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Efficient Energy Management in Wireless Sensor Network

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Abstract—In our work, we have to study the impact of heterogeneity of nodes, in terms of their energy, in wireless sensor networks that are hierarchically clustered. In these networks some of the nodes become cluster heads, aggregate the data of their cluster members and transmit it to the sink. It is assumed that a percentage of the population of sensor nodes is equipped with additional energy resources this is a source of heterogeneity which may result from the initial setting or as the operation of the network evolves. In our LEACH MAC protocols applied to heterogeneous network .Efficiency is improved as compare to traditional leach process.

Keywords—Wireless sensor network; Energy awareness; application type; scalability; protocol complexity

I. INTRODUCTION

WSN are specially motivated by military applications as well as many industrial and consumer applications such as industrial process, monitoring and control, machine health monitoring and in a home or large building for security. In a sensor field, each node senses surrounding conditions (data) may perform some data fusion and route the data back to the sink; which might be one or multiple nodes, to reveal some characteristics around the phenomena located in the area around the sensor [1]. The route choice takes place in a multi-hop infrastructure-less architecture fashion. The sink(s) communicates to the user, who acts as a task manager node through the Internet and/or satellite. Sensors are deployed manually or in a random fashion in the sensor field [2].They are made up of 4 basic components: a sensing unit, a processing unit, a transceiver unit, a location finding system, a mobilizer and a power unit (some of these units are optional, like the mobilizer and power generator). Sensing units usually consist of a sensor and Analog-to-Digital Converter (ADC) [4]. The signals sensed by the sensor from the sensor field are converted to digital signals by ADC and passed into the processing unit. The processing unit, which in general is associated with a storage unit, computes the tasks intended to be done with the other sensor nodes. Transceivers regulate communication across the network. One of the important components of a sensor node is the power unit, which commonly is just limited power resourced. Some units are application dependent like a mobilizer which is used when a sensor is mobile. However, most of the sensing routing techniques and tasks require accurate knowledge of the sensed data thus the location finding system is a common component in the sensor nodes. Usually they work in an unattended environment like in surveillance, environmental monitoring and telemedicine.

The rest of paper is design as follows. The overall past work is describe in Section II. Section III describes the methodology used for proposed work. Result analysis describe in section IV. Finally, Section V describes the conclusion of paper.

II. PREVIOUS RESEARCHERS

Payal Khurana Batra et.al (2015) [1] present an approach which attemptsto control the randomness present in LEACH's clustering algorithm. This approach makes the cluster head count stable. NS-2 simulation results show that proposed approach improved the First Node Death (FND) time and Last Node Death time by 21 and 24 % over leach, 10 and 20 % as compared to Advance leach and 5 and 35 % over leach with Deterministic Cluster Head Selection respectively.

Roslin, S.E(2015) [2] developed a hierarchical network using genetic algorithm. This network controls the network topology without affecting the network properties. In this paper, a two tier WSN developed using GA can be implemented in any hazardous applications. Though genetic algorithm gives an optimized list of cluster heads, there

are possibilities of local minima. This could be further improvised by simulated annealing which results in global minima.

A.S. Uma maheswariet.al (2014) [3] design new method which is based on AHYMN approaches and genetic algorithm is represented to choose a cluster head in WSNs in dynamically. Therefore, it is quicker and also more accurate to detect the node with higher energy and to select the cluster head. Moreover, this network has used nodes with heterogeneous characteristics.

Kiranpreet Kaur(2015) [4] proposes EDCHBO a cluster head selection algorithm for effective cluster head selection. This algorithm considers the energy and distance factor as parameter to improve cluster head selection. Simulation results show that EDC-HBO is more energy efficient than LEACH and UCR protocol.

R.Aiyshwariya et.al (2014) [5] introduced into the scheme in order to make the most criteria that can influence energy efficiency become a single one to determine the selection of the CHs, which is the main innovation and improvement of the classical algorithms. The simulation results demonstrate that the lifetime and energy efficiency of FAHP is better than other classical algorithms, time synchrony and fault tolerant problems are overcome by using FAHP process it also improves the localization accuracy and efficiency.

