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Energy Consumption in Wireless Sensor Networks Using Multi Level Clustering Energy Efficient Protocol

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Abstract— A wireless sensor network (WSN) consists of a huge number of sensor nodes that are inadequate in energy, storage and processing power. One of the major tasks of the sensor nodes is the collection of data and forwarding the gathered data to the Base Station (BS). Hence, the network lifetime becomes the major criteria for effective design of the data gathering schemes in WSN .In this paper , every sensor nodes can converse straight with every other or with the base station. This develops into impracticable when the size of the region of interest enlarge. The anticipated protocol uses a multi-hop communication among the cluster-heads to preserve energy and cover up a huge area of interest. To diminish the quantity of information to be sent to the base station, we incorporated data aggregation. Furthermore, the rotation of cluster-heads and the utilize of the low-power sleep mode by the sensor nodes that do not contribute in routing permit to balance the load and reduce energy utilization considerably**.** Apply the MAT LAB Simulation software Tool to confirm the proposed design, comprehensive simulation has been approved. The NARRATIVE-LEACH schemes recommend reliable wider experience area and longer life span of WSN. To compare the other modules N-LEACH is the best enhanced in terms of stability period while compromise on lifetime.

Keywords: F-Leach, M-Leach, Narrative Leach, WSN. Clustering; Cluster head; Energy-efficient

I. INTRODUCTION

A Wireless Sensor Network (WSN) consists of a large number of small-sensor nodes used to monitor areas, collect and report data to the BS. Due to the accomplishment in low-power digital circuit and wireless transmission, most of the applications of WSN are implemented and used in military applications, object tracking, habitat monitoring. One of the primary issues in WSNs is raising an energy-efficient routing protocol. Since the sensor nodes have controlled accessible power, energy conservation is a serious issue in WSN for nodes and network life. The majority of the obtainable routing protocols for sensor networks don't turn off the radio frequency entirely. They speed up the energy utilization. LEACH is a clustering-based protocol that non-cluster-head nodes will turn off their radio frequency entirely until their pre allocated time slot. A typical WSN is composed of a huge number of sensor nodes, which are randomly disseminated over the network. The signals are picked by all types of sensors and the data acquiring unit, processing and transmitting them into a node called sink node. Though, LEACH has a problem that the cluster is not recurrently distributed due to its randomized turning round of local CH [14]. Hardware and software

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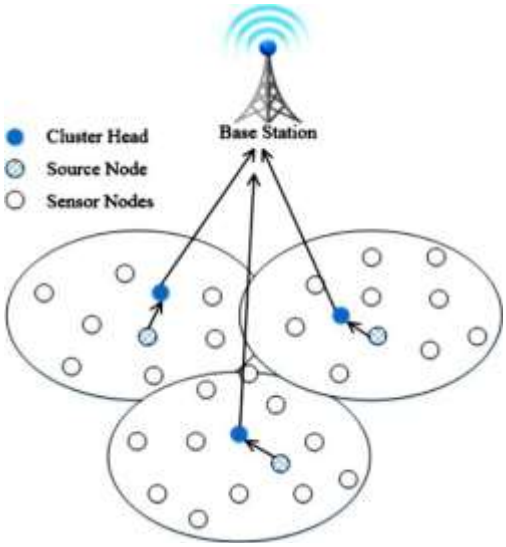
constraints create a lot of intend issue that have to be addressed to achieve a helpful and enceinte operation of WSNs. additional, novel application scenarios lead to new challenges. The subsequent point corresponds to a small number of problems which are obtainable in WSN. Energy-aware algorithms: Sensor nodes are motorized by exterior batteries and it can be complicated to replace them when consumed, so it is significant to design algorithms and protocols that make use of smallest energy. The major problem is energy consumption and it is concentrated on the cluster heads . In order to resolve this issue, the cluster routing is used to distribute the energy consumption with the cluster heads. Data gathering is an efficient method for conserving energy in sensor networks. A data- gathering algorithm includes some aggregation methods to minimize the data traffic. It reduce the number of message exchange among the nodes and BS. Data gathering capacity reflects how efficient the sink can gather sensing data from all sensors under the presence of interference. Normally Cluster Head (CH) will updated and link performance will be maintained. But in such cases, CH will not effective and soon will die and re-clustering will be initiated. So such problems EE-LEACH will be initiated. The proposed method focuses on defining an energy efficient routing based on low energy Adaptive clustering hierarchy (LEACH) clustering and optimal cluster Head(CH) Selection. The next generation Novel approach is M-LEACH, F-LEACH, and NARRATIVE- LEACH (N-LEACH) using MATLAB. N-LEACH has the best performance and long stability period. In this model is incorporated for the node deployment. The data are forwarded from the different sources to the BS based on the energy efficient routing strategy.

