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On Demand Artifical Bee Colony Based Routing Protocol For WSN

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ABSTRACT : The quick growth in network multimedia equipment has given room to real-time digital services. WSNs have become a vital area of research for computational theory owing to their huge range of applications. Owing to limited power of the battery consumption of energy has become an issue in sensor network protocols. Many routing protocols have been presented to enhance the energy efficiency a bit more but still more improvement can be done. To outperform the limitations of the earlier schemes an improved scheme is proposed. The proposed scheme is capable to outperform the drawbacks of the GSTEB routing protocol using the reactivity and artificial bee colony optimization based optimized path selection.

Keywords : WSN; Clustering; GSTEB; Artificial Bee Colony

1 INTRODUCTION

Wireless sensor networks are a special kind of Ad hoc networks that became one of the most interesting areas for researchers. Typically, a wireless sensor network comprises of hundreds or thousands of low cost sensor nodes. A sensor node consists of small sensors able to detect light, sound, temperature and motion, an intelligent computing device that enables the processing of raw data collected from the sensors, and communication capabilities with other nodes through wireless networks. There are many practical applications of wireless sensor networks. Some of the most promising application areas are environmental monitoring, battlefield tracking and disaster recovery operation, building control systems, and smart entertainment devices that adjust audio and video signals based on their surroundings [1].

2 DATA AGGREGATION TECHNIQUES

Data aggregation is a process of aggregating the sensor data using aggregation approaches. The algorithm uses the sensor data from the sensor node and then aggregates the data by using some aggregation algorithms such as centralized approach, LEACH(low energy adaptive clustering hierarchy),TAG(Tiny Aggregation) etc. This aggregated data is transfer to the sink node by selecting the efficient path. The purpose of the aggregating the data is to minimize the power consumption by reducing the number of information transmissions. Data aggregation is defined as the method of aggregating the data from multiple sensors to remove redundant transmission and provide fused information to BS (base station). All the aggregation nodes collect data from the leaf nodes and calculate the value of aggregation. Then only the calculated aggregated values are forwarded to the data sink. The aggregate value can be average, maximum (minimum), summation, etc. it is calculated as per requirements of the application. Data generated from neighboring sensors is usually redundant and highly correlated. The amount of data generated in large sensor networks is usually huge for the Sink to process. The data aggregation often involves the fusion of data from multiple numbers of sensors at intermediate nodes and the transmission of the aggregated data to the base station.

The classification of Data Aggregation Mechanisms: According to the WSNs, data aggregation mechanisms can be classified as structure-based, structure-free, and hybrid structure. When the sensor nodes are deployed at random in air, by nature, they need a structure-free mechanism. When sensor nodes are deployed at a large scale, their data aggregation and management of WSNs become difficult. The structure-based data aggregation is explained with a set of algorithms, which divide the network into groups. The group manages the data aggregation. The structure-based mechanisms need an extra charge to organize the network as well as to maintain this organization throughout the network lifetime. Hybrid structure is the combination of the characteristics of structure-free and structure-based depending upon the application.

Structure-Free Data Aggregation WSNs are as multi-hop Ad-Hoc networks, in which no infrastructure is present to connect the network nodes. The communication architecture for structure-free aggregation of data is termed as basic client/server architecture. To achieve the scalability, several key points need to be considered such as the high amount of detected data along with communication session needed to forward the data to the server. The sensor nodes are energy constrained, it is inefficient for the sensors to transmit their data directly to the BS (base station). The communication becomes very expensive in terms of energy when compared with local processing.

Structure-Based Data Aggregation: This scheme can be classified either as based on tree or based on cluster.

A) Tree-Based: In this structure, the sensor nodes are arranged into a tree like structure and data aggregation is performed at the intermediate nodes along with the tree. Aggregation is achieved by constructing an aggregation tree, which can be a minimum spanning tree, rooted at base station and source nodes are considered as leaves. Every sensor node sends its data to its parent node.

b) Cluster-Based: In this, network is divided into sub-groups. Every sub-group is named as “cluster”. Every sub-group constitutes of many nodes from which a node is assigned as a “cluster head” (CH). The CHs are designated to forward their sensor nodes data to the base station.

Cluster Head is the master and sensor nodes are the slaves, the master/slave mechanism allows tight traffic control as no node is allowed to send outside their clusters, communication is not allowed between the slaves except through the master.

