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Comparison of leach and energy efficient protocol

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Abstract: ***Wireless Sensor Network (WSN) consists of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, enabling also to control the activity of the sensors. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer application, such as industrial process monitoring and control, machine health monitoring, environment and habitat monitoring, healthcare applications, home automation, and traffic control.Due to the energy constraints wireless sensors usually have a limited transmission range. As low power, low cost, and longevity of transceivers are major requirements in wireless sensor networks, optimizing their design under energy constraints is of paramount importance. In this paper, we have studied Leach and EEP protocol and compare them with MATLAB.***

Keywords: WSN, Leach, EEP

I. INTRODUCTION

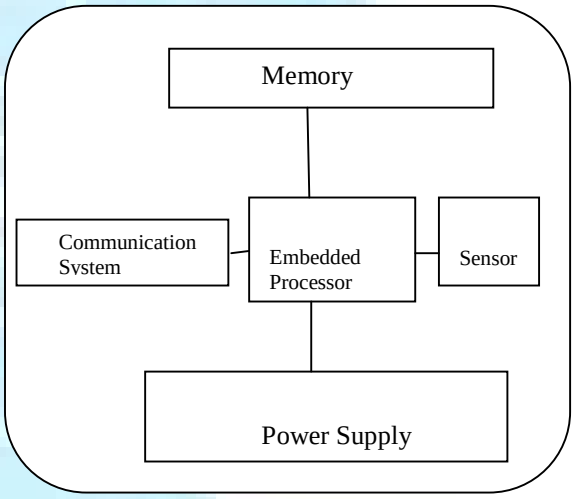
The WSN is built of "nodes" from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created.

II. WSN TCHNOLOGY

WSN represent a paradigm shift in wireless networks. A standard wireless sensor network consists of a large number of tiny sensor nodes. A sensor node basically consists of the following modules:

- The sensing module that collects information from the environment.
- The communication module that sustains wireless data communication between nodes.
- The processing module that processes the information provided by the sensor module or received from neighbor nodes.

Figure 1: Typical Wireless Sensor Network Node Architecture



A WSN is characterized by the follfeatures:

- The network relay on a collection of tiny sensors to observe and influence the real world.
- The sensors have a modest and sometimes non-renewable power budget and do not necessarily need to be active at all times. So sensors can be dynamically added to or removed from the network.
- There is no infrastructure (wireless).
- It is a self organized network.
- Multi-hop communication is used and the network topology changes dynamically.

III. RELATED WORK

Yingpeng Sang[1], Author survey these work and classify them into two cases: hop-by-hop encrypted data aggregation and end-to-end encrypted data aggregation.
Jamal N. Al-Karaki Raza[2], Author present solutions for the data gathering and routing problem with in-network aggregation in WSNs. **Bhaskar Krishnamachari[3],** here Author model data-centric routing and compare its performance with traditional end-toend routing schemes.
Sokwoo Rhee[4], Author have devised several novel techniques for minimizing power consumption in wireless sensor networks.
Muruganathan[5], Author compare the performance of THCHP to the previously proposed APTEEN protocol. Presented results show that THCHP achieves significant energy savings when compared to APTEEN.
Mohamed Watfa[6], Author give an energy efficient approach to query processing by implementing new optimization techniques applied to in-network aggregation.
Ameer Ahmed Abbasi[7], Author present a taxonomy and general classification of published clustering schemes.

