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ACO Based Multi-Featured Analysis Method for Route Optimization in WSN

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Abstract— The restricted resource based sensor network, can be optimized at different level. The route optimization is one of the methods to improve the resource utilization and effective network communication. In this paper, a multi-featured route optimization is provided using ACO approach. At the earlier stage of this work, random ANT agents are distributed over the network with coverage constraints. Each ANT analyzed the sensor devices under energy, distance and direction parameters. Based on these parameters, the effective node in each ANT regions will be identified. In the final stage, the backward ANT is processed to generate the optimized path.

Keywords : ANT, Route Optimization, Energy, Mutli-Featured

I. INTRODUCTION

Sensor network is composed of multiple sensor nodes defined without or with specification of infrastructure. The nodes can be deployed with static or the dynamic properties. The communication between the nodes can be drawn by specifying the two end nodes. If the nodes are in coverage range of each other, then direct single hop communication can be performed. If nodes are not in range, then the multi-hop path between these two nodes will be formed. For this path formation, the first requirement is to apply the broadcasting method. In this method, each node sends the request to all of its feasible neighbors[1][2][3][4][5]. Each neighbor also processes the same to identify the neighbor list. This process is repeated till the destination node not occurs. Here figure 1 is showing the route exploration between two end nodes. Here source and estimation nodes are shown at two end points. The bidirectional path between each node to the neighbor is identified. This process is here repeated to generate the effective route between the source and the destination. To identify the one effective path among all possible paths, there is the requirement to take some parametric decision. Some of the considered parameters can be energy, node degree, coverage range, fault probabilility etc. Different algorithmic models, protocols and constraints are defined to optimize the communication path.

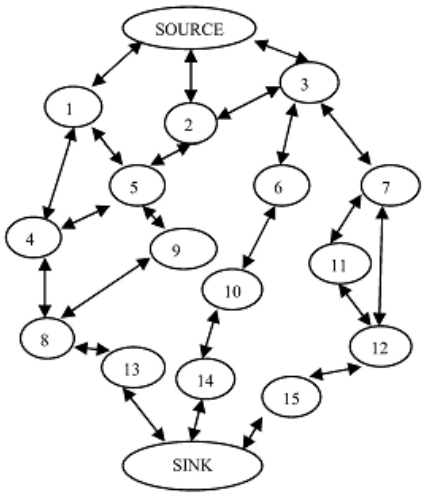

Figure 1 : Routing in WSN

The common phenomenon here divides in two main approaches called source specific or the destination specific routing. As the name suggest, the destination specific routing start from destination node start exploring the neighbors towards the source. This kind of routing is performed at level based and identified the neighbors with each communication. In sensor network, with each communication, some energy consumption occurs. It can also affect the data delivery and increases the communication fault, because of this, there is requirement of route formation with each communication. To improve the communication effectiveness, the number of hop count can also be reduced so that the effective data delivery between the source and sink will be performed[6][7][8][9][10]. While estimating the neighbor different measures can be applied to identify the cost at neighbor level. This measure includes communication cost analysis, energy stock analysis, sensing rage analysis and the error rate analysis. These measures can be applied collectively to generate the adaptive network path. The evaluation of the routing effect and to generate the comparative between the methods, protocols and the routing constraints[11][12][13][14]. In this research a more adaptive and intelligent routing method is provided for sensor network which is explained in later section of this paper.

A) ACO

ACO (Ant Colony Optimization) is the approach that generates a primary network and relative communication through ants. Each ant is here recognized by some chemical called pheromones. The ant communication is here provided to trail these pheromones. Other ants can sense the position of the ants by this pheromone. The concentration path formation and the following path generation can be done using the pheromones. The ant behavior is here divided in two main stages. In first stage, the forward ant is processed to generate the path by sensing the pheromones of ants. The pheromone over the path is evaporated with time. Till this pheromone exists, other ants can track the ants. The ant processing is shown here in figure 2.

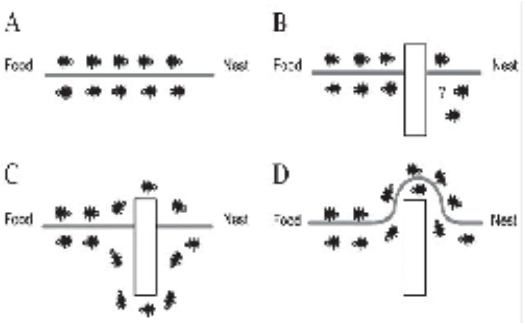

Figure 2 : Basic ANT behaviour

Here figure 2 is showing the basic ant behavior in search of food. If some obstacle occurs in the path, the ant identifies the next possible alternate path solution. The pheromone trail can be used by the other ants to construct the optimum path. As one ant locates the food source, a backward ant is processed to intimate the other ants about the located path. In this paper, ACO adaptive path formation is provided to optimize the communication in sensor network.

