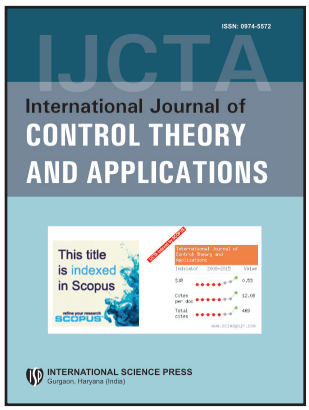

International Journal of Control Theory and Applications

ISSN : 0974-5572

Volume 10 • Number 25 • 2017

Tree Based Clustering Effective Energy Aware Routing Protocols to Enhance the Performance in Wireless Sensor Networks

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Abstract: Today's WSN has created a demand in communication with smart devices day by day and has deployed many challenging and research issues related to energy and security. We know that clustering is the basic method which is used to enhance the performance of the sensor network. We propose an effective energy tree based clustering protocol for rapid increase in data transmission and is formulated based on parameters related to node of nodes, size of buffers, sink distance and efficiency of energy. The tree head collects the aggregated data and is used to find the path effectively from cluster head to sink.

Keywords: WSN, Routing, Security, Attacks, Sensors.

1. INTRODUCTION

WSN is a collectively connection of sensor nodes which are connected using wireless media to perform distributed sensing task. The WSN and its devices are equipped micro battery, having processor, transceiver of radio, which has numerous transducers for receiving data and gathering data from various sources from environment and transferring to the base station. The transducers supervise the system environment based on certain parameters of temperature, humidity and pressure. The WSN nodes consume less power and are low cost. Its implicational areas are surveillance, detection of flood, military, monitoring of patients and house hold applications. The network consists of various resources which are constrained to energy, computing speed, resource for communication. To coup with the resources in a network, energy is the critical and major issue in sensor networks. Each node sensor is fixed with an energy renewable source. Battery replacement is impossible. The protocols of routing are categorized into 3 namely routing based on location, hierarchical routing and flat routing. The routing hierarchical protocols mainly maintain the consumption of energy in sensor network using multihop effective communication and aggregation of data fusion performance. Tree clustering is collection of nodes based on certain criteria. In tree based clustering, root head of the cluster is the main node responsible for

aggregation of data. Aggregation of data is the integration of data from various sources using various functions like suppression, max, min and average.

These methods are used to gather data and eliminate redundant data and also eliminate traffic. The developed protocol allows the data to be routed from the tree head of the cluster to the base station which save and reduces energy in transmission of data to long distance. This paper proposes an effective energy routing tree based protocol to increase the life of the network.

2. RELATED WORK

In routing hierarchical, each of the nodes are segregated for playing various roles like tree head cluster and member of cluster. Each Tree head of the cluster gathers data from various nodes of the tree members, aggregate data and transfer data via the head to the sink. The main aim of this routing is to save energy and increase the life of the network. This type of clustering protocol will execute the process of selecting and re-clustering the root head dynamically based on load and performance of the load in a network [1].

Residue energy routing [RER] is a cluster routing algorithm based on energy related to hierarchical. This method is an improved version of leach which includes cost of communication in a cluster. The cost includes energy residual, energy for communication and the number of nodes in a sink. RER use the cluster head concept for selecting and communication of data based on improved schemes for the selection of a head cluster [2].

Protocol LEACH uses rotation randomized scheme for energy high cluster nodes position, where the head rotates dynamically among different sensor nodes in a cluster in order to reduce the drain of battery of each sensor. Rather LEACH does native aggregation of data for the compression of data which is been sent from the cluster node to base station. In this energy reduced dissipation is used to increase the life of the sensor nodes and he network based on probability and cluster head management [3].

The head cluster will broadcast the status of all the nodes and their performance in the network. As the nodes are assembled, the node head creates an index for managing the nodes in the cluster. By doing this radio signaling will be dropped off when not required for all times except and when only transmission of data, which reduces the energy efficient in a network. The cluster head collects the data from the non-cluster node aggregates and transmit the data to the sink [4].

These protocols studies has made us to join the work in building an effective cluster tree based routing protocol for managing the energy of the sensor nodes in a network. The proposed work will creates a tree head cluster based on election and dynamic route discovery based on energy saving schemes for energy residual, size of buffer and sink distance.