IV. LEACH (LOW-ENERGY ADAPTIVE CLUSTERING HIERARCHY)

LEACH could save a greater degree of energy. For most sensor nodes, the short-distance communication saved more energy, in LEACH, the more communication was limited within clusters, only a few Next Node, node communicated with base stations long distance. It used adaptive technology and Next Node, node rotation technology, the LEACH was more efficient than the original class network structure; the whole WSN was more balanced on load distribution, and could extend the WSN lifetime greatly. In addition, each cluster could calculate locally and remove redundant data, reduce the communication burden of Next Node, node. As the energy consumption of calculation was much less than the energy consumption of communication, so LEACH could save energy greatly. But there were still problems in LEACH: Firstly, the node used power control when sending data, the energy consumption of node was not same. When Next Node, node election, it was considered that the number of Next Node, node in the past, without the energy difference between the remained nodes, leading to uneven distribution of energy consumption. Secondly, LEACH selected Next Node, node randomly, the number of Next Node, node closed to the optimal value could not be guaranteed.

V. PROBLEM DEFINITION

- The main problem with LEACH protocol lies in the random selection of cluster heads. There exists a probability that the cluster heads formed are unbalanced and may remain in one part of the network making some part of the network unreachable.
- This problem is resolved by using the concept of EEP. EEP uses the concept of alternate Cluster Head called Vice Cluster Head. As a Cluster Head dies it is replaced by the Vice Cluster Head.
- But in case of Vice Cluster Head Dies, it does not provide solution for that and the network start reducing the energy very fast and finally the network dies completely.
- The proposed work is the improvement over the EEP. In this proposed work we are trying to improve the network life. In this work, initially when the cluster heads are selected based on the energy and the distance parameters, we also select the Vice Cluster Head.
- Now when the cluster head dies, it is replaced by Vice Cluster Head and new Vice Cluster Head will be selected at the same time. It means the cluster head will stay over the life of network. The decision of the Cluster head and Vice Cluster head selection is on the basis of Energy, Distance and Residual Energy.
- The proposed system will improve the network life and total communication over the network.

VI. EEP (ENERGY EFFICIENT PROTOCOL)

Energy efficient protocol is a clustering based protocol. Grouping nodes into clusters has become into an interesting issue for the research community in order to achieve the network scalability objective. In the last years, a number of clustering algorithms have been specifically designed for WSNs. These techniques widely vary depending on the node deployment, the bootstrapping schemes, the network architecture, the characteristics of the cluster head nodes and the network operation model. A cluster head may also be one of the nodes or one specifically richer in resources. The overall number of cluster heads within the network and the amount of nodes per cluster may be variable or fixed by the user. Cluster heads may form a second tier network, i.e. making another level of hierarchy or they may just pass on the data to the base stationIt also allows conserving communication bandwidth since it limits the scope of inter-cluster interactions to cluster heads thus avoiding redundancy in message exchange among sensor nodes. Furthermore, clustering isolate sensor nodes of changes at the level of inter-cluster heads tier reducing topology maintenance overhead. The cluster head can implement optimized techniques to enhance network operation and extend the battery life of sensor nodes. In the same way, cluster heads can schedule the cluster activity so that nodes can switch to the low-power sleep mode most of the time thus reducing power consumption. Some techniques like data aggregation reduce data redundancy in clusters thus further reducing power consumption in sensor nodes.

VII. ALGORITHMS

A. Algorithms for LEACH Protocol
// The number of rounds

```
r=0
while node alive do
for i=1to N do
checkNumDeadNode(arrNode[i].E<0)
end
// loop to select cluster heads
for i=1 to N do
if arrNodes[i].E>0 then
randomNumber=rand()
if randomNumber<threshold (r,k) then
// node i selected as cluster head
arrNode[i].type='cluster head'
//increase the number of cluster heads
numClusterHeads++
calcdissipation CH()
end
end
end
// computations for nodes not selected as cluster heads
for i=1 to N do
if arrNodes[i].Type!='clusterhead' AND arrNodes[i].E>0 then
assign nodes to clusters
calcDisssipationNodes()
end
end
// increment number of rounds only if cluster head selected
If numClusterHeads>0 then
r=r+1
end
end
```