Ebin Deni Raj et.al (2012) [6] suggested new protocol EDRLEACH is based on clustering with maximum lifetime for wireless sensor networks. It improves LEACH by using a very equally distributed cluster and decreasing the unequal topology of the clusters. The new network protocol can be built on the shortcomings of Leach to try and rectify them. The applications of the new algorithm are immense as the life period has increased considerably.

Nabil Ali Alrajeh et.al (2007) [7] analyzed that WSNs have special vulnerabilities that do not exist in wire-line networks. Therefore, our protocols can't be simply transferred for wire-line networks to WSNs. Protocols must be designed with low computational power and low energy requirements in mind. In this paper it has been seen some of the protocols that are used, as well as some ways to determine where to check packets, including a new game theoretic approach in which it has been observed that by allowing the attack to have some utility.

IoannisKrontiris et.al (2009) [8] designing a security mechanism, we must consider the limited resources of WSNs. Anomaly-based IDSs are lightweight in nature; however they create more false alarms. Signature-based IDSs are suitable for relatively large-sized WSNs; however they have some overheads such as updating and inserting new signatures.

IoannisKrontiris et.al (2009) [9] proposes the development of an Intrusion Detection Program (IDP) which could detect known attack patterns. An IDP does not eliminate the use of any preventive mechanism but it works as the last defensive mechanism in securing the system. Three variants of genetic programming techniques namely Linear Genetic Programming (LGP), Multi-Expression Programming (MEP) and Gene Expression Programming (GEP) were evaluated to design IDP.

III. METHODOLOGY

Proposed protocol routing protocol was developed by inducing the features of energy aware routing and multi-hop intra cluster routing. The operation of the proposed protocol is broken up into rounds where each round begins with a set-up phase, when the clusters are organized, followed by a steady- state phase, when data transfers to the base station occur. The below flow chart describes the overview of the protocol initially the user has to give the input which is in the form of number of nodes.

For the nodes generated, their positions are randomly assigned and displayed. Once the nodes are deployed, every node uses the neighbor discovery algorithm to discover its neighbor nodes. Using the cluster head selection algorithm cluster heads are selected among the nodes. These cluster heads broadcasts the advertisement message to all its neighboring nodes and thus clusters are formed with a fixed bound size. Each node in the cluster maintains routing table in which routing information of the nodes are updated. Distributed randomized time slot assignment algorithm method is used, it allows several nodes to share the same frequency channel by dividing the signal into different time slots. The cluster head aggregates the data from all the nodes in the cluster and this aggregated data is transmitted to the base station. Once the clusters are created, the sensor nodes are allotted timeslots to send the data. Assuming nodes always have data to send, they transmit it at their allotted time interval. When a node receives data from one its neighbors, it aggregates it with its own data. While forwarding the aggregated data, it has to choose an optimal path from its routing table entries. It uses a heuristic function to make this decision and the heuristic function is given by, $h = K (E_{avg} / h_{min})$where K is a constant, E_{avg} is average energy of the current path, h_{min} is minimum hop count in current path, t = traffic in the current path. The path with highest heuristic value is chosen. If this path's E_{min}> threshold, it is chosen. Else the path with the next highest heuristic value is chosen, where