II . METHODS AND MATERIAL

RELATED WORK

The basic Task of the WSN is to effectively collect the data- gathering are aimed to minimize the energy consumption problem. LEACH is a hierarchical protocol in which the node details are handled by CHs . THs gather the data and compress them and forward to the base station (sink). The structure of the proposed LEACH Protocol is shown in the Fig.



The Drawbacks of this protocol are as follows:

- A Sensor node is selected as the CH- Using distributed probabilistic approach, Where as the non-cluster nodes calculate which cluster to join based on the signal strength. This approach assures lower message overhead, but cannot assure that CHs are uniformly distributed over the network. In this case , CHs may lead to minimum network lifetime.
- Leach involves source nodes to send data to directly. However if the CH is extremely far away from the source nodes , they might expand excessive energy in data transmission. Further LEACH requires CHs to transfer their aggregated data to the sink node over a single hop link. Single-hop transmission may be quite costly when the sink appears far away from the CHs.
- Leach also holds an assumption that all sensor nodes have sufficient power to reach the sink node if necessary, which might be resistant for energy-constrained sensor nodes.

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The LEACH Protocol is a hierarchical clustering protocol that provides an elegant solution for such protocols. One deficit that affects the presentation of the procedure is endurance of very large and very small clusters in the network at the similar time. This leads to reduce in life span of WSNs. This research work focused to analyze a new energy proficient clustering protocol (Z-LEACH)that eliminates the above problem forming Far-Zone. It is a group of sensor nodes, which are placed at locations where their energies are less than a threshold. The result shows the good performance of energy consumption in a certain level and it is not maintained in long stability level. In this regard to analyze the Narrative LEACH protocol to perform Energy Consumption.

In a sensor network , sensed data should be collected at a centralized location , called sink, for processing and assignment. With limited transmission distance , sensed data might require multiple relays to arrive at the sink.

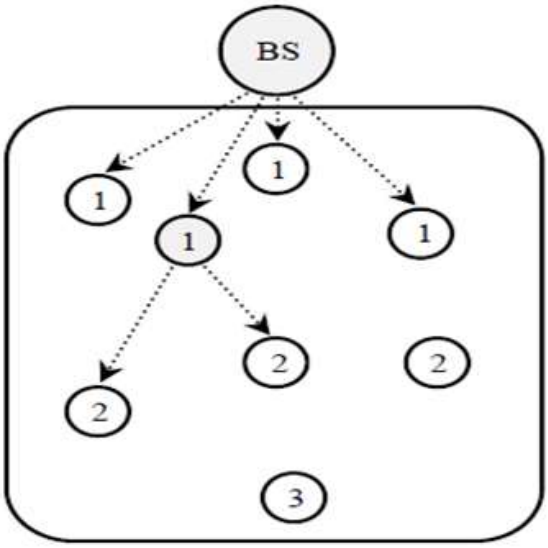


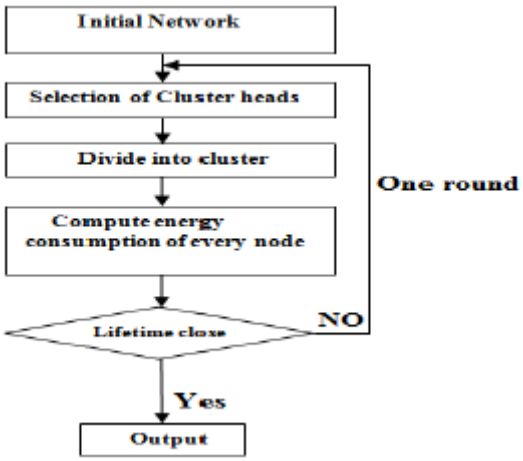
Figure 2: Determination of levels and exchange of information.

In this work , we projected narrative- LEACH Protocol that based on multi level clustering scheme for optimizing power in WSNs. The function is to construct an energy efficient and effective routing method for the WSNs. Cluster establishment in this work is different from the well-known LEACH Design. Cluster-heads in our proposed work intend form a tree with aim to get to all sensor nodes in a network. Subsequently, each one sensed data in the tree can be deliver to the sink while LEACH cannot present this guarantee. Energy assets may be improved with different numbers of levels in the hierarchical clustering architecture.