3. MODEL OF SYSTEM

The protocol model designs a tree root cluster, which should rotate along all the nodes in a network. The working of our protocol is categories into two ways. The first way begins with preparation of a root head cluster and then followed by dynamic route discovery. Various routes are paths are created and formed with the root head of cluster, selection of the path is done and data aggregation is used in transmission of data to sink node.

Our proposed work, root head is selected based on certain parameters,

Residual energy node – the selected head node must be residual high energy node

Neighbor distance node – total distance of all active neighboring nodes from Si to the end node.

Frequency of Tree root node – it is the node record which servers all the nodes in a cluster which is elected based on election**.**

Network model is divided into following phases

- **NETWORK SIMULATOR**
- **CLUSTER FORMATION**
- **CLUSTER HEAD SELECTION**
- **DATA AGGRETATION**
- **DATA TRANSMISSION**

A. Network Model

This paper assumes that 106 sensor nodes are randomly scattered in a two dimensional square field. The simulation area is 1000 × 1000 square meter. Each sensor node has a unique ID in the network and nods are cannot be recharged. Also at any time, we assume that each sensor node is able to compute its distance to sink, residual energy and buffer size. Area of simulation –1000 × 1000 sq.m, Total number of nodes – 106, Common Nodes – 100, Cluster/Cluster Head – 4, Sink Node –1, Access Point – 1.

A. Cluster formation phase Clustering is grouping of nodes based on some criteria such as residual energy of the node, buffer size and frequency range. Clustering is in such a way that intra cluster similarities is more and inter cluster similarity is less. In cluster, Cluster Head (CH) is the prime node which is responsible for data aggregation.

B. Cluster head selection each node first broadcast the cluster head election message (CE_Msg) with in a radio range *r*. This message contains the value of CE parameters. Each node receives the CE_Msg from all neighbors in its cluster range and compares it with its CE.If nodes CE is the largest value with in radio range *r*, it will set its state as cluster head. CE parameter obtained by equation 1.

B. Formation of Cluster Phase

Clustering is a process of grouping the nodes based on certain criteria related to energy residual on nodes, size of buffer and range frequency. Clustering is made in a way that inter-cluster similaraties is larger and intra-cluster identical are very few. In the process of clustering, TCH a tree cluster head is the main node responsible for aggregation of data.

C. Tree Head Cluster Selection

The nodes in the clusters broadcast the tree head with an election message (CHE_msg) with a range *r*. The message broadcasted contains parametric value of CHE. Every node in the cluster receives the message from all the neighbors in a cluster range and will be compared with the other with CHE parameter. If the value of CHE is larger than the range *r*, that node is selected as the head tree cluster based on CHE parameter gained from equation 1.

$$\mathrm{CHE} = (E_{\mathrm{NODE}} - \mathrm{res}) \times j/(1 - (\mathrm{dis}(j)))^2/100) \quad (1)$$

Where, (Enode-res) j is the current residual energy of node j dis (j) is calculated by equation 2.

$$\mathrm{dis}(j) = (\Sigma(|D_{db}(j)\ D_{db}(i)|) \times t_p \times k) \quad (2)$$

In here Ddb is node distance to sink also we assume that number of bits, $k = 1$ and transmission power, $tp = 1$.

After selecting the CH node, the CH node collects the data from within its cluster members and aggregated. The data aggregation function is to reduce the amount of data traffic and data redundancy.

Data Aggregation

It is a process of gathering the data gained from the sensor using a method of aggregation. This process uses algorithm for gathering data from various sensor nodes filtering the data using method on a network by the process of centralized approach. Network aggregation method is a process of transferring encrypted data to the node sink by selection the efficient path using aggregation of network.

Network aggregation is a dynamic process of gathering data and information routing via multi-hop process, it processes data at various intermediate nodes with an objective of reducing energy consumption and increase in lifetime of network.

Each node first broadcast the cluster head election message (CE_Msg) with in a radio range *r*. This message contains the value of CE parameters. Each node receives the CE_Msg from all neighbors in its cluster range and compares it with its CE. If nodes CE is the largest value with in radio range *r*, it will set its state as cluster head. CE parameter obtained by equation 1.

