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Optimal Route path Discovery in Wireless Sensor Network by Amended Ant Colony Optimization

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Abstract: Ant colony optimization (ACO) is a technique for optimization that was introduced in the early 1990's. The inspiring source of ant colony optimization is the foraging behavior of real ant colonies. This behavior is exploited in artificial ant colonies for the search of approximate solutions to discrete and continuous optimization problems and to important problems in telecommunications, such as routing and load balancing. We proposed on some of the advancements occurring in the domain of ant colony optimization and provides a possible classification based on the developments that took place. The merits of the advanced ACO algorithms as well as their applications are also discussed.

Keywords: ACO, WSN, Pheromone, Optimal path, AACO.

I. INTRODUCTION

Wireless sensor network is a very important part of day to day of a person. WSN provides interconnection between environment conditions and the internet [11]. The wide range of application of WSN include weather monitoring, structural health monitoring, vehicular telematics, biomedical signal monitoring, green house monitoring and tracking etc [10].

The WSN is dynamic in nature. WSN also undergoes several limitations i.e. lifetime, limited computational power, memory size, hardware failure, harsh environment conditions and security issues [3, 11].

The main goal is focused on lifetime of the network in WSN. This can be achieved by using Ant Colony Optimization technique in WSN. ACO is a bio-inspired probabilistic technique and a part of Swam Intelligence [8]. ACO works on pheromone trail laid by ants while finding food. The pheromone concentration of the extremely travelled path is high. It is mostly the shortest path [9]. ACO takes the pheromone trail as an information source which probabilistically constructs the solution for various complex computational problems [4].

ACO contain two different types of ants classified as: Forward Ants (FANTS) and Backward Ants (BANTS). FANTS are hurled by sender to the network. They probabilistically selects the next node .They gather information such as number of nodes required to reach destination, remaining energy of nodes [2]. FANTS turn into BANTS at destination. BANTS use the information gathered by FANTS and travel in reverse path [6].

Ant Colony Optimization has basic three phases i.e. route discovery phase, route maintenance phase, route failure handling phase. Route discovery phase uses control packets which are basically FANTS and BANTS to find route between sender and receiver. They both are similar in structure but have different work. Route maintenance and route failure phase deals with problems which may appear during data transmission. Route maintenance phase deals with congestion, weak signal strength and route failure phase provides an alternate path in case of route failure [8].Initially Ant System(AS) was proposed. It was completely focused on finding shortest path and providing solutions to solve travelling salesman problem. The next system was Ant Colony System (ACS). It was the first bio-inspired systems which further lead to Ant Colony Optimization. ACS only compute the best solution and was effective as it avoid long convergence time by directly concentrating the search to the best tour found up to current iteration.

II. LITERATURE SURVEY

M. Umadevi and Dr. M. Devapriya proposed an Enhance Ant Colony Optimization (EACO). EACO focused on usage of critical node i.e. the node having less energy. EACO had three levels i.e. dense network, critical node scenario and affiliation request. EACO only preferred the dense network i.e. network with high pheromone concentration. In critical node scenario, critical node only transfer data based on priority levels. The repeated request of same data packet should

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allow critical node to transfer data. Critical node needed affiliation from high energetic neighbor node to produce transaction.

Dr. V.Raghunatha Reddy and A.Rajasekhar Reddy proposed an improvement in ACO base on trust level. The technique was named as Trust Level based Ant Colony Optimization (TLACO). The trustworthy nodes were valid node for data transmission. These nodes were selected on the basis of two parameters i.e. energy and packet delivery rate. The trust level was updated in trust level table. The trust level table was maintained and continuously updated by checking the trust level from every node. Each node maintained its own table. The trust level was calculated periodically and also overwritten in the table.

Chaganti B N Lakshmi and Dr. S.K. Mohan Rao focused on enhancing the lifetime of the network with the help of ACO. ACO contained two different types of ant i.e. forward ants (FANTS) and backward ants (BANTS). FANTS were launched by the sender to find the route for the destination. When FANTS reached at the destination, it turns into BANTS. BANTS travelled in backward direction and analysis the information collect by the FANTS. Sender analysis the information collected by the BANTS to find the optimal path.

III.PROPOSED METHOD

This work mainly focuses on enhancing the discover of finest route in WSNs from the sources node to the Base Station the optimal route path is found by intelligent ants those have some information regarding nodes in route path the amended Ant Colony optimization is used for optimal path.