Data Aggregation on the basis of Grid: In this strategy, an aggregator selects the geographical position in accordance to either base station or center of the grid. Only critical information is forwarded to the base station. This scheme suits best to mobile environments instead of localized events. The issue of selecting the point of aggregation and optimal data routing is also addressed. It shows enhancement in the sensor network life time with improved levels of latency. [4][7]

3 LITERATURE SURVEY

In this paper, a Two-Level Cluster base Protocol (TLCP) for wireless sensor networks was presented which aims at increasing the sensor network lifetime and reducing the consumption of energy. In this scheme, sensor nodes are organized into clusters and a cluster is formed among the CHs so that every CH sends its information to the head of the cluster instead of forwarding data directly to the Sink located far away and only the head can forward data directly to the sink. The performance of TLCP is evaluated by comparing it with LEACH and CBRP. The simulation results show that TLCP is more efficient in terms of network lifetime, stability period, instability period, balancing energy consumption among sensor nodes, energy consumption and network throughput than other protocols [1]. Various research issues in wireless sensor networks and the current trends in overcoming such issues are highlighted. The wireless sensor network has got many advantages and many features like fault tolerance, low cost, high flexibility, rap-id deployment etc., There are many ongoing researches to overcome the existing issues and to enhance the sensor's performance. The wireless sensor network is deployed in al-most many fields and it will continue growing every now and then [2]. Various existing techniques used on leach protocol are discussed. The comparison is based on two methods of leach protocol that are genetic algorithm and optimization of leach protocol. The results are compared on the basis of rounds. This comparison is based on optimal threshold probability for cluster formation. Basically in LEACH probability is determined by user and then a CH is chosen. For this probability, performance of a network is very sensitive and it is very difficult to get an optimum setting from existing prior knowledge. LEACH-GA method outperforms MTE, DT, and LEACH in terms of network lifetime, since the use of the optimal probability yields optimal energy-efficient clustering [3]. An Adaptive Energy Aware Aggregation tree (AEDT) was presented for wireless sensor networks. In the presented tree, node with highest energy available is selected as the parent node for aggregation. The tree incorporates sleep wait technique where only the parent node and the communicating node are awake rest all the sensor nodes go to the sleep state, where in the intermediate nodes periodically go to awake state if they have any message to be forwarded. Shortest distance path with maximum available energy is selected for communication. Once a path is selected it is stored in memory for further use. Each node estimates its traffic load when it receives the data from the sources. The parent node estimates the total traffic load in the system and sends an overload packet to the sources if it is greater than its communication capacity. As soon as the source node receives the overload packet it decides whether to send message in chunks depending on the communication capacity of parent node or waits till the refresh time. If the traffic load is less than the communication capacity the parent node accepts the message for further communication. The presented tree provides a reliable transmission environment by minimizing energy consumption. Simulation results show that presented technique achieves good delivery ratio with reduced delay and minimized energy consumption. And also enhance the network lifetime by using maximum energy available node for transmission [4]. A distributed, energy-efficient and flexible clustering approach was presented. Based on the hierarchical agglomerative clustering (HAC) method, the algorithm uses the qualitative connectivity data as input data, and tailor simple numerical method to generate a cluster tree. Simulation results demonstrate that this method is energy-effective and flexible, which can improve sensor network ability to self-control and efficient use of resources, and maximize the sensor network lifetime. DHAC classifies the nodes into sub groups instead of randomly gathering the sensor nodes to CHs selected at random [5]. The advantages and disadvantages of LEACH protocol are analyzed and then put forward the improved LEACH-SAGA protocol to balance the energy of WSN on the basis of genetic algorithm and simulated annealing. When the nodes are deployed at random, firstly, the nodes are made into clusters by genetic algorithm and simulated annealing and the cluster center of every cluster is calculated. If sensor node's energy in a cluster is more than cluster energy at an average, that sensor node will be the candidate CH; at last the candidate CH becomes the CH in accordance to the distance from the centre of the cluster. The residual energy of the nodes and the average energy of the cluster are also considered, to get more reasonable cluster head distribution in the lower level of power consumption. Furthermore, it can balance the load balancing of network and extend the lifecycle of wireless sensor networks. An energy-efficient protocol of a reliable trust-based data aggregation for WSN was presented. The ERTDA protocol can replace the RDAT algorithm, which only considers the node trust value, rather than the defects in the node energy and the availability routing link. As such, the ERTDA protocol improves the excessive dependence on the energy parameters of iRTEDA protocol. The ERTDA protocol calculates the trust values of nodes, monitors and evaluates the nodal trust degree, and timely detects and excludes the compromised nodes based on the observation of the nodal behavior. The simulation results illustrate that the ERTDA protocol can improve the accuracy of an aggregation effectively. It can also reduce the mortality rate and the energy consumption of a node, improve the reliability of data transmission and extend the effective life of the networks.