$$E_{min} = E_{avg} / const$$

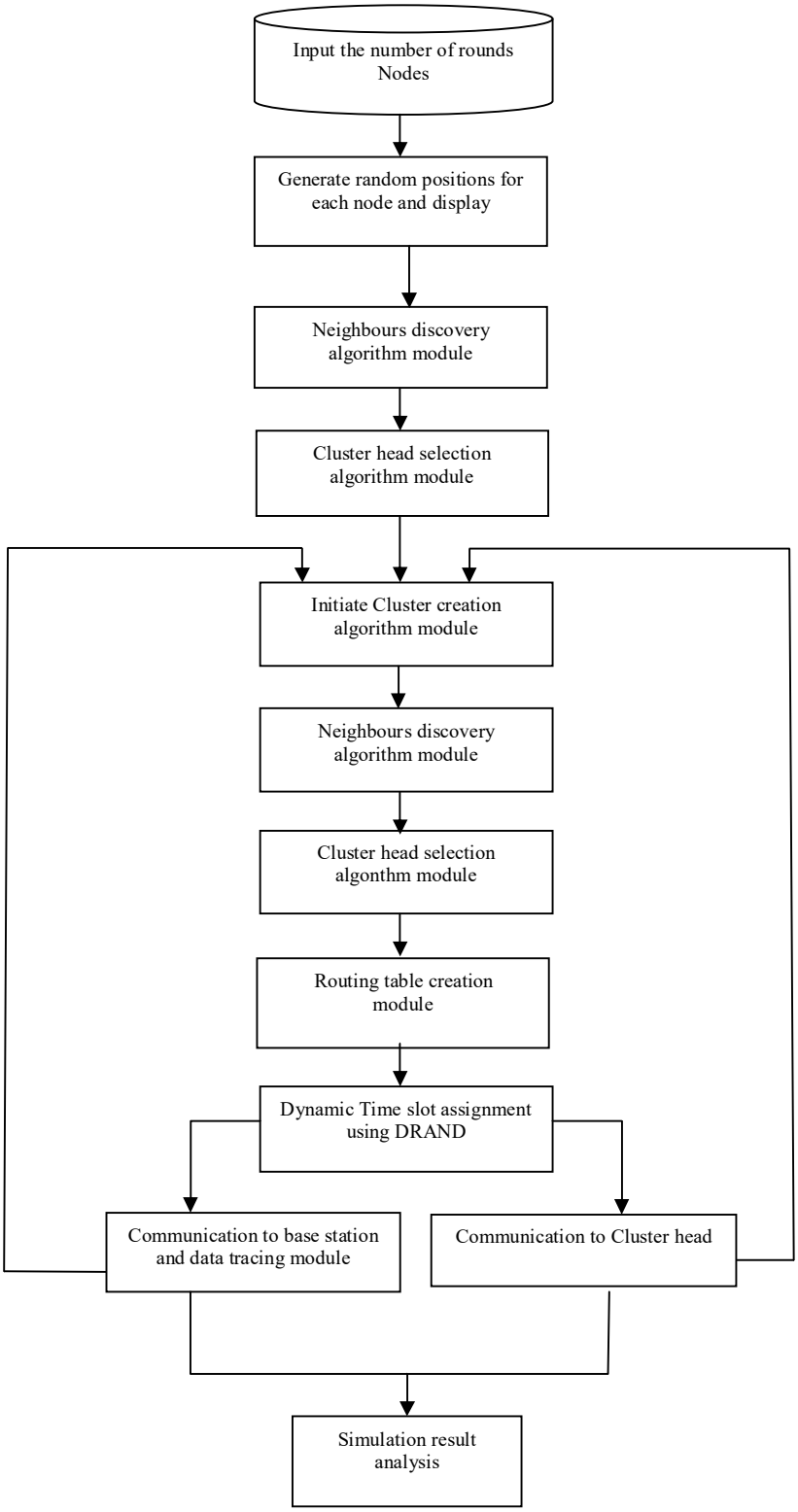

Fig 1 Proposed Flow Chart of the Process

IV. RESULT ANALYSIS

To simplify the simulation of these protocols few assumptions are made. They are as follows:

- Initial energy of nodes is same.
- Nodes are static
- Nodes are assumed to have a limited transmission range after which a another equation for energy dissipation is used
- Homogeneous distribution of nodes.
- Nodes always have to send the data.

Details of the simulation environment are mentioned in Table 1, given below:In order to evaluate the performance of proposed technique, a MATLAB simulator has been used. Table 1 contains the standard parameters of environmental parameters used in the simulation.

Table 1: Simulation Parameters

Parameters	Values
Number of sensor nodes	100 nodes
Initial node energy	0.1 J
Percentage of CH selection	0.05
Transmitter/Receiver electronics E_{elec}	50 nJ/bit
Transmitter amplifier ϵ_{fs} ($d < d_0$)	10 pJ/bit/m^2
Transmitter amplifier ϵ_{mp}($d > d_0$)	0.0013 pJ/bit/m^4
The energy for aggregation E_{DA}	5 n J/bit/signal

The selection of energy efficient routing protocol depends on the applications. Thus, it is necessary to compare the results of different energy efficient routing techniques.