A. Optimal Path Discovery

To find the optimal path among all paths that may exist from the source to Base Station. First, the source node sends ants to all neighbours, and then each ant tries to find a route to Base Station. The ants will calculate the intellectual amounts for their neighbours and the next hop based on these intellectual amounts will be selected. This step will continue until the ants are able to find a route to Base Station. If an ant could not find this route in determined time, it kills itself. After that, the Base Station makes final decisions and determines the winner ant. The winner ant returns to its route and updates the routing table and some more information for all nodes on its route. The ants are shown with RREQ and RREP messages. The proposed algorithm reduces the network bandwidth usage and decrease the amount of energy consumption because each node needs energy to send the packets.

ALOGRITM: Optimal path discovery

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1: for time=1 to simulation time
2: for i=1:N, where N the number of ants that located in the network
3: for antid=1:antid ant id numberwithin the network
4: Find neighbour ant Amended Amount
5: if location (i) within the loc(antid);
6: Add i to (Amended amount); calculate amended amount with time
7:else
8:Antid kills itself
9: endif
10: end
11: end
12: end
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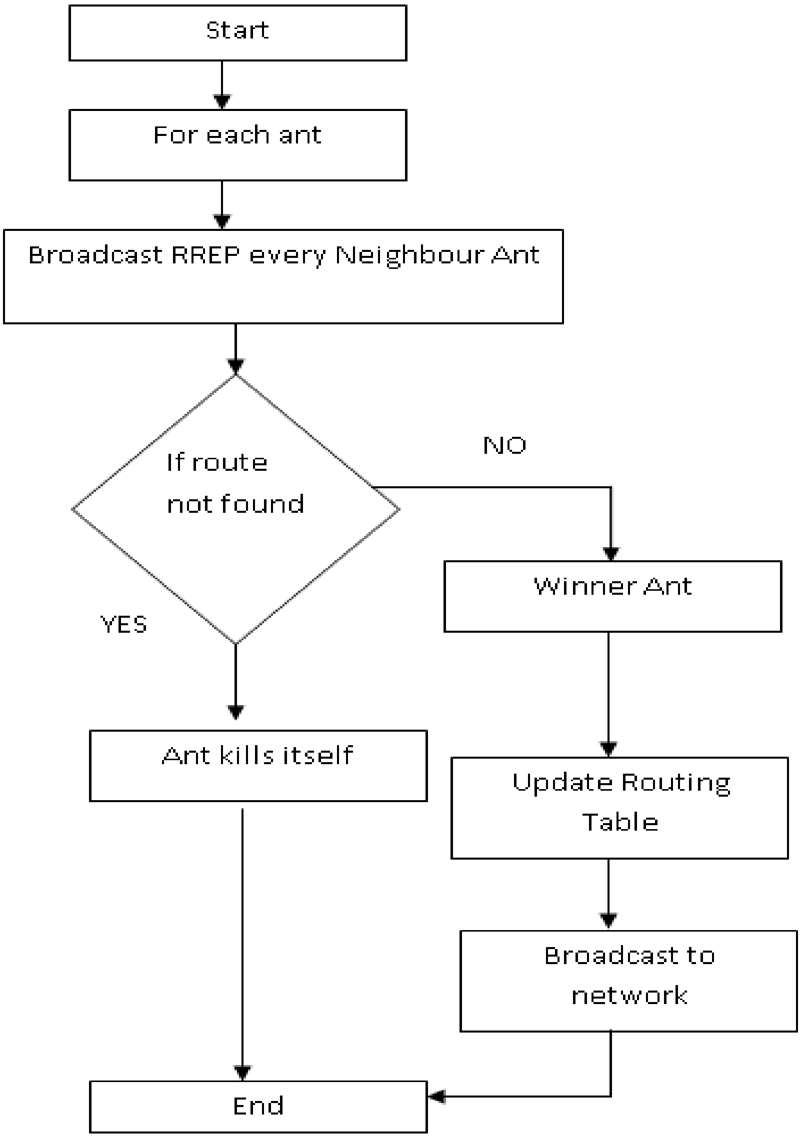

RESULT AND ANALYSIS

S. No.	Parameter	Value(s)
1	Simulator used	NS 2.35
2	Simulation Time	10 Secs
3	Simulation Area	500 X 500
4	MAC	802.11
5	Number of nodes	60
6	Speed of Nodes	2 to 16 (m/sec)
7	Mobility Model	Random Waypoint

The analysis of Throughput with Amended ACO for optimal route path discovery is shown in fig.1. and Table I.