B. Algorithm for EEP Protocol

```
// the number of rounds
r=0
for i=1 to N do
p(i)=f(d)
end
while node Alive do
for i=1 to N do
checkNumDeadNodes(arrNodes[i].E<0)
end
//loop to select cluster heads
for i-1 to N do
if arrNodes[i].E>0 then
random number<P(i) then
// node i selected as cluster head
arrNodes[i].Type='cluster head'
// vice cluster head selection
num vice cluster head++
calcViceClusterHead()
end
end
end
// computation for nodes not selected as cluster head
for i=1 to N do
if arrNodes[i].Type!='cluster head' AND arrNodes[i].E>0 then
assign nodes to cluster
calcDissipation Nodes()
end
end
// increment number of rounds only if vice cluster head is selected
if num vice cluster head>0 then
r=r+1
end
end
```

VIII. COMPARISON BETWEEN LEACH AND EEP PROTOCOL

Table1 shows the steps taken in each round of LEACH and EEP when the base station located far from the field. There are some difference between two algorithms while there are some common areas in LEACH and EEP. Table of basic differences between LEACH and EEP is given below:

Steps	LEACH	EEP
Cluster head selection	a. Defines a threshold that resets in every N/K rounds: T(t)= K/N-K*(r mod N/K) b. Nodes select random number between 0 and 1 and Compare it to T(t).	a. Calculates a probability for each node base on distance of each node to base station b. Nodes select random number between 0 and 1 and compare it to their assigned probability values.
Cluster formation	Based on the received signal strength of the advertisement message sent by CHs nodes choose their clusters.	Based on the received signal strength of the advertisement message sent by CHs nodes choose their clusters
Data transmission	Based on TDMA schedule nodes send data to their CHs afterwards CHs send the aggregated data to BS.	Based on TDMA schedule nodes send data to their CHs afterwards CHs send the aggregated data to BS.

IX. RESULTS AND ANALYSIS

This paper is devoted to the presentation of experimental results and all the results refer to simulations. The experimental result shows that the modification in LEACH decreases the amount of dead nodes and increase alive nodes. This experimental result will shows that the life time of network is enhanced because of dynamic clustering and increased packet transmission rate.
This paper is implemented in MATLAB tool.
MATLAB is a high-performance language for technical computing.
The result refers to the measurement of life time. Figure shows the output of modified LEACH protocol. Life time of network related to no. of alive nodes, no. of dead nodes, and rate of packet transmission and how long time cluster of nodes is formed in network. System which is proposed here gives good output in all three parameters.
We have take all these values and find that there are less dead nodes and more alive nodes in proposed system. Also rate of packet transmission is enhanced and due to more alive nodes cluster formation process is ensue for a long time which tends o increase life time of wireless sensor network.
Here figures are presented which shows the output of modified system, existing LEACH output is also considered for the purpose of comparison.
Modified system output shows improvement in four areas.

- There is less number of dead nodes.
- Number of alive nodes is enhanced.
- Packet transmission to base station occurs frequently.
- Even in last round clustering process is going take place.

These are the basic parameter taken for simulation of results in WSN. Here n is number of nodes, p is the probability factor, Eo is the thresh hold energy value, rmax is the no. of maximum rounds.
In this scenario we are taking n=50 i.e no. of nodes in network is 50. The probability factor p and thresh hold value Eo and number of rounds rmax will be taken constant for all the three scenarios. Depending on these parameters we will get different graphs which consist of output of EEP and LEACH protocol. These graphs will show whether our protocol is better or not and if it is better then up to which size of network it will work better. In WSN network size and network topology is not fixed most of the time. So efficient working of EEP protocol with different network size is very much important.