4 PROPOSED ALGORITHM

Figure1 represents the proposed methodology.

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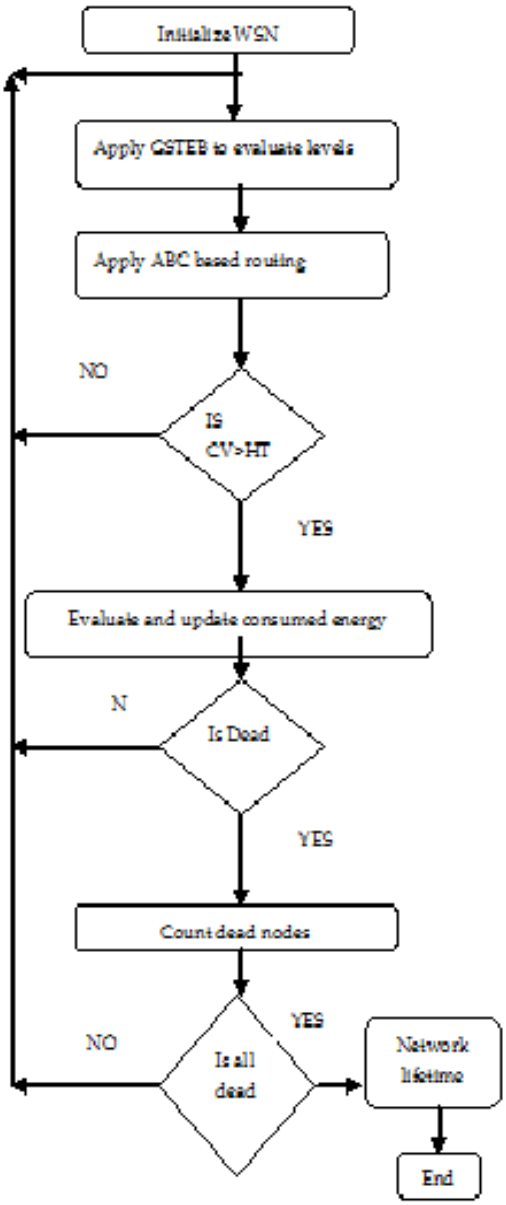

Fig 1: *Proposed Methodology*

The design and flow of implementation and step by step description of the proposed algorithm is detailed as follows.

Step 1: Initialize network

Step 2: Deploy network randomly in predefined sensor field.

Step 3: Apply GSTEB to evaluate levels.

Step 4: Check if Current value (CV) > Hard threshold (HT)

Step 5: Apply artificial bee colony on clusters to find the best route among nodes to sink.

Step 6: Evaluate and update energy consumption.

Step 7: Check whether all nodes become dead, if yes then show network life time and Return else continue to step 3.

5 RESULTS AND DISCUSSIONS

FIRST NODE DEAD : - Figure 2 shows the first node dead evaluation of the existing protocol and the proposed protocol. It is clearly shown that the proposed technique performs better as compared to the existing protocol.

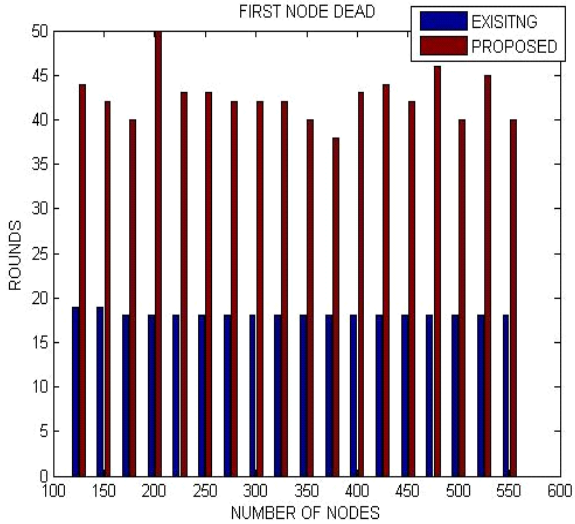

Fig 2: *FIRST NODE DEAD ANALYSIS*

The comparison of existing protocol and the proposed technique is drawn with respect to total number of rounds in case of first dead node when the number of nodes is changed. X-axis is representing number of nodes. Y-axis is representing the number of rounds. It has been clearly shown that the overall number of rounds in case of proposed technique is quite more than that of the existing protocol.