III. PROPOSED METHODOLOGY AND SIMULATION

Existing cluster algorithms frequently focus on convinced features while missing other features like acquire scalability, load complementary, responsibility tolerance, energy efficiency and multilevel clustering structure. It is complicated for application layer growth as well as lower layer alteration. The situation in which we put as one of our simulation model was MATLAB. The name MATLAB stands for matrix laboratory. MATLAB residential by Math Works Inc., is a software package for high presentation numerical computation and exposure. The understanding of examination ability, flexibility, dependability and influential graphics make MATLAB the primary software package for practical researchers. MATLAB Present an interactive situation with hundreds of trustworthy and precise built in mathematical function. These function nearby declaration to a broad range of mathematical problems including mathematical algebra, The almost all important feature of MATLAB is its programming competence, which is tremendously simple to study and use, and which permit user- developed functions.

FLOW CHART NARRATIVE –LEACH



Cluster Formation Steps :

Step 1: neighbour information retrieval

The neighbour node information are sensed by broadcasting the beacon messages throughout the network.

Step 2: perform selection algorithm

The selection algorithm is performed to retrieve the list of all neighbor nodes about its hop distance. All nodes in the network are arranged in decreasing order of residual energy. Initially all nodes in the network are unclustered.

Step 3: candidate for cluster

When its two- hop neighbor node is not enclosed, analyze all the members of stage 2 one-by-one and crown any one two-hop neighbour for being as a candidate for the cluster.

Step 4: calculate the residual energy of neighbour nodes

Finally, the selection algorithm is executed based on the residual energy of the neighbour nodes.

IV . CH SELECTION

There are two steps of phases to perform cluster formation operation are setup phase and steady state phase.

Setup Phase

In the setup phase, every node decides to become a cluster head or not. In LEACH protocol, each node elects itself as a cluster head on the basis of the desired percentage of the cluster heads for the network and number of times a node has been a cluster head. Each node chooses a random number from zero to one and then calculates the threshold T(n). The node then compares the random number with T(n). If the random number is less than or equal to T(n), the node becomes a cluster head for the current round. The threshold for cluster head selection is calculated by using Equation.

$$T(n)=\begin{cases}\dfrac{P_d}{1-P_d*\left((r)\bmod\dfrac{1}{P_d}\right)} & \text{if } n\in A\\ 0 & \text{Otherwise}\end{cases}$$

Where P_d is the desired percentage of cluster heads, A is the group of nodes which are not selected as cluster heads in previous 1/p rounds and r is the current round. After several rounds, the energy of nodes in the network will become uneven, and nodes with high energy and low energy will have the same probability of becoming the cluster heads, so there will be an inappropriate cluster head selection. Unlike LEACH, our proposed protocol follows a different approach for cluster head selection. From each rectangular cluster, the node with the highest remaining energy will be selected as the cluster head. The current cluster head will decide the next cluster head for the next round in its cluster. All the nodes send their remaining energy information along with data packets to the cluster head. From this information, the current cluster head selects the node with the highest remaining energy as the cluster head for the next round.

We have simulated LEACH, M-LEACH, F-LEACH and N-LEACH using MATLAB, a separate event based object oriented simulator. Table 1 lists the simulation parameters used. To review the algorithms, we have use the following presentation metrics. Reproduction were perform using MATLAB for a clustered WSN, where nodes were randomly organize and it was unspecified that each SN is capable of sensing and transmitting data packet to its CH. A TDMA base MAC scheme was deliberate where SNs broadcast one packet in their owed time slots so that no smash occurs. The energy model approve in has been approve to appraise the energy compulsive by the nodes. The steady radio parameter i.e. α.

The conclusion is inclusive in terms of the succeeding metrics Energy spending. This metric exhibit the energy stimulated throughout the network operation. Network lifetime this metric demonstrate the number of sensor nodes that die every during the network process. Received data messages this metric exhibit the number of data messages in effect delivers to the base station. For the motive that the CH consumes further energy, our protocol distributes this role to sensor nodes with prominent remaining energy. Subsequent every round, these CH will be alternate with complementary sensor nodes with further outstanding energy.

LEACH does not get into clarification the outstanding energy of sensor nodes every through the selection of CH. The alternate is made randomly and every one sensor nodes in the network engage in exercise that role each so often. Moreover, the CH communicates instantly with the base station using the highest announcement power, which necessitates a high energy. Our protocol uses short reserve transmission to reasonable energy consumption. To examine the network lifetime, we have selected the subsequent three definitions. The time throughout the most important sensor

node dies, the time pending half of the sensor nodes die, and the time pending the

Preceding sensor node dies. Since added than one sensor node is necessary to attain the clustering, the previous meaning converse to the lifetime of the network when 80% of the sensor nodes die. In the case anywhere the CH is not in the center of the clusters, a measure of sensor nodes will use additional energy than others. LEACH does not declaration a superior portion of CH since the assembly is done arbitrarily without behaviour in intelligence the network parameters.