4. MULTI-HOP ROUTING

A tree head cluster will send the packet to the station; at first receives the aggregated data from the members of the tree and transmit the packets to the base using multi-path hop through the tree head of the cluster.

We choose procedure of consumption energy for extending the life of the network. As other state that the cost of energy can be decreased by decreasing the packet cost which contribute to the life of network.

Our work designs a multi-path routing from tree head cluster to the base which tries to reduce the cost of energy for the packet transmission. The shortest path algorithm is used for routing; source node is identified first from the sink. Our proposed algorithm uses aware energy routing methods in providing energy balance and consumption in sensor networks.

The network life is prolonged based on the knowledge of network and base station. Assuming the connected graph G = (V,E) using the Tree head cluster as vertices.

Procedure for Generate Clusters ()

{

Determine alive nodes in current round

For *i* = 1 to N

If RE(si) > 0

Alive_node_list ← Alive_node_list U si

Calculate average node energy

For *i* = 1 to N

Tot ← Tot + RE(si)

Avg_eng ← Tot/N

For *i* = 1 to N

If RE(si) > Avg_eng

#Calculate cluster head selection probability of the node

CHPsi = (RE(si)/Eo + C + 1/FQ.si) – D and C = A_node(si)/N_node(si)

RAND() is function generates random number between

[0,1]

T = RAND(0,1)

x is initial cluster probability

If CHPsi > xT

Clusterhead _list ← Clusterhead _list ∪ si

Member_list ← Alive_node_list - Clusterhead _list

For each node belongs to Member _list

For each cluster_head i Clusterhead _list

Calculate distance distto(si) between each member node and cluster_head si

Min_dist ← min{distto(si), distto(si+1), distto(si+2), …, distto (|Clusterhead_list|)}

id ← node id of minimum distance cluster head from the node, ← si Clusterhead _list

Clustermember(id) ← Clustermember(id) ∪ {node}

Clusterhead(node) ← id

}

We assume vertices V of a Graph G as V = Tree_head Cluster_list(station base) and adjacent vertices which are connected to each one only if

$$S_i, S_j = \{(S_i, S_j) \mid d(S_i, S_j) \cup 2\ R_i\ \&\ d(S_j, BS) < d(S_i, BS)\}$$