In this paper, an ACO improved route optimization method is provided to improve the communication throughput. The method used the distributed ANTs as the network agent to provide the zone specific analysis. The multi-featured analysis is performed to identify the effective node and later on applied adaptive communication route over it. In this section, the concept of sensor network optimization and route formation is provided. In section II, the work defined by earlier researchers is provided. In section III, the proposed work model is defined with relative process stages. In section IV, the conclusion of work is provided.

II. RELATED WORK

In this section, the work provided by some of the earlier researchers is presented. The work is done for different routing method and QoS optimization in the network. Different issues raised by different researchers are discussed in this section. Author has proposed directed diffusion routing strategy in[6] is based on attribute-value querying and when queried, nodes establish gradients to the query initiator and send the attribute-value pair to the query initiating node. In [7], author proposes a refinement to the directed diffusion algorithm proposed in [7], named Rumor routing. Rumor routing is applicable in areas where nodes do not have a coordinate system. In this, the query generated is sent on randomly until it finds nodes which are on the path to the event destination. Servetto et al. recently proposed in [8], a routing algorithm (Servettos' algorithm) It basically the congestion avoidance and the load distribution approach over the center nodes. Such kind of problem occur in case of some grid ndetwork or the hierarchical networks where some central nodes get the extra load on it and in such case a load distribution scheme is required to avoid the extra load over that node. The author has taken the grid network to present the work. In a grid network the routing is performed from the static routes either diagonal based or the horizontal or the vertical route identification schemes. In each case, the load over some specific node increases and the requirement of the load distribution or the load prevention is expected. In another paper [9] provide the solution to avoid the network faults and to provide the reliable communication in a fault oriented network. They split the data packet into multiple segments in such a way that the original data can be constructed from subset of all the segments. They route these multiple segments on multiple paths and at the destination construct the original message from the messages received. Author [10], proposed in this paper describe a Two-Tier Data Dissemination scheme to improve the data transmission in case of multicast communication. The author has presented a reliable and efficient communication to enable the continuous and flow less reliable communication over the network. Author[11] proposed a zig-zag routing to generate the optimal communication path in case of congested network as well as in a network having the fault over the nodes.. Author[12] proposed an unreliable wireless sensor grid-network with n nodes placed in a square of unit area. The author has defined the active communication without any coverage specification. The presented work was the probabilistic work in which routing will be generating by performing the analysis on next neighbor as well as to preserve the connectivity over the network.

The major issue in a sensor network is the energy consumption while performing the different events so that some energy saving approach is required. Many of the authors performed work in this direction respective to different network problems. These energy saving approaches are categorized as the Greedy approach in which a greedy factor is included with each routing or the clustering algorithm. The major objective of such kind of work was to improve the network life and to improve the network QOS. The authors have defined the effective work in these energy effective algorithmic approaches.

Most of these energy effective approaches require the intelligent analysis over the network to process on to improve the QOS[6]. In order to reduce and control the energy consumption on each node as well as over the network different approaches are suggested by the authors. These all approaches include the redundancy avoided routing, network sensing approaches etc. Based on this phenomenon different greedy approaches are suggested. Some authors also use the fuzzy and other soft computing approaches to generate the energy effective routing path over the network. Each of these approaches is effective in terms of energy consumption, memory requirement, and the bandwidth utilization.

III. RESEARCH METHODOLOGY

In this present work, an optimized path formation method for sensor network is provided using ACO adaptive parametric analysis. The work is defined for a random sensor network where each node is defined with fixed coverage and random energy. In this work, an ACO optimized route formation method is provided. The work is here divided in three main stages. In first stage, the random ants are generated and distributed over the network. Each of the ants is defined with constraint specification with life and the coverage constraints. The ant moves in the random direction to search for the destination node. The node specific movement is performed by the ants and the featured analysis is applied on each node tracked by the ant. The life covered region of the ant is considered as the zone of that ant. In this zone, each visiting node information is captured and relatively assigned the priority. The features captured here include the energy, node degree and the direction towards sink. Based on these ants, the multiple features are extracted and the characterization of node is decided. This quality measure is considered as the node priority. This zone adaptive feature generation and node priority assignment is processed by each ant in parallel for its covered zone. This process is cycled till the sink node is not recognized by some ant. Once the ant identifies the sink node, it performs a back trail using backward ant to generate the optimized path. While trailing this path, it connects to the previous ant and the coverage

relative to zone priority analysis. The zone specific backward trail is accomplished. As the zones covered in the path are identified, the next work is to capture the zone node information from the relative controller. The flow of work under the ant adaptive path formation is shown here in figure 2.

