Routing of data packets using ACO in WSN

Vaishali B Nikhade
Department of Information Technology,
Amrutvahini College of Engineering,
Sangamner ,(M.S) India- 431005
vkbnikhade@gmail.com

R.N. Devikar
Department of Information Technology,
Amrutvahini College of Engineering,
Sangamner ,(M.S) India- 431005
rohit.devikar89@gmail.com

***Abstract*-The routing protocol plays a very important role in choosing, and selecting the path for transferring the data from the source to destination efficiently. There are already many routing algorithm for finding shortest path at the same time increase the lifetime of wireless sensor network .In this paper ACO algorithm is used for selecting shortest path from source to destination. ACO is used for load balancing which will help in selecting the node according to the load over node and at the same it is proving that it is an best algorithm for routing as it gives good result for time and energy consumption.**

Keywords- Wireless sensors network, Load balancing, ACO, Routing

I. INTRODUCTION

A wireless sensor network consists of number of sensor node with less transmission of energy and unstructured infrastructure. The network is used mainly in military target tacking forecasting natural disaster and monitoring human health. Sensor node can sense and detects disaster in environment before occurring [1]. Component which store sensor nodes energy are power storage components i.e. battery. Energy consumption is done by radio link of each node and it is analyzed by two topology one with equidistant hop and other space between last nodes. Acquisition, communication and data processing are the function performs by sensors to use energy [2]. Energy consumption is a crucial issue on how to limited energy sensor of WSN consists of operation that is transmitting and receiving data running application .this all consume lot of energy. Usage of large amount of energy affects the network lifetime. [2] Objective is to find out how much of energy is consumed and increase the life time of sensor node at the increase life time of network. Energy and time consumption in WSN also depend on the construction of network topology [3]. The process selecting the path in the network for transferring the data from source to destination through router is called routing. There are many routing algorithm which aim for energy and time consumption for increasing the life time of WSN. But only that routing algorithm is said to be best which is able to transfer packet from source to destination by using minimum energy. Currently used routing algorithms are adaptive, intelligent and fault free .Routing table used by them are always updated by exchanging routing information. Factors that support routing protocol are effective routing, congestion avoidance, energy consumption, load balancing, reach ability. Till now the routing algorithm were finding smaller path for transferring data from source to destination algorithm by shortest path algorithm. Algorithm based on swarm intelligence was also used for routing purpose such as honeybee algorithm, termite routing algorithm etc [4]. These algorithm was used to find only shortest path but the path used to break in between when node are having lots of data and this would lead to delay in data transmission ,and waste of energy and time in network.

In this paper we have proposed Ant optimization algorithm which deals with load on nodes, Its is inspired by natural behavior of ants. It works similarly as ant works for finding their food, Ants consists of a liquid call pheromone with the help of this liquid they communicate with each other.

II. LITERATURE WORK

Energy efficient is main constraint of WSN designing energy saving routing algorithm is necessary so energy aware in routing is design. Tarahand Amgoth et al. [5] proposed for a cluster based routing WSN here all sensor nodes are organized in the form of distinct cluster select cluster head. Each cluster head will transfer the data packet from source to destination and her e some amount of energy is consumed. Robert Newman et al. [6] proposed a protocol of cluster based route optimization and load balancing .It uses many metrics of quality of service. It support in prolonging the lifetime of WSN. Sabet Maryam et al. [7] propose a decentralized hierarchical cluster based routing algorithm for WSN .It work mainly during construction of routing tree Naércio Magaiaa et al. [9] propose an approach of new multi objective for WSN routing problem that take in account parameter such as delay

through put etc sometime it may cause congestion in network. Pratyay Kuilan et al. [10] Proposed two PSO (particles swarm Optimization) algorithm in WSN and non linear programming formulating for routing and clustering problems. It sometime result in energy consumption in routing. R.K. Singl et al. [8] Proposed a routing based on the fishy state routing to select different route to ensure the reduction of energy consumption in WSN. [11] Proposed routing algorithm for nodes according to the nodes distance from base station node distribution but it will waste lot of time and energy may be wasted. Yang Geng1 et al. [12] propose some strategy for balancing energy consumption among node and increase the lifetime of network. Adel Ali Ahmed et al. [13] propose a routing protocol aiming to route data with less consumption of energy and prolong lifetime of network. Rahim Kacimia et al. [14] Proposed a load distribution routing protocol for mobile wireless sensor network which will help in high data packet transmission in WSN.