Cost of network assignment is formulated as

$$COST(S_I, S_J) = RE\ (S_J, S_J)$$

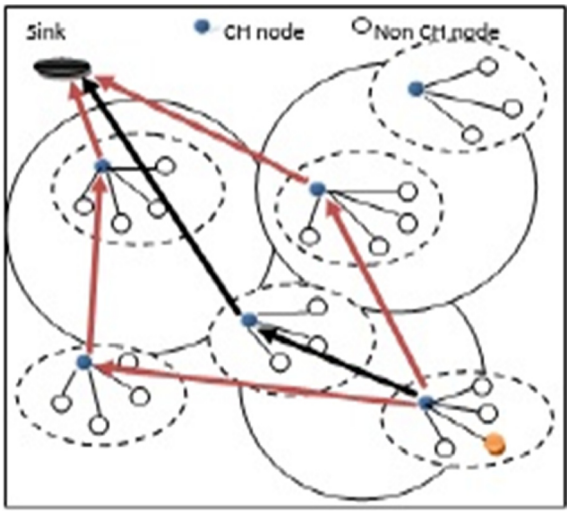


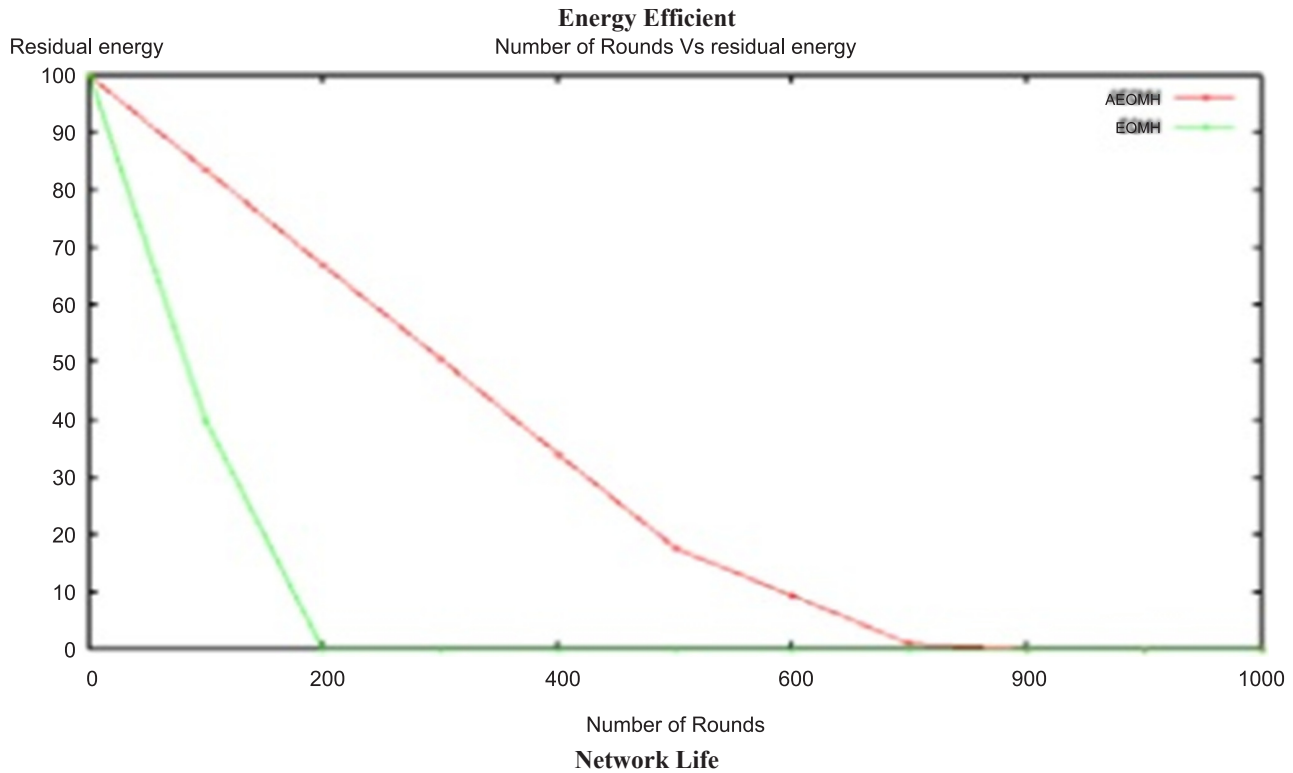
Figure 1: functional Diagram of EETC

Were propagation α is between the range of sensor S_i. The station base uses shortest path Dijistra's algorithm for choosing the source node. Where α is the propagation constant between and R_i and transmission range sensor S_i.