III. RESULTS AND DISCUSSION

Experiment Parameters

Each Leach procedure round consists of Set-up phase (clusters are accepted). Cluster Head Selection. Cluster pattern stable state Phase (data transmission) One Round supposes 10 statement frames. We are presumptuous 3 bytes of data at each node to be sent to the BS. Inflated the energy in the CH selection at the BS. Exaggerated the node registrations in the cluster have energy at each node subsequent to the cluster formation according to the equation the energy expenses is intended. Assuming 10 nodes at every head and having ten different distances and ten dissimilar energies.

The energy being deteriorate to run the transmitter:

Eelec=50 nJ/bit

Energy dissipation of the transmission amplifier:

Amp = 100 pJ/bit/m2.

Transmission costs: Etx (k, d)=Eelec k + eamp k d2

Receiving costs: Erx (k) = Eelec K

Where k is the length of the message in bits d is distance between nodes.

For LEACH Implementation's Parameters

PARAMETERS	VALUES
Network Field	100 X 100 m^2
Number of Nodes	100
E_o(Normal energy of initial Nodes)	0.5j
Message Size	5000 bit
E_{elec}(the radio dissipates energy to run the transmitter or receiver)	50 Nj / bit
E_{fs} (free space loss Energy)	10Nj / bit / m^2
E_{amp}(multipath loss Energy)	0.0013Pj / bit / m^4
EDA(Compression Energy)	5Nj / bit / signal
d_o (Threshold distance)	70 m
P_{opt}(Probability of Cluster heads)	0.1

Table 1 : narrative –Leach Simulation parameter and its Values.

E in 100 Nodes in 40 round

01	0.308478	0.308408
02	1.42768	0.717138
03	2.26208	0.754026
04	3.18469	0.796172
05	4.05291	0.810582
06	4.99641	0.832735
07	5.91044	0.844348
08	6.93677	0.867096
09	7.85366	0.872628
10	8.90056	0.890056
11	9.79771	0.890701
12	10.6676	0.888969
13	11.5932	0.891783
14	12.5856	0.898969
15	13.3981	0.893209
16	14.3452	0.896573
17	15.3733	0.904309
18	16.3215	0.906748
19	17.2418	0.907465
20	18.2201	0.911004
21	19.1815	0.913403

22	20.1201	0.911455
23	21.1384	0.919062
24	22.0232	0.917634
25	22.9484	0.917936
26	23.8186	0.916098
27	24.7566	0.916913
28	25.6816	0.917199
29	26.7342	0.921870
30	27.7567	0.925222
31	28.6767	0.927545
32	29.7344	0.929087
33	30. 0014	0.929817
34	30.9392	0.930523
35	31.7219	0.932346
36	32.6762	0.933478
37	33.7274	0.935901
38	34.8412	0.936752
39	35.7825	0.938994
40	36.7274	0.939754

Table 2: Energy level in Leach (100 nodes in 40 rounds) E inside the N-LEACH in the 10 frame or one round.

We have examined LEACH, M-LEACH, F- LEACH and narrative- LEACH for heterogeneous WSNs containing different level of heterogeneity. Simulations prove that LEACH and M-LEACH perform well in the networks contain high energy dissimilarity among normal, difficult and super nodes. Whereas, we discover out that F-LEACH and narrative-LEACH perform well in all scenarios. NARRATIVE-LEACH has best performance in terms of constancy period and life time. So, N- LEACH is enhanced in terms of stability period while compromise on lifetime.

CONCLUSION

The N-LEACH Protocol is presented to improve the lifetime of the sensor network. The coverage probability is derived with respect to the N-LEACH. A selection algorithm based on the residual energy of the neighbour nodes is executed to obtain the list of neighbour nodes. The N-LEACH Protocol results in a better packet delivery ratio, lesser energy consumption and lesser end to end delay. WSNs have the difficulty of lifetime and scalability. To enlarge lifetime and scalability it's essential to have control above topology of the network. In this paper we propose a dynamic multi-level hierarchal clustering technique for sensor networks. The proposed technique will generate a dynamic system which can differ topology architecture according to traffic patterns. This technique can make a decision size of cluster, nodes in a cluster and level of hierarchy of a cluster and will differ according to state of the system. In this technique for clustering we utilize nodes having multiple energy level for energy resourceful clustering and cluster heads are chosen occasionally based on dissimilar attributes (i.e. residual energy, node degree etc) but different previous technique here we utilize mutual negotiation connecting nodes as a criteria for cluster structure. We extend this work with the security concepts, which analyses the traffic flow among the sensor nodes. Hence, in the future, the proposed N- LEACH Protocol is integrated with the security mechanisms to protect the network from security attacks.

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