An Advanced mobile agent data aggregation technique for Wireless sensor networks

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Abstract: Reduction of the network nodes energy consumption is one of the major troubles for routing in the networks of wireless sensor due to the battery limitation in each sensor. The mobile agent technology introduction in the networks of wireless sensor for collaborative signal and processing information which has provided the latest scope for the proficient processing and aggregation of data. The mobile agent executes the data processing task and aggregation of data at the stage of node rather than at the sink, therefore, the elimination of the redundant network overhead. One of the primary issues in mobile agent based paradigm that is scheduling of an itinerary for an agent traversal. Here, a dynamic mobile agent based aggregation of data approach has been initiated which would be taking into the energy efficiency consideration, throughput, and end to end postponement while making the choice for the agents' migration in the network of multi-hop sensor. At the end, we could be able to show that AMADWSN with the outcomes of the numerous simulations, while comparing with the previous life time algorithm of responsive routing and ant colony based routing algorithms for the wireless sensor networks routing, mobile agent based data aggregation algorithm, diminishing the routing energy consumption and that extends the network lifetime.

Keywords: Wireless sensor networks, Routing algorithms, Ant colony optimization, Mobile agent based data aggregation, Energy consumption, Network lifetime.

I. INTRODUCTION

A wireless sensor network (WSN) characteristically consists of tens to hundreds or thousands of small nodes relatively, each equipped with a sensing device. The majority sensor networks utilize the wireless communication, and the nodes are repeatedly battery powered. The restricted communication capabilities, limited resources, and constrained power consumption demand that effectiveness be elevated on the design criteria list [1]. The wireless sensors are been acquired cheaper, smaller, and more powerful as a result of the advances in wireless communication and technologies of electronics. As the rapid microprocessor development, the sensor and transceiver, there would be a great applications foreground about WSNs. As we regularly use the networks in irregular and inaccessible environments such as volcanoes, battlefields, forests etc., usually there is very less likelihood to vary or recharge the faulty or dead nodes. Thus, the key dissimilarity between WSNs and the other classic wireless networks is that WSNs are hypersensitive and vulnerable to energy [2]. The limit energy is the primary issue that influences WSNs performance. Thus, to utilize the limit energy of WSNs to take advantage of the life of WSNs that becomes the all-important routing design challenge [3]. Various routing algorithms for sensor networks would require the location information for sensor nodes. In many situations, location information would be needed in order to compute the distance between two particular nodes so that the consumption of energy could be approximately estimated [4]. Hence, the information of location could be utilized in the routing data in the efficient way of energy. A family of Ant Colony optimization (ACO) algorithms has been effectively applied to resolve few problems of routing in WSN [5]. More than two decades, Ant Colony Optimization has been emerged as the leading the method of Meta heuristic for the solution of combinatorial optimization problems [4]. A life time aware algorithm for wireless sensor networks (LTAWSN) has been applied effectively to resolve problems of energy level in WSN [6]. The aim of this algorithm is to maximize the lifetime of the network by defining carefully the link cost as a node function that remain the energy and the transmission energy which is required for using that link. In this paper, we recommend MA based approach of the data aggregation in which the route is decided on the fly. We have included the remaining node energy as a significant factor in the cost function so that the consumption of energy is unbiased between the nodes. Hence, this approach has the capacity to balance the consumption of energy among the nodes which would increase the on the whole life time of the sensor network.

II. LITERATURE SURVEY

The authors in [7] have proposed a routing algorithm for Wireless sensor networks by using Ant Colony Optimization which would be presenting a similarity of two algorithms that are ant colony-based routing, that would be taken into account the energy consumption current amounts under different scenarios and also report the usual metrics to route in wireless sensor networks.

In [8], the authors have initiated an energy aware ant colony algorithm for the wireless sensor networks routing when the ant selects the next node, not only the sink node distance, but also the next node's residual energy and the average energy path are been taken into the account. This algorithm has been weighed against with traditional ACA algorithm and that gets more enhancements in balance the nodes' energy consumption and that would be extending the network life time.

In [10], the authors have planned a fair comparison of Low Energy Adaptive Clustering Hierarchy (LEACH) and the ant colony which has been applied on LEACH on the origin of the death of first node in the networks of wireless sensor and is displayed that when the ant colony algorithm is applied on LEACH protocol that is existing, the network lifetime has been improved.