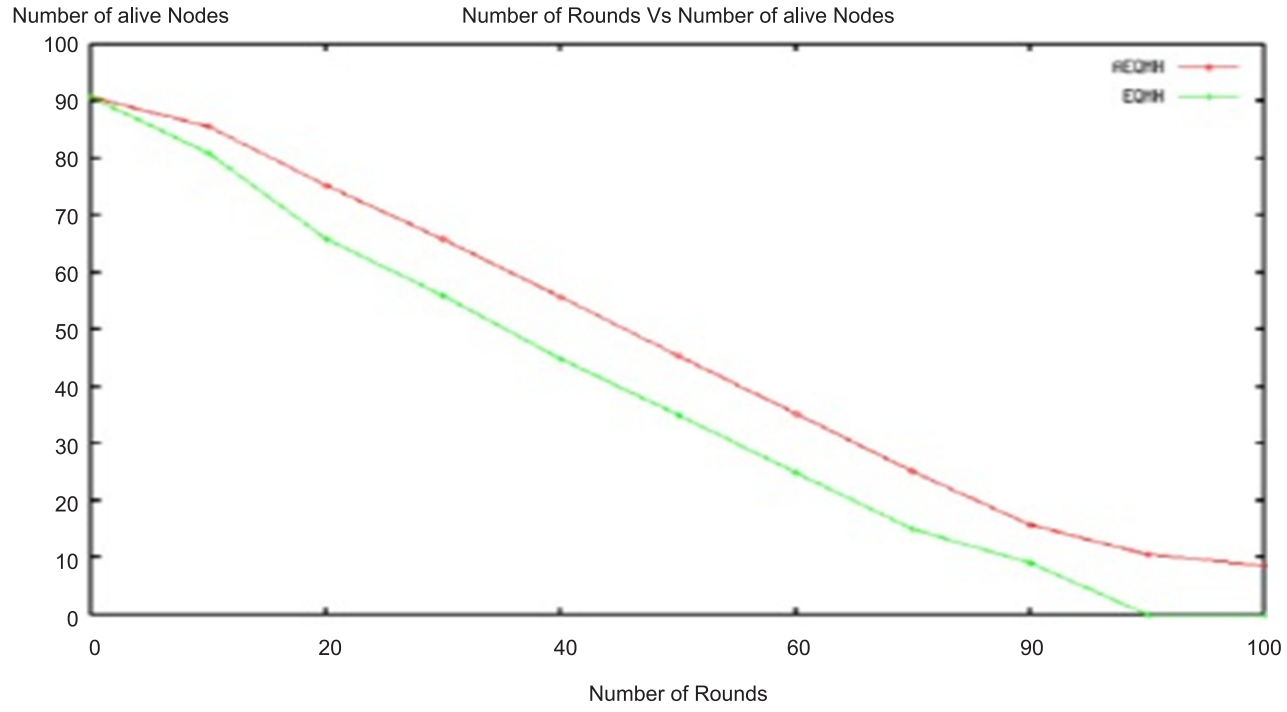
Table 1
Simulation parameters

Parameters	*Value*
Network field	1000 × 1000
Number of nodes	110
Cluster radious R	35m
Sensing radious *r*	15m
Initial energy	12J
Data packet size	1024 bytes
Ethreshold	0.01 J
Eele	50 nJ/bit
Efs	10 nJ/bit/m2
Threshold distance	
MAC layer	IEEE802.11
Simulation time	1000s