Many swarm algorithm such as Bee colony optimization routing algorithm, termite routing algorithm etc work better as routing algorithm .Bee routing algorithm it is inspired by honey bee in working together in nature for searching their food how they communicate with each other .similarly they work in routing to transfer data from source to destination[15]. Termite routing algorithm is inspired from working of termite in nature termite go on depositing pheromone on path and following that pheromone deposition the other termite follow each other ,similarly the data packet are transfer by termite algorithm from source to destination through pheromone deposition [16].

In this paper we are proposing Ant colony optimization algorithm which work as ant work in nature ,as we know that one of the factor which is need for routing is load by using load balancing we are going to perform routing. Difference between other algorithm and load balancing ant algorithm is that it first search for under loaded node and also nearby under loaded node at the same time keep on updating pheromone table to keep the records of node traversing. This algorithm gives good result in energy consumption, time consumption and reducing failure in WSN.

III. PROPOSED SYSTEM

A) ACO

Ant Colony Optimization (ACO) is used for load balancing so it is used for network routing for routing of data packets. This approach is used for distributing the working load over the WSN (Wireless Sensor Network). As the ant have the nature of working together to search a new food by using previous food source for putting the food at their nest.

B) Working of ACO

ACO works according to the ant in nature; firstly in the created WSN we have chosen the head node. If the head node stops functioning we can select the head node. While selecting the head node care should be taken that it has many neighbor nodes, so that if one path is not working then the ant can move for another by moving from one node to another the ant will go on updating the pheromone table which will help in keeping the record of resource utilization of node. Ant have two way of movement one is forward movement, another is backward movement.

a) Forward movement

Ant continuously move in forward movement until it find the underloaded or overloaded node.

b) Backward movement

While moving if ant find an over loaded node then it will go back by backward movement to the under loaded node to check the loaded node. If the node is overloaded then distribute the work to the less loaded node and finds under loaded node. Following formula is used for finding nodes for next process-

$$P_k(c, n)=\frac{\alpha(c,n)[\lambda\beta(c,n)]^{\gamma}}{\alpha(c,n)[\beta(c,n)]^{\gamma}} \quad (1)$$

P_k is the probability of ant which are on current node c selecting neighbor node n, c is current node, n is neighbor node, $\propto$ is pheromone concentration, β is desirable move for the ant, γ referring the relevance of the pheromone concentration with the move distance.

Continuously Ants coming at an interval of Δt, the overloaded on WSN will increases. As number of path followed by ant will increases cost and maintenance also increases. To decreases the maintenance a suicide timer is set on ant. As the timer reach zero the ant will get terminated.

Timer selection will depend on number of nodes in WSN and overloaded would depend too much on the interval Δt as the overloaded decreases overloaded increases overhead decreases. If we increases overhead decreases. If we increase the frequency of ant the change in data will be less and load balancing will be tuff and thus efficiency decrease.

C) Pheromone table

Two type of pheromone updated by the ants are as follows-foraging pheromone and trailing pheromone-

a) Foraging pheromone

Ants use this Fp for finding new food. After finding under loaded nodes for find overloaded node the ant will use Fp i.e. find next path through Fp.

$$Fp(t+0.92)=(0.92-\beta_e)F_p(t)+\sum_{i=1}^{n}\Delta F_p \qquad (2)$$

Where βe is Rate of pheromone evaporation, Fp is foraging pheromone before the move, Fp(t+0.92) is foraging pheromone after move, ΔFp is variation in Fp.

b) Trailing pheromone

Trailing pheromone is used by ant to find return path for next i.e. It will find its path to under loaded node after finding overloaded node.