Now we will give the comparison graph of EEP with existing LEACH protocol for the network consists of 50 nodes. The graphs are given below:

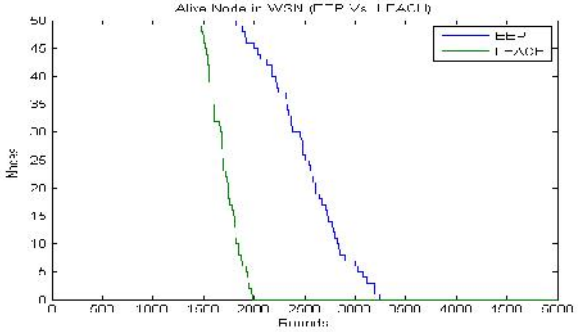


Figure 2 No. of Alive nodes in 50 nodes network

The first graph will be of no. of alive nodes in WSN. The life of nodes in EEP is more than the LEACH protocol.

The next graph will be consists of no. of Dead Nodes in WSN.

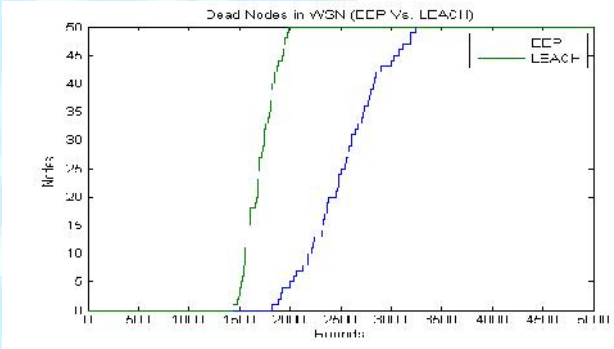


Figure 3 No. of Dead Nodes in WSN of 50 Nodes

The second graph will be of no. of dead nodes in WSN. The life of nodes in EEP is more than the LEACH protocol. In LEACH the nodes starts to die around round 1400.

Now we will see the number of packets transmitted to base station in both LEACH and EEP.

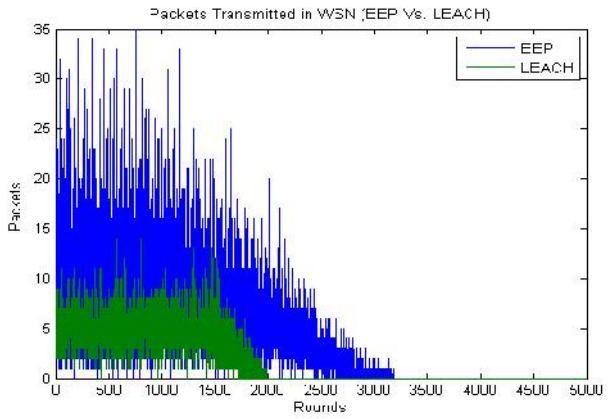


Figure4 No. of Packets transmitted in 50 Nodes WSN

The number of packets transmitted to base station in EEP is higher than the LEACH protocol. The reason of high data transmitted is that the network life is more in EEP than the LEACH protocol.

X. CONCLUSION

The core operation of a WSN is to gather and convey the collected data to a distant BS for further processing and analysis. In this thesis, we have proposed an architecture modified EEP which extends the EEP clustering routing algorithm. The result of simulations conducted indicates that the proposed clustering approach is more energy efficient and hence effective in prolonging the network life time compared to LEACH. In existing system data transmission depends on current energy of nodes and distance between nodes. Modified-LEACH algorithm works on two additional parameter residual energy of node and time stamp of packet transmission from. Modified-LEACH affords to conserve energy through multilevel clustering. If each node were to transmit its sensed data directly to the BS, it will deplete its energy reserves rapidly. So Next Node directly communicates with base station and approach to minimizing energy consumption which reduces transmission costs.

XI. FUTURE SCOPE

The EEP of WSN has the scope of giving better results if the parameters are chosen suitably. The modified cluster head selection technique may give better results if implemented with other clustering techniques which have not been discussed in the thesis (e.g. Fuzzy C-Mean clustering).The network lifetime may also be improved if the clustering algorithms are made distributed as in LEACH. In all of the methods discussed above the energy parameter is taken into consideration only during cluster head selection (after clustering).The performance may be increased by considering energy as a parameter during clustering itself.

