A Clustered based Approach for Energy Efficient Routing in WSNs

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ABSTRACT
Wireless sensor Networks (WSNs) contains a large amount of tiny and low value sensor nodes powered by tiny non reversible batteries and furnish with numerous sensing devices. The cluster-base technique is one among the nice perspectives to reduce energy consumption in WSNs. The lifespan of WSNs is maximized by using the uniform cluster location and leveling the network loading between the clusters. They've reviewed numerous energy efficient schemes apply in WSNs of which tend to combined on cluster approach. During this paper this tends to perform intensive simulations of the projected protocol and compare the simulation results with that of the present protocol. The results demonstrate that the projected protocol outperform the existing protocol in terms of various performance metrics together with remaining energy, percentage of alive nodes, percentage of dead nodes and throughput.

Keywords
WSNs, Clustering, LEACH, Network Lifetime, Throughput, Energy, Dead nodes

1. INTRODUCTION
WSNs are consisting of sensor nodes that are connected through wireless media. It consists of spatially distributed sensor nodes that are interconnected without the utilization of any wires. WSNs are to monitor and measure the environmental conditions like temperature, humidity, sound, pollution levels, pressure, and so forth. The energy efficiency may be a difficult issue in multimedia communication because of the resource constraints, economical channel access, and low transmission delay. Energy-efficient routing is a key analysis area in wireless sensor networks for dynamic topology nature property. So want to style the effective routing protocols. Numerous energy-efficient routing protocols are planned for WSNs. The energy-efficient routing Protocols are based on the node uniformity that is taken into account to be deployed uniformly within the field. Routing protocols style relies on the topology which could change dynamically. It should include a set of procedures for a router that is to tell other routers regarding its directly connected networks, where to receive and process a similar info from other routers, and to pass on the data it receives from different routers.

Classical approaches like direct transmission used to send information from sensing element nodes on to BS and in Minimum Transmission Energy nodes close to BS has higher chance to send knowledge than nodes that are placed way away from BS [6]. To stop this imparity and improve the lifespan of WSN LEACH was proposed by Wendi Rabiner Heinzelman et al in 2000 [8]. LEACH is a cluster based Routing protocol for WSNs. The sensing element nodes are created to make many clusters within the sensing region. LEACH is a self-organizing, adjective cluster protocol that uses randomization to distribute the energy load equally among the sensors inside the network [9]. This is often a method within that network energy Consumption is well managed by minimizing the transmission range of the sensors. A cluster head (CH) is chosen at every round in a cluster. All sensing element nodes in a cluster transmit knowledge on to the native CH. Then CH gathers all knowledge from device nodes within the cluster and sends the information to BS. After every round a new cluster head is elected [3].

The main objective of this paper is to develop new approaches for providing energy efficiency, longer lifetime, and higher output in WSNs. A close literature survey is completed for developing a thought concerning the solutions already provided for these issues. This paper studies the performances of some existing algorithms and proposes an efficient algorithm for fulfilling its objective. The planned algorithmic program is improved by putting some nodes in sleep mode, whereas the other nodes are kept in active mode for sensing and communication tasks. Sensing element nodes are alternatively sensing the surroundings and perform information collection and processing.

2. RELATED WORK
This related work presents an existing works that were associated with Wireless sensing element Networks. There are several sorts of cluster that supported the routing protocols that are projected for Wireless sensing element Networks. Energy consumption and network lifetime are the foremost vital options within the design of the wireless sensing element network. Heinzelman in [1] gift Energy-Efficient Communication Protocol for Wireless Micro-sensor Networks. Supported MATLAB simulations delineated on top of, results shows that LEACH will surmount typical communication protocols, in terms of energy dissipation, simple configuration, and system lifetime/quality of the network. In [5] author had survey varied Descendant of LEACH based Routing Protocols in Wireless sensor Networks. Moreover, the timeline and surveyed define table of LEACH and its descendant routing protocol has been given. Improvement on LEACH Protocol is given in [3]. They modified LEACH protocols into energy-LEACH protocol and Multihop-LEACH protocol that have higher performance than LEACH protocol. [4] Present associate formula for Time-based Cluster-Head selection. During this, author had given a very distinctive approach to boost LEACH protocol, and compared it to the LEACH protocol. Simulation results show that the TB-LEACH provides the higher energy efficiency and additionally the longer network time period than the LEACH.

[6] Gift Energy-Efficient Communication Protocol for Wireless Micro-sensor Networks. During this, we've a tendency to represented LEACH, a clustering-based routing protocol that minimizes international energy usage by distributing the load to any or all the nodes at completely different points in time. Author [2] presents Gateway-Based Energy-Aware Multi-Hop Routing Protocol for WSNs. during this the network divides into logical regions. Each region use entirely different communication hierarchy. This technique encourages higher distribution of CHs among the network. Simulation results show that the projected protocol performs well compared to LEACH in terms of Network lifetime, Residual energy and throughput

3. PROPOSED TECHNIQUE

In this section, tend to present detail of planned protocol. Sensing element nodes have an excessive amount of sensed information for BS to method. Therefore, an automatic technique of combining the info into a small set of significant information is needed. The method of information aggregation additionally termed as data fusion. So as to enhance network lifetime and throughput, thus tend to deploy an intelligent node at the centre of the network field. Function of intelligent node is to gather information from CHs and from nodes close to intelligent, aggregation and send it to BS. The results make sure that network lifespan and energy consumption improved with the expense of adding intelligent node.