In [11] first, a grade table has been built and that was referred to generate various routing paths that are possible. And then the ACO would be exploring these ways to condense the nodes' power consumption.

In [12] each node that computes the amount of its own level of energy and later sums up the remaining network's energy level. The node would decide either to become the cluster head or not for that round with the support of the comparison. The nodes with a high energy are expected to become cluster heads. The problem that lies in this approach is that it would need an extra nodes communication with the base station which in turn requires more energy.

In [13] the authors said an Energy-Efficient Ant Based Routing algorithm (EEABR) for location and flat awareness architectures. In this proposal, the ants look for less consumption of energy path meanwhile decreasing the size of the ants at the time of communication among nodes.

In [9] the authors have proposed the called Ant Colony Optimization-based Location-aware Routing algorithm (ACLR) that it is a flat and location awareness algorithm. It combines the residual energy and the global and local location information of nodes, to describe the possibility to choose the next node for the ants.

In [14] the authors recommended an ant colony optimization algorithm and apply it to control of energy and the control of congestion on the wireless sensor network route. Here, in this algorithm, the pheromone and the energy of the node are united to affect the ration of pheromone consent in path of optimization, which could avoid the network congestion and fast energy consumption of individual node. Subsequently it can prolong the whole network lifecycle.

The authors in [15] have a proposal that a predication mode routing algorithm based on ACO (PRACO) to attain the energy-aware data-gathering routing arrangement in wireless sensor networks. This algorithm would check the load factor in heuristic factor and initiates a novel pheromone updating rule.

In this algorithm, artificial ants could foresee the networks local energy state and the corresponding actions which could be obtained adaptively to improve the efficient energy in routing construction.

The authors in [16] have proposed that a new energy which is efficient routing algorithm for wireless sensor networks that consist routing and clustering phases. The outcomes of simulation have shown that this algorithm in comparison of other algorithms would be extending the lifetime of network and lessen the consumption of energy. However, in this paper the dynamic scenario and the sensor network's fault tolerant aspects were not been considered by the authors.

A Genetic Algorithm (GA) [17] based approach does not require any stating node finding for the algorithm to perform; instead it selects any of the active node as the initial node. As, each node has to be reported its status to maintain the global information at the PE, so GA gains a lot of communication overhead.

Algorithm:
Inputs:
Prev: information gain at previous hop node
curr: information gain at current hop node
node: $\begin{cases} 1, if\ next\ source\ node\ is\ found \\ 0 \quad otherwise \end{cases}$
n: Number of hops calculated
Threshold: predefined information gain required for any application
At the PE (w_0):
Find the first source node using the cost function:
prev=curr
node = 1
n=1
jump=1
At the node w_i(i $\neq 0$):
If node =1 then{
Find next source node using above equation:
gain=curr-prev
if gain ≥ threshold then{
Select node as next source node
prev=curr
node = 1
n=1
jump=1
}
else
{
Find nearest neighbour that has not been selected
node = 0
n = n∗4
jump = n
}
else
if node=0 then
{
jump = jump-1;
if jump = 0 then{
gain = curr - prev
prev=curr
node = 1
n=1
jump=1
}
else
{
Find nearest neighbour that has not been selected.
}
If gain ≤ threshold then {
Select node as forwarder node
Node = 0
}
End
End

III. PROPOSED FRAMEWORK

This approach would provide the elasticity to decide the impact which would be having on individual parameters that get included in the function of cost. Therefore, depending on the application's constraint one can alter the factors of weight accordingly providing the lower or higher priority to the parameters that would be based on the situation. If there is any necessity, we can alter the cost function weight factors to change the environments to offer more elasticity in terms of individual parameters impact in deciding the route of MA migration.

Once MA has got dispatched from PE, it would migrate to the nearest node with the minimum cost computed according to the equation of cost function. After accomplishment at first source node, MA will aggregate the data at that node. After then MA would find the next candidate for source node. First of all, the entire one-hop neighbors would check by using to designate the cost function to the less costly node of candidate. Later, the difference of information would gain for this node of candidate with the information gain current value is considered. If difference is more than the value of predefined threshold then MA would migrate to that node and execute the aggregation of data. Otherwise MA will be migrating to the nearest node two hops away from the present node for which data is aggregated.