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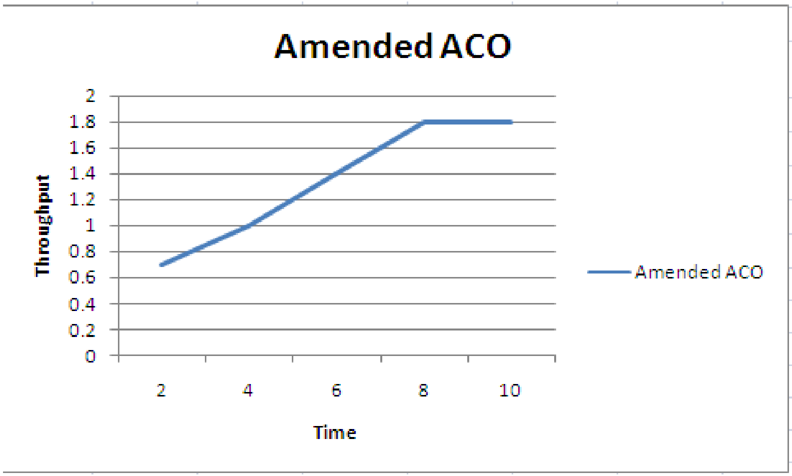

Fig.1. Throughput

Table I. Throughput

Throughput	
Time	**Amended ACO**
2	0.7
4	1.0
6	1.4
8	1.8
10	1.8

The analyses of Packet Delivery ratio with Amended ACO are shown in Fig.2. and Table II.

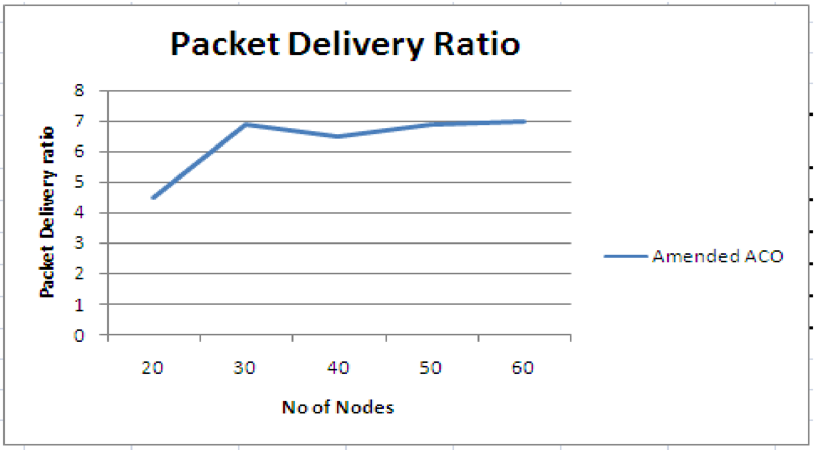

Fig.2. Packet Delivery ratio

Table II. Packet Delivery Ratio

Packet Delivery Ratio	
No. of Nodes	**Amended ACO**
20	4.5
30	6.9
40	6.5
50	6.9
60	7.0

The analysis of Jitter with Amended ACO for optimal route path discovery is shown in fig.3. and Table III.

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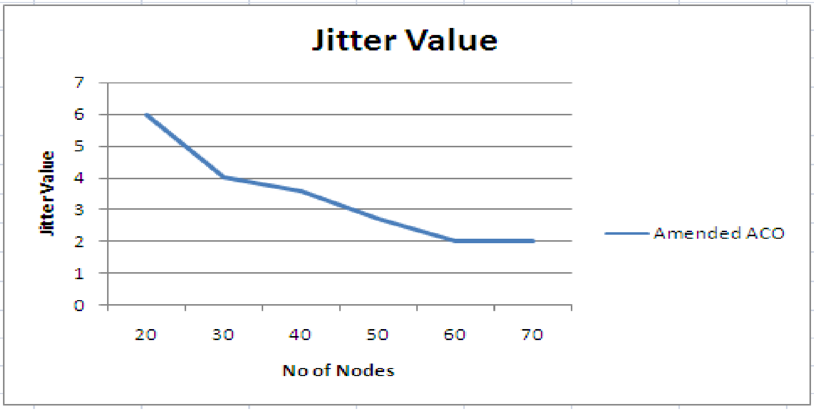

Fig.3. Jitter value

Table III. Jitter Value

Jitter Value	
Time	**Amended ACO**
20	6.0
30	4.0
40	3.6
50	2.7
60	2.0
70	2.0

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