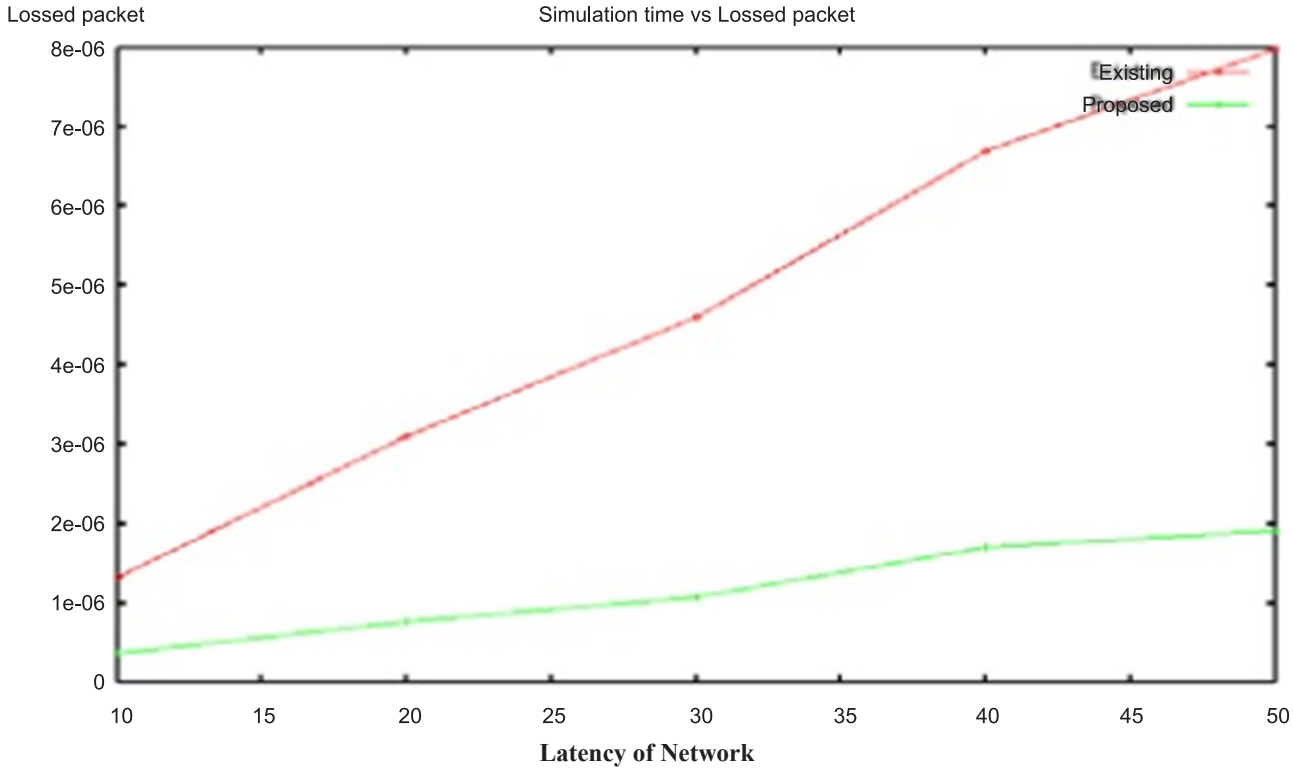
5. OUTPUT OF SIMULATIONS



Our system proposed gives better results and performance over existing system. Results are gained based on graph output. The gain results show an improvement of latency on the network.

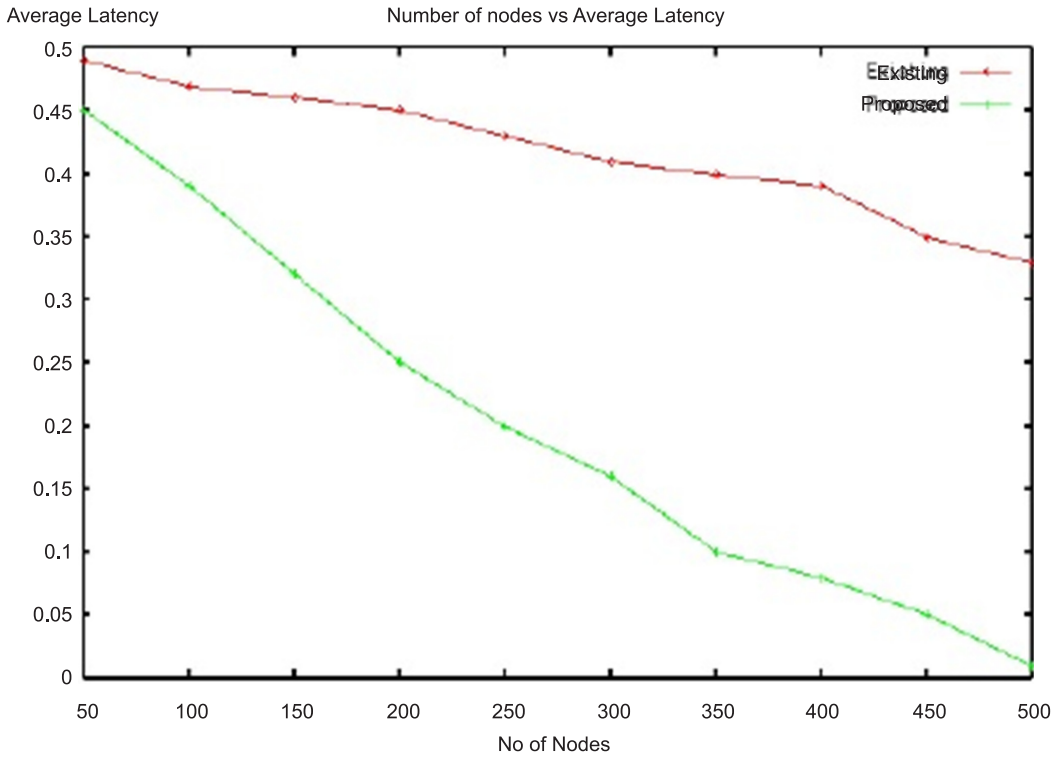


Number of Nodes Alive



Latency of Network

Initially, the evaluation is done for efficiency of energy based on proposed and it is been compared with life of the network, Figure below shows the alive nodes based on nodes used the results simulated shows that an improvement is done based on energy and life time**.**



Delivery Ratio of Packet

6. CONCLUSION AND EXTENDED WORK

Our work proposed a Tree based cluster routing protocol (TBCR) in WSAN. The selection of Tree head is based on energy residual and election method, size of buffer and distance node. The cluster Tree head is the main node responsible for aggregation and sending of data to the base. The results shows that our model developed will give better improvement in life of the network.

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