2. HALF NODE DEAD: Figure 3 shows the half node dead evaluation of the proposed technique and the existing protocol.

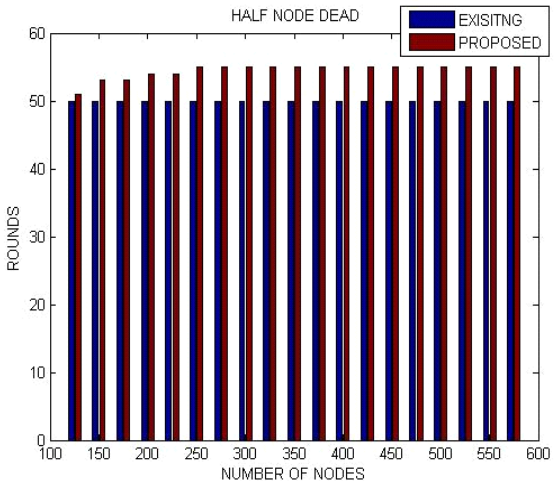

Fig 3: *HALF NODE DEAD ANALYSIS*

It is clearly shown that the proposed technique performs better as compared to the existing protocol. The comparison of proposed technique and the existing protocol is drawn with respect to total number of rounds in case of half dead node when the number of nodes is changed. X-axis is representing number of nodes. Y-axis is representing the number of rounds. It has been clearly shown that the overall number of rounds in case of proposed technique is quite more than that of the existing protocol. Thus proposed technique outperforms over the existing protocol.

3. LAST NODES DEAD: - Figure 4 shows all node dead evaluation of the proposed technique and the existing protocol. It is clearly shown that the proposed technique performs better as compared to the existing protocol. The comparison of proposed technique and the existing protocol is drawn with respect to total number of rounds in case of last dead node when the number of nodes is changed. X-axis is representing number of nodes. Y-axis is representing the number of rounds. It has been clearly shown that the overall number of rounds in case of proposed technique is quite more than that of the existing protocol. Thus proposed technique outperforms over the existing protocol.

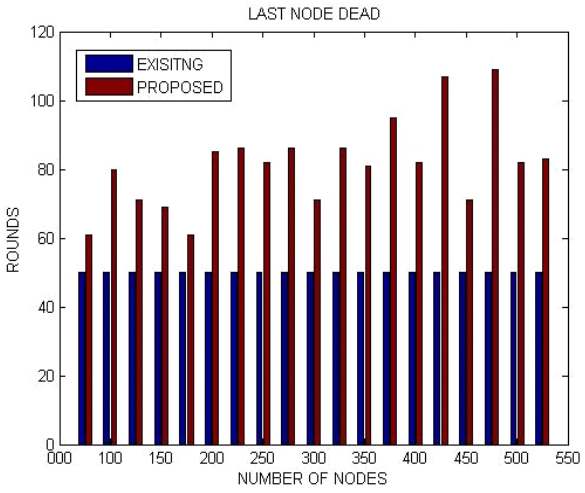

Fig 4: *ALL NODE DEAD ANALYSIS*

6 CONLCUSION AND FUTURE SCOPE

In this paper, reactivity and artificial bee colony based protocol for wireless sensor networks has been proposed. As from the survey it has been found that GSTEB has shown quite significant results over the available WSNs protocols. But it has neglected the use of the two things: - (1) as know in prior the tree based routing require shortest path between the source and the sink, but shortest path problem is NP-Hard in nature. Therefore the Artificial bee colony is required to enhance the GSTEB protocol further to find shortest route. (2) The use of reactivity has also been ignored in GSTEB routing protocol, so clustering is required to reduce the redundant data. (3) GSTEB has only applied on the small networks; the effect of dense network has been ignored in the GSTEB protocol. Therefore the proposed technique has been designed and implemented in the MATLAB tool. From the various metrics, the evaluation of the improvement of the proposed technique over GSTEB has been found.

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