ideal ways due to the problem of fumarum fumigation. These strategies are used to control unmanned vehicles, to map the planets and to solve the various problems of harmonic improvement.

Some features specifically required in MANET, providing load balancing and multi-cycle routing, the durability of the decomposition factor, the use of dynamic path samples, and high adaptability with network differences, are conventional in the entire routing algorithms based on the ant. Therefore, flow safety may progress proportionately according to the movement's participation, which also contributes to a very good response. Based on this term, an ant colony improvement approach has been converted into a design that performs ACO repeatedly so that the person can obtain the best affinity solution.

5 ANTS Behavior and Communicating Networks

Stigmergy :

Behavior is linked with interaction amid individual ants and the environment. Many cases involve use of stigmergy. Stigmergy refers to indirect communication via the environment. Only the local stimuli are communicated by the ants.Ants can change those stimuli and this guides the future behaviour of ants at the location.

Environmental change is either via change in physical characteristics or through congestion avoidance telecommunication networks. It is influenced according to the shortest route to the food or the way they choose food source of varied values.

Artificial ANTS

Artificial ants or agents are used by ant-based routing algorithms. Such agents have similar possibilities as real ants:

- Availability of memory to remember the route.
- Capable to deposit pheromone as per the quality of produced solution. Like quality of ant’s path.
- Are not completely visions-less? Helps to solve shortcut problem.

A scenario is prepared to reflect on behavior of artificial ants considering case of connected network where all nodes can be accessed by other nodes.

6ANTNET ROUTING:

Pheromone tables are used to store routing information which are used in the algorithms known as ACO routing algorithm. The data packets are forward and controlled in stochastic manner, with the help of pheromone tables. Link failures are allocated to the reactive mechanism, for example repair of the local route or by using warning messages.

Now below we are discussing the routing of Ant Net working algorithm. In this routing the pheromone tables are used, in which information are well organized, which is also used in ACO routing algorithm which is already described Ant Net.

It is a routing which is based on agent which influenced the real ant behavior. Which find the path which is optimal from selecting random destination pair from different source.

When learning about the network, it updates and constructs the statistical model and probabilistic routing tables of local traffic nodes. And these tables provide exchange of information within in other there are two types of algorithms are used they are as follow forward and backward ant which uses for collecting statistics of network and for updating of routing able.

And each of these nodes contain two kinds of queues they are low and high priority. In which data packet and which forward ant which uses for low priority queue and of high priority contain backward ant and further forward ant also uses the highly priority queues.

Therefore,

Forward Ant are used for gathering information about the network state
The backward Ant collects information the router of routing tables adapts their path
.
The routing tables of the router of Ant Net contain the destination of the entire interface and eachof the interfaces has all the probabilities. Which indicate that whether the link in current circumstances. These routers contain a model which contains a variance and means which provide a trip time to reach the destination in the table of routing.

To overcome from the problems of blocking network we have to change some of the energy providing parameter or by changing the mobility of the Ant -colony optimization which is the better version of ACO which found a optimal interface outgoing which compare and identify only a single path, overload traffic connects to other favored connections.

Therefore, the throughput of the system will be made strides and the problem ofstagnation will be refined, which will distribute to explore a new for providing higher forbetterment part and for the topology of the network which provide higher throughput by settingchanges frequently.

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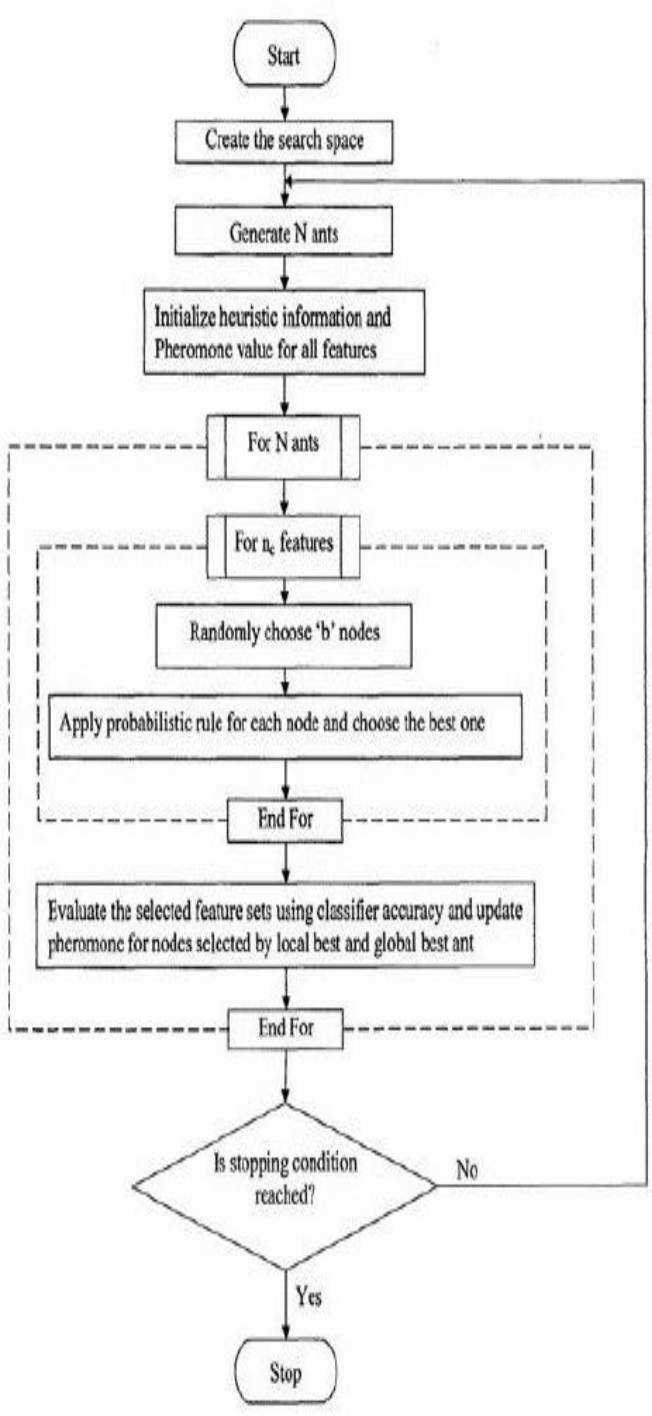

Figure: General ACO Framework

CONCLUSION

In this paper, we have studied about Ant Net Algorithm, various security aspects, general frame work of Ant Colony Optimization technique, Protocols and routing behavior, etc.

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