$$Tp(t+0.92)=(0.92-\beta_e)T_p(t)+\sum_{i=1}^{n}\Delta T_p \qquad (3)$$

Where, βe is rate of pheromone evaporation, Tp is tracing pheromone before the move, Fp(t+0.92) is tracing pheromone after move, ΔTp is variation in Tp. Pheromone updating aims to classify the ants according to the types of modes searched. After originating from main node i.e. head node. They follow foraging pheromone and also update FP. After finding overloaded node they follow trailing pheromone and update TP. After encountering under loaded node while TP ant will store information. After every successful location of data at nodes will be checked by time and if found zero ant will terminate.

The fig.1 describe that the source node is searching for node whether it is under loaded or overloaded as it encounters the overloaded node it starts searching for under loaded node among its neighbor nodes as shown in fig.2. After finding all the under loaded node it form a routing path for transferring the data packet from source to destination. fig.3 show the routing path with all under loaded node.

D) Algorithm

Initialization of pheromone table, ants;
If (load ([dst node] >=threshold))
{
Max Tp (under load node)
update pt of both nodes
}
else
{
Min Fp (overload node)
Update pt of one node
}
If (under loaded node)
{
Free resource of node
}
Else
{
search for another under loaded node
}

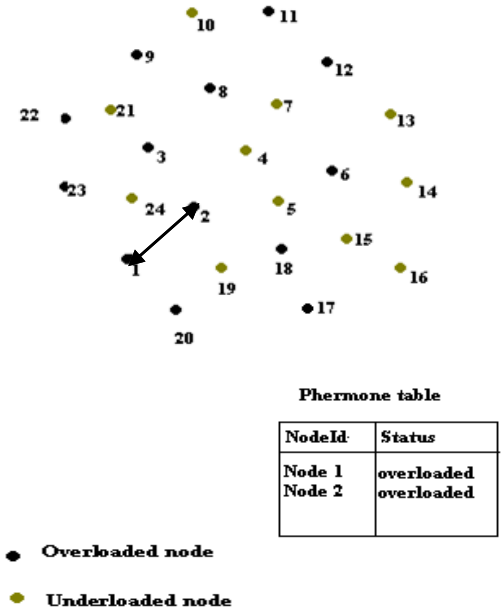


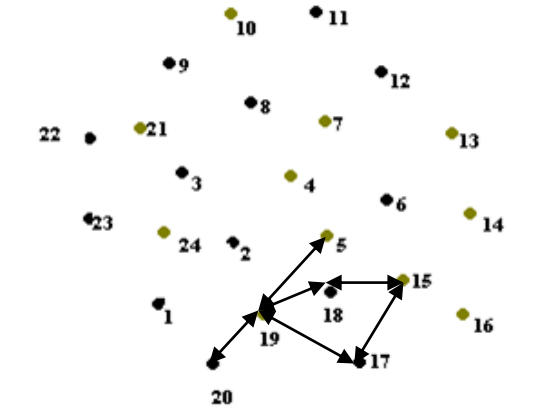
Fig :1 Source node encounters an overloaded node

I. COMPARISION OF ROUTING WITH ACO AND ROUTING WITHOUT ACO

In our existing system when we were routing data packets through the node in WSN by using another algorithm rather than ACO, The data packets use to go from source to destination at the same time it use to transfer the data from source to destination in WSN .But when they were passing data packets some time node may get fail due to less battery power, consisting of load or due to some other problem and this will result to data loss, connection break. This will take more time to send the data from source to destination and at the same time there will be large time and energy consumption, higher in cost. When we are using ACO for routing data packets this ACO algorithm just

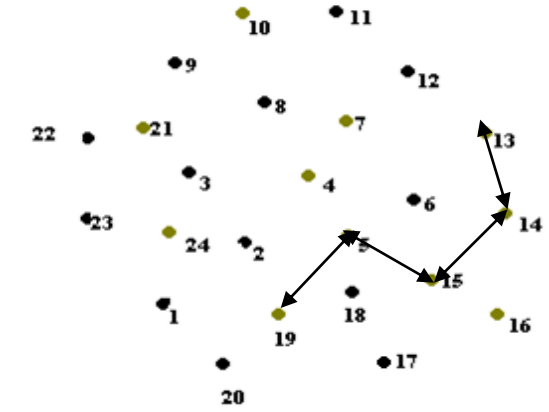
work like as ant are working in nature for finding their food. First the ant checks for the node which are under loaded and over loaded and at the same time these node should have the neighbor node which are having more under loaded node so that data packets will be transferred through the under loaded node and at the same time they will find the shortest path for transferring the data packets from the source to destination with in less time. This will help in time and energy consumption.