In each zone, the ant provided the information about the priority node present within the zone. The effectiveness of node is here identified in terms of node degree, energy and the direction towards the sink. The process is repeated in parallel for each inclusive zones and later on the connectivity path is formed by selecting these adaptive zone nodes. The process is repeated till the complete network path is not formulated. The parameter specific evaluation is here defined to generate the more optimized and reliable communication path. The method is able to improve the network life and to optimize the communication over the network.

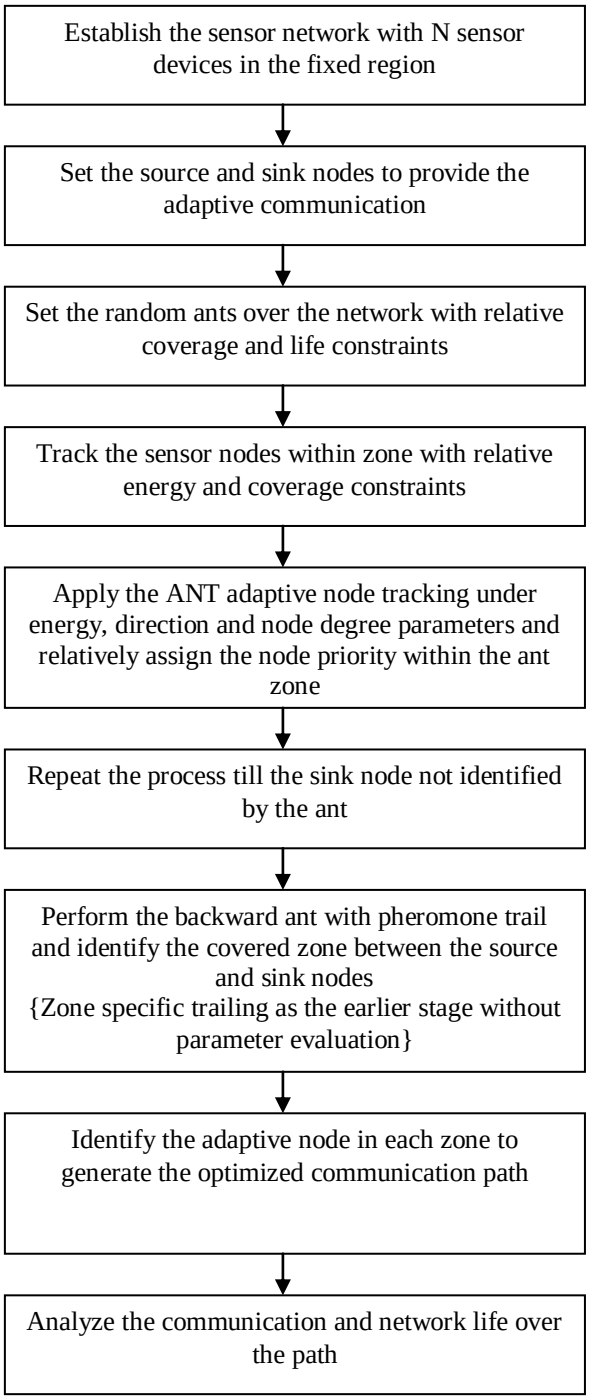

Figure 2 : Flow of Work

Here figure 2 is showing the flow of work to generate the optimized communication path over the network. The work model is here defined to provide the optimized network communication. The ant based parametric analysis is here defined to elect the adaptive zones in first stage and later on the reliable nodes in each zone is identified to formed the optimized communication.

IV. CONCLUSION

In this present work, ACO optimized route formation is provided for sensor network. The proposed work model is here defined to provide the agent adaptive communication to improve the communication reliability. The proposed work model first used the parameter specific forward ant to identify the feasible effective nodes in each coverage zone and later on applied the backward ant to form the path. The work is to optimize the network communication and life.

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