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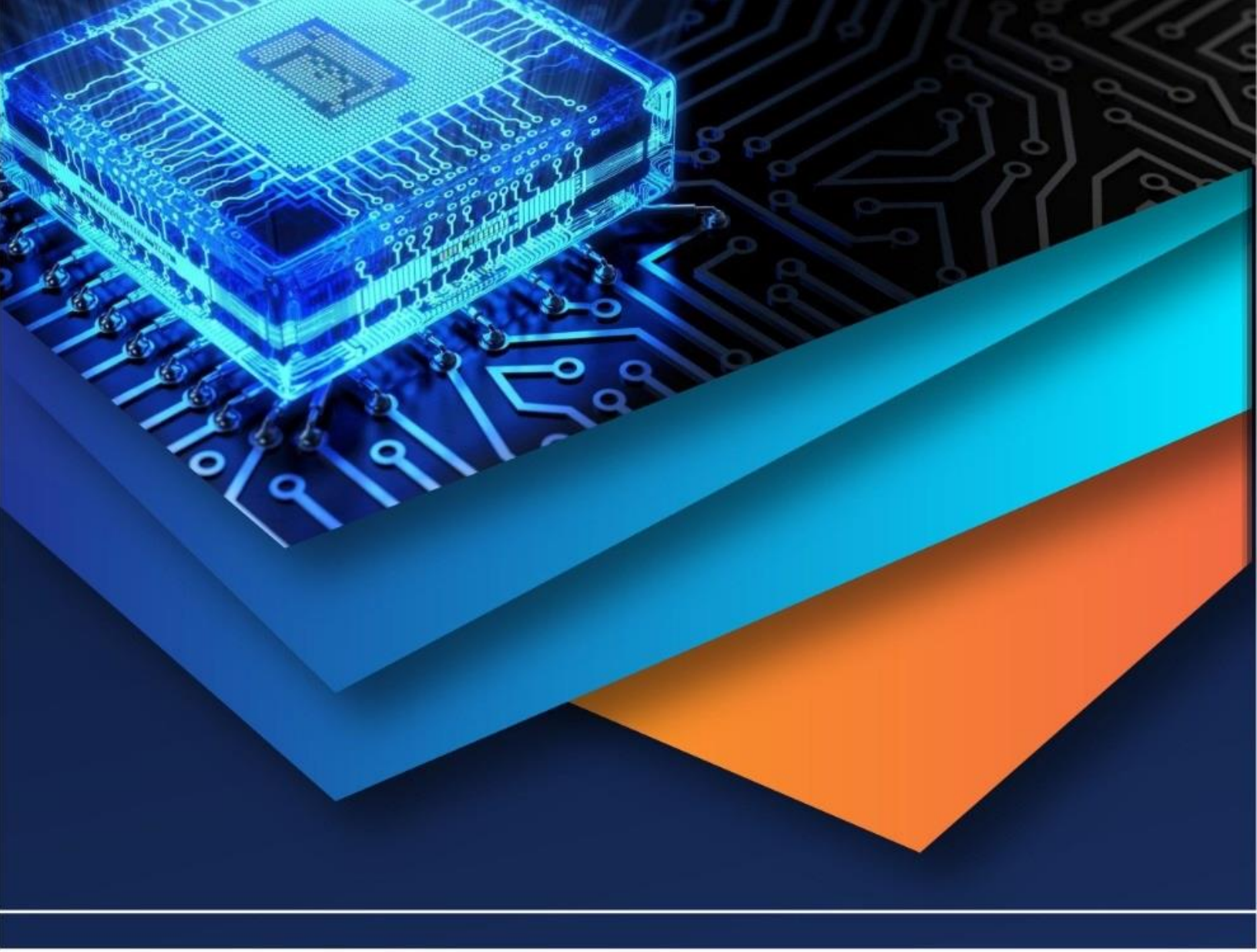

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