3.1 Phases of Proposed Protocol

1. Initial Phase
2. Setup Phase
3. Cluster Head Selection
4. Scheduling
5. Steady State Phase

3.1.1 Initial Phase

Sink broadcasts a hello packet. Then sensing element nodes transmit acknowledge packet. The Sink stores all info of nodes in Node information Table. Node knowledge Table includes node ID, Residual Energy, and distance of node from Sink and intelligent node.

3.1.2 Setup Phase

Sink divides the nodes into four logical regions. Two regions use direct communication. Two regions use clustering technique.

3.1.3 Cluster Head Selection

CHs are elected based on the remaining energy of node and chance p. Every node elects itself as a CH once each 1/p rounds. A node generates a random number between (0-1). If the generated random variety is less than a predefined threshold T(s) value, then the node becomes CH.

$$T(s) = \begin{cases} \dfrac{p}{1-p\times\left(r \bmod \left(\frac{1}{p}\right)\right)} & if\ s \in C \\ 0 \end{cases}$$

Where,
p = Desired percentage of CHs
r = Current round
C = Set of nodes not elective as CH in current round.

3.1.4 Scheduling

Every CH creates a TDMA primarily based schedule for its member nodes .CH collects information and forwards to intelligent node. Intelligent node assigns a TDMA with R.N.G (Random number Generator) schedule to CH. Intelligent node aggregates information and forwards to Sink.

3.2 Protocol Steps:

Step 1: Sink node send hello packet to sensing element node.

Step 2: Divide network field into four logical regions supported location.

- Region 1: Directly communicate with sink node
- Region 2: Intelligent node is employed in this region. Intelligent node does: energy awake, information aggregation and TDMA with Random number Generator.
- Region 3: Cluster Head is employed in this.
- Region 4: Also a clustered region

Step3: CH is chosen based on comparison random number generated by node with predefined threshold.

Step 4: Nodes transmit there information to CH in its own scheduled time interval base on TDMA.

Step 5: Sensing element nodes send information to CH then CH to intelligent node then aggregate knowledge and send it to sink node.

4. PERFORMANCE ANALYSIS

This assesses the performance of planned protocol and compares it with existing protocol in WSN, referred to as LEACH.

4.1 Simulation Setting

To increase the performance of projected protocol, there simulate protocol using MATLAB. This tends to think about a wireless sensing element network with a hundred nodes distributed indiscriminately in 100m X 100m field. An intelligent node is deployed at the centre of the sensing field. The BS is found far away from the sensing field. This tends to consider packet size of 3000 bits. In this we compare proposed protocol with LEACH protocol. To determine performance of proposed protocol with LEACH, thus neglect the results generated by signal collision and obstruction within the wireless channel.

4.2 Performance Parameters

This segment, tend to present performance metrics. During this work, we evaluated 3 performance parameters given below.

4.2.1 Network Lifetime

It's the interval from the beginning of the network operation until the last node die.

4.2.2 Throughput

To evaluate the performance of throughput, ranges of packets received by BS are compared with the number of packets sent by the nodes in every round.

4.2.3 Residual Energy

The residual battery energy of network is taken into account so as to analyze the energy consumption of nodes in every

round. Residual energy ensures graceful degradation of network life.

4.3 Simulation Results and Analysis

4.3.1 Network Lifetime

Once running the simulation, discover out that the projected protocol outperforms LEACH. In fig.1, tend to show the results of Network lifetime. Nodes are considered dead once consuming initial energy. Projected protocol obtains the longer network lifespan. This is often because, here the energy consumption is well distributed among nodes. Network is divided in projected protocol into logical regions and it balances energy consumption among sensor nodes and some nodes are place to sleep mode in each round to save lots of energy whereas not losing data.

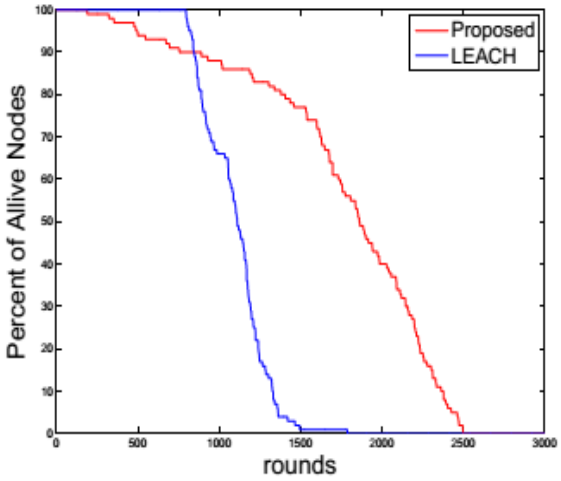

Fig.1 Interval plot- Analysis of Network Lifetime

4.3.2 Throughput

By analyzing fig.2 this tend to see that the throughput of projected protocol is larger than that of leach. This can be as a result of sensor nodes close to intelligent node send their information directly to intelligent node; similarly nodes close to BS transmit information directly to BS. Sensing element nodes in each region consume less transmission energy therefore; nodes keep alive for extended period. More alive nodes contribute to transmit a lot of packets to BS.