As MA does not have prior knowledge about the topology of network it migrates first to the nearest neighbor at one hop distance which was not selected. Later, MA shifts to the next closest neighbor that would be decided as per the cost function. The threshold for information gain would be checked after arriving at node two hops away. MA would be migrating to the nearest node four hops away from the present node if these differences do not satisfy the threshold value.

This searching approach would be continued in all 2n hops nodes till the most informative node is been found as the next source node. MA would be again starting for the aggregation of data and also to locate next node in all one hop neighbour's by locating the informative node. At last, MA will be migrating to PE, when it attains the desired level of accuracy or the desired nodes visits. The proposed approach represented in above algorithm.

IV. RESULT AND DISCUSSION

In our proposed scheme simulation, we would be considering all the energy consumption ways which include both computational as well as communication costs. First, impact the factor of weight 'a' of information gain utilized in the cost function on the approach performance which have been assessed.

Parameter	**Value**
Application Traffic	CBR
Transmission rate	1000 bytes/0.1ms
Radio range	250m
Packet size	1000 bytes
Maximum speed	25m/s
Simulation time	50sec
Number of nodes	41
Area	1500x1000
Routing protocol	AODV
Routing method	AMADWSN, LTAWSN

Table1: Simulation table

In this paper, we are assuming that 41 sensor nodes which have been distributed randomly about a 1500x1000m^2 fields by taking into consideration of the Radio range as 250m. Table 1 show that the method of parameters that are being used in our simulations. We use the Application Traffic as CBR (Constant Bit Rate) and it can be support the control of the traffic in network, Routing Protocol as AODV and it is been used to route the level in network, Routing Methods are AMADWSN, LTAWSN in our simulation, and this routing methods are used efficiently to perform the network results. Then, the rate of transmission is 1000 bytes/0.1ms by assessing the size of packet as 1000 bytes and with a speed of 25m/s and the total time for simulation is 50 sec.

4.1 Evaluation results

In this segment, we would utilize the mobile agent based data aggregation method. According to the delay, energy, and throughput, we show experimental outcomes of the algorithm which are been introduced below.