The following graphs show the variation between the routing done with ACO and without ACO fig.5 is the graph of without ACO in which the WSN consist of node with less battery power lot of data or is busy will break of path which will prevent the data packets transfer from source to destination , thus it will lead to more cost, time and energy consumption and fig.6 is the graph of routing with ACO the data packets are transferred by checking the node whether the node are overloaded or under loaded by doing so the data packets will be transferred from source to destination without wasting the time and energy.



NodeId	Status
Node 20	overloaded node
Node 19	underloaded node
Node 17	overloaded node
Node 18	overloaded node
Node 15	underloaded node
Node 5	underloaded node

Fig: 2 Searching for under loaded node



Pheromone table

Node id	status
Node 19	Underloaded
Node 5	Underloaded
Node 15	underloaded
Node 14	underloaded
Node 13	underloaded

Fig: 3 All under loaded node forming routing path

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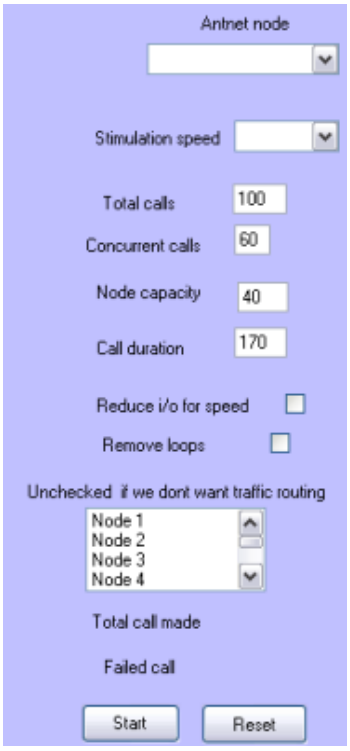

Fig: 4 GUI of input

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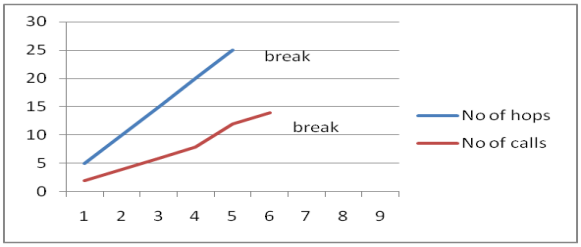

Fig: 5 Routing without ACO

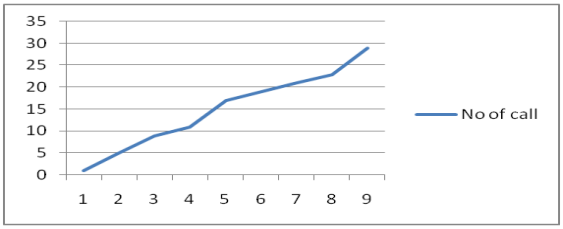

Fig: 6 Routing with ACO

CONCLUSION

Wireless sensor network sometimes consists of overloaded node in network which causes calls in the network to fail prevent the data packets to be transferred from source to destination. Load balancing ACO is used for routing is used for minimizing energy and time consumption .we have also made the comparison of routing algorithm with ACO and routing algorithm without ACO and performance of both algorithm is mapped with respect to average number of hops taken to complete number of calls in WSN. The result of graph proves that routing with ACO work better than routing without ACO. Routing done by load balancing ACO help in reducing energy and time consumption. In future we are going to add TARF to ACO for providing more security to ACO for avoiding attacks.

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