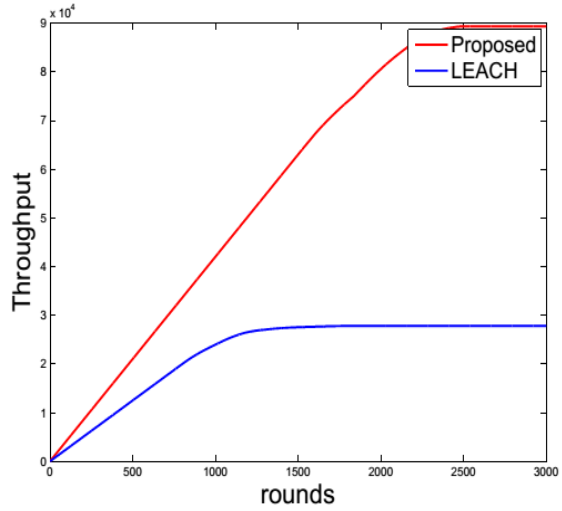

Fig.2 Interval plot-Analysis of Throughput

4.3.3 Dead Nodes

By analyzing fig.3 we tend to found that the amount of nodes per round die more quickly in LEACH then projected protocol. This is often as a result of the energy consumption is well distributed among nodes in projected protocol.

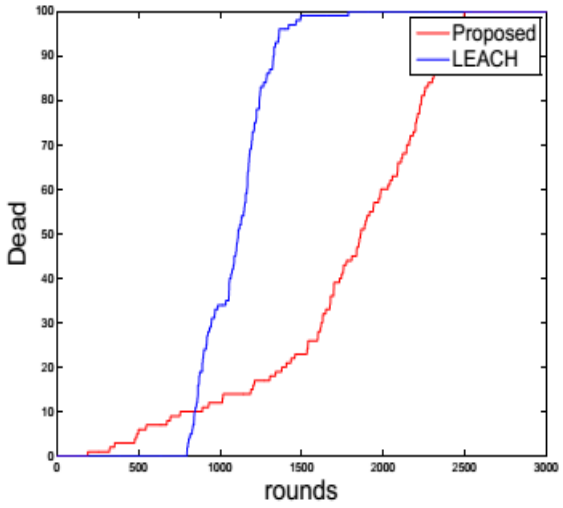

Fig.3 Interval plot- Analysis of Dead nodes

4.3.4 Residual Energy

Fig.4 shows average residual energy of network per round. It is assumed that a node has 0.5 joule energy. The overall energy of a hundred node network is 50 joule. Planned protocol yields minimum energy consumption than LEACH. Fig.4 clearly depicts that projected protocol outperforms LEACH routing protocol in terms of energy consumption per round. Deployment of intelligent node at the centre and high probability of CHs in all regions ensures minimum energy consumption.

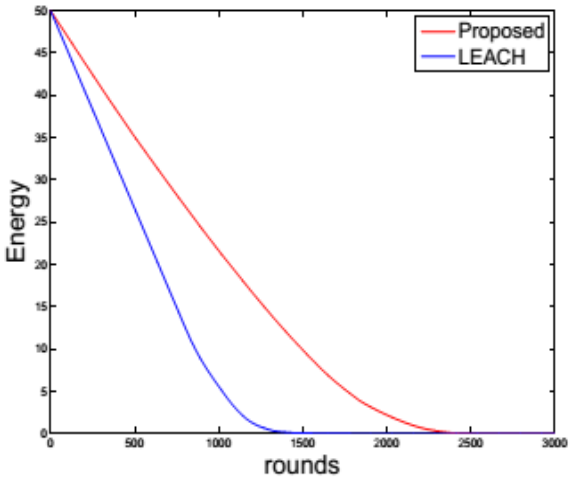

Fig.4 Interval plot- Analysis of remaining energy

5. CONCLUSION & FUTURE SCOPE

In this work, we divide the network into logical regions. Every region use different communication hierarchy. 2 regions use direct communication topology and 2 regions are sub-divided into clusters and use multi-hop communication hierarchy. Every node in a region elects itself as a CH independent of alternative region. This method encourages

better distribution of CHs within the network. This technique encourages better transmission of information that further will increase lifetime of the network. Simulation results are computed in MATLAB and check for the efficiency of our planned protocol. Simulation results show that planned protocol performs well in term of network lifetime, remaining energy, no. of dead nodes and throughput. Therefore we conclude that at the expense of the intelligent node one will simply achieve higher performance of the network.

The future scope of work is to find some more techniques with which there can be improvement in the performance of network with respect to network lifetime and energy consumption. The number of rounds should be increase to find the performance of protocol.

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