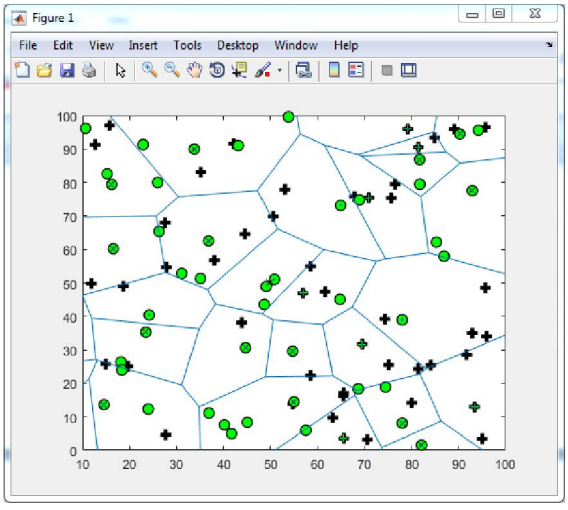

Fig 1 Nodes placement in Wireless sensor Network

Fig 1 shows that efficient node placement in wireless sensor network. The wireless sensor network, the nodes are

alive nodes dead nodes are representing in the figure.

Figure 2 represents dead nodes during the round. Proposed work for heterogeneous network having more no. of dead nodes as compared to traditional LEACH protocols

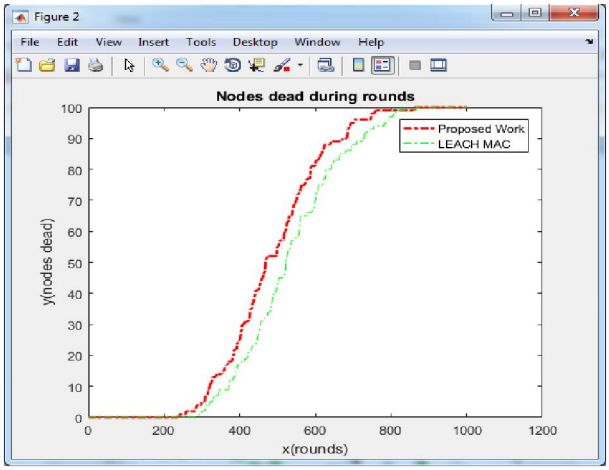

Fig 2 Nodes dead during round

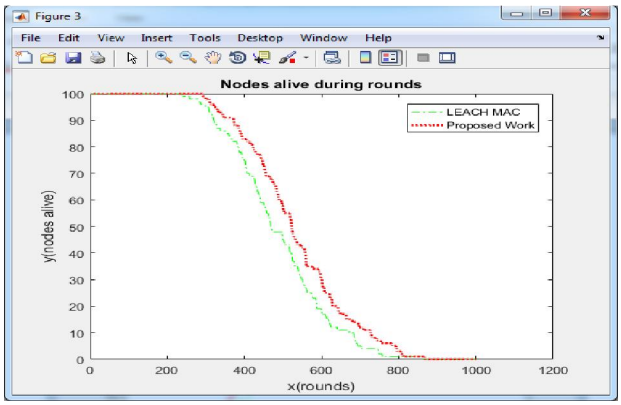

Fig 3 Nodes alive during round

Fig 3 represents alive nodes during the round. Proposed work for heterogeneous network having more no. of alive nodes as compared to traditional LEACH protocols

V. CONCLUSION

Also assume that the sensors are randomly (uniformly) distributed and are not mobile, the coordinates of the sink and the dimensions of the sensor field are known. The behavior of such sensor networks becomes very unstable once the first node dies, especially in the presence of node heterogeneity. Classical clustering protocols assume that all the nodes are equipped with the same amount of energy and as a result, they cannot take full advantage of the presence of node heterogeneity. we propose, a heterogeneous-aware protocol to prolong the time interval before the death of the first node, which is crucial for many applications where the feedback from the sensor network must be reliable. The proposed work can greatly improve the Energy Efficiency and Overall stability of the Heterogeneous WSN Network.

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