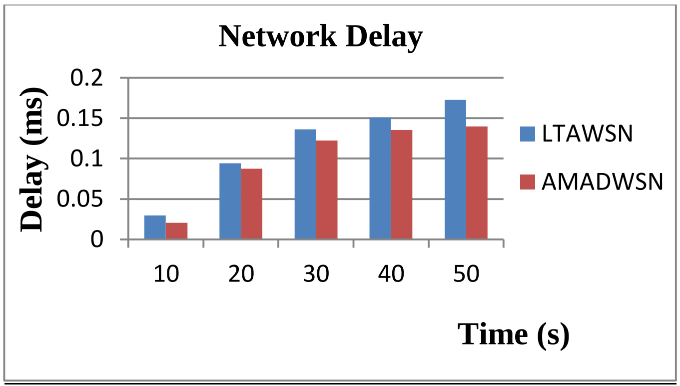

Fig1: Delay time

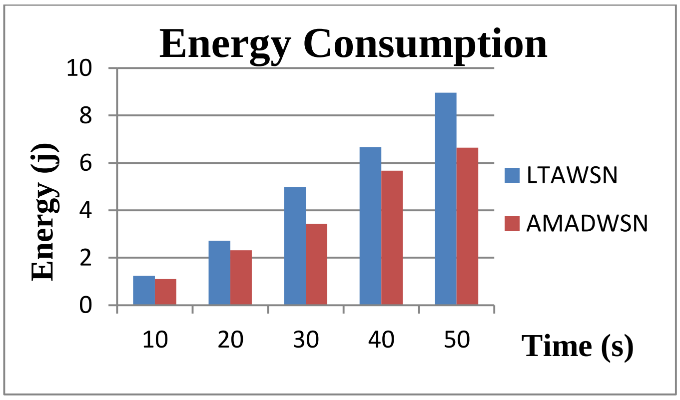

Fig2: Energy consumption

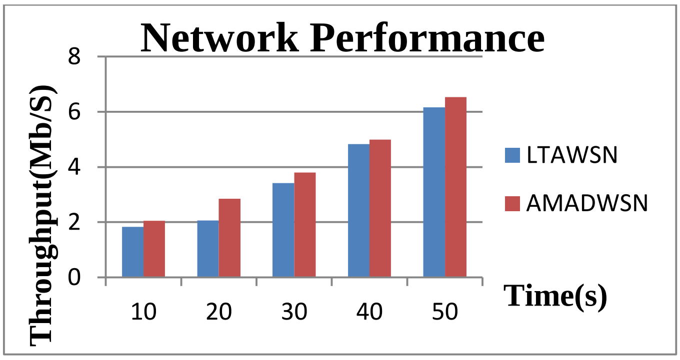

Fig3: Throughput

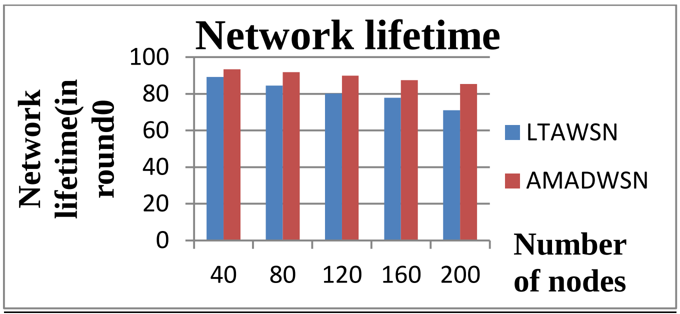

Fig4: Network lifetime

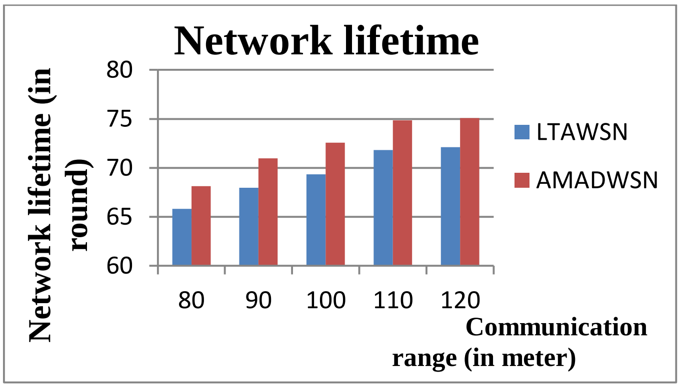

Fig5: Network lifetime Vs communication distance

In Fig 1, graph is showing and representing the end 2 end delays and that would show a time of simulation versus delay. The advanced mobile agent performance is based on the algorithm of data that improves delay time it means reduction in the delay between the communication nodes that compare to the life time aware routing algorithm. Fig 2 is showing and also representing the energy consumption and that would be showing a time of simulation versus consumption of energy. The advanced performance of mobile agent based algorithm of data improves consumption of energy it means reduce the energy consumption that compare to life time aware routing algorithm. Fig 3 shows and represents performance of network and it shows a time of simulation versus throughput. The advanced performance mobile agent based data algorithm has improved the throughput which is meant to increase the performance of network that compare to the life time aware routing algorithm. Fig 4 shows and signifies lifetime network and that shows a number of nodes versus network of lifetime. The advanced performance of mobile agent based algorithm of data that would improve the lifetime of network which means run the process of simulation for long time which compare to the life time aware routing algorithm. Fig 5 represents network lifetime in the rounds and it would show a number of nodes versus lifetime of network. The presentation of advanced mobile agent based data algorithm enhances the lifetime of network it means run the process of simulation long time that compared to the life time aware routing algorithm.

V. CONCLUSION

In this paper, the authors' have given a presentation that a new ACO based routing algorithm for WSN. Dissimilar to the earlier initiated scheme utilize the parameters of spatial in its capability function and a new pheromone operator that was update has been designed to combine consumption of energy and hops into the choice of routing. In this system, the function of cost has been enhanced such that the utmost possible information benefit could be attained while keeping the consumption of energy lowest, thereby increasing the accuracy of data aggregation. The results of simulation validate the feasibility of the approach. It is understandable from the outcomes that the recommended method of approach would be performing better than previous approached in terms of the consumption of energy, throughput, end-to-end delay, and lifetime of the network.

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