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ENERGY EFFICIENT CLUSTERING BASED ROUTING STRATEGY FOR WIRELESS SENSOR NETWORK

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ABSTRACT - Wireless Sensor Networks (Wsns) Is Identified As One Of The Most Important Technologies For The 21st Century. Limited Power Resource Is One Of The Major Constraints For Wireless Sensor Networks. As The Network Life Time Is Directly Depends On Power Efficiency Of A Network, So The Prolonging The Network Life Time Is One Of The Most Important Challenge For Research Community From The Beginning Of This Technology. Various Techniques Have Already Proposed For Increasing Power Efficiency Of Wsns Based On Duty Cycling, Data Driven Techniques, Or Mobility Based Approaches. Here We Are Particularly Interested In Clustering Based Wsns, By Use Of Clustering We Enable A Sensor Network To Work In More Efficient Way In Terms Of Energy Efficiency And Thus Leading To Increased Life Time Of The Network.

KEYWORDS: wireless sensor network ,routing strategy, clustering, network lifetime ,Specific nodes

1 INTRODUCTION

Wireless sensor network (WSN) is a key technology for future. It has been identified as one of the most important technologies for the 21st century [1] and is regarded to revolutionize the way of information gathering and processing of a communication system. The development of low cost, small size micro electro mechanical systems (MEMS), wireless communication devices, complementary metal oxide semiconductor (CMOS) devices and digital electronics enable the development of an overall low cost, low power (due to small communication range and low computational capability), multifunctional sensor node that are small in size and communicate free to communicate in short distances.

Organization

In **section 1** we have already discussed the basic of WSNs, their application, historical perspective etc. The rest of the paper is organized as follows:

Section 2: In this section we have given the literature review, where basics of cluster based techniques used in Wireless Sensor Network are discussed. In this section we will also compare some of the clustering based protocols frequently used in WSNs.

Section 3: This section gives basic idea of the proposed model used in this paper. This section also explains the detailed working of the protocol i.e. how the Specific node is significantly increasing the network lifetime and overall throughput at base station of the network.

Section 4: Section 4 will give the simulation parameter used in this paper and the result obtained.

Finally, **Section 5** concludes this paper and gives basic outline of future scope of the protocol used in this paper.

2 RELATED WORK:

Wireless sensor networks (WSN) consist of a huge number of small self-contained devices with computational, sensing and wireless communication capabilities. WSN aims to apperceive in collaborative mode, gather, deal with and send information to observer in network areas. Sensor, sensing object and observer form the three factors in WSN [1][2][3]. WSN protocol stack contains physical layer, data link layer, network layer, transport layer and application layer [4]. According to network architecture, routing protocols are generally classified as plane routing, and level routing. Typical plane routing protocols are LEACH [3], PEGASIS [6] , SAR [7], SPIN [8] GEAR[9] etc.

Table 1 Comparison Of Different Schemes:

Scheme	Advantages	Drawbacks	Scalability	Mobility	Route Metric	Robust
LEACH	Low energy, ad-hoc, distributed protocol	It is not applicable to networks deployed in large regions and the dynamic clustering brings extra overhead	Good	Fixed BS	Shortest path	Moderate
LEACH-C	The energy for data transmission is less than LEACH	Overhead	Good	Fixed BS	The best route	Good
PEGASIS	The transmitting distance for	There is no consideration of the base	Good	Fixed BS	Greed route selection	Good

	most of the node is reduced	station's location about the energy of nodes when one of the modes is selected as the head node				
SPIN-RL	It disseminates data through a broadcast even in the cases that a network loses packets or communication is asymmetric	Time consuming	Good	Yes	Each node sends data to its single-hop neighbours	Good
GEAR	It attempts to balance energy consumption and thereby increases the network lifetime	The periodic table exchange	Limited	Limited	The best route	Good
MIP	It can consume less energy when the number of nodes of the network is large	High delay	Limited	Good	The path that minimize the total power consumption	Good

3 PROPOSED SCHEME:

3.1 Introduction

In this section we will start our discussion with the basics of heterogeneous WSNs. Then we will see the network model as well as energy model used in this paper. Further in the section we will discuss how cluster formation is taking place, we will also discuss the data aggregation and dissemination model, path loss model and assumption used in this

paper. . The section will also explain how addition of few Specific nodes is increasing the network life time and overall throughput at the base station (BS) significantly.

3.2 Specific Node Based Clustering Protocol

We will discuss our proposed routing models in this section. As sensor node has to send the sensed data to base station. If the sensor node send the data to directly to base station or with help of multi hop technique the sensor node may exhaust their energy soon as they have to send their own data as well as they have to work as transit node too for the data forwarding for data of other nodes. Although clustering technique like LEACH is good and able to increase the life time of network considerably but with the help of our proposed model we will able to increase the life time of network almost double as compared to LEACH. For increasing the network life time and throughput we deploy some Specific node at some fixed location in the network field such that a virtual maximum area network sub-field can created such that all the nodes within that sub-field can communicate with an Specific node directly as well some sensor node can communicate with the base station directly while considering energy efficiency. The function of Specific nodes is to collect data from the nodes near to it and can also collect the data from the cluster heads of the other cluster forming by the nodes which have not any Specific node nearby. The Specific node work is forwarding the overall aggregated data collected by other cluster heads and the data gathered from the sensor node associated with it to the base station. Our result will reflect the increase life time and throughput with the expense of addition of Specific nodes because adding Specific Specific node is cheaper than the price of sensor node itself.

3.2.1 Creation of Logical Regions

The creation of logical regions in ABCP is done by the base station. Base station divide the whole network field in three types of logical regions based on their locations. It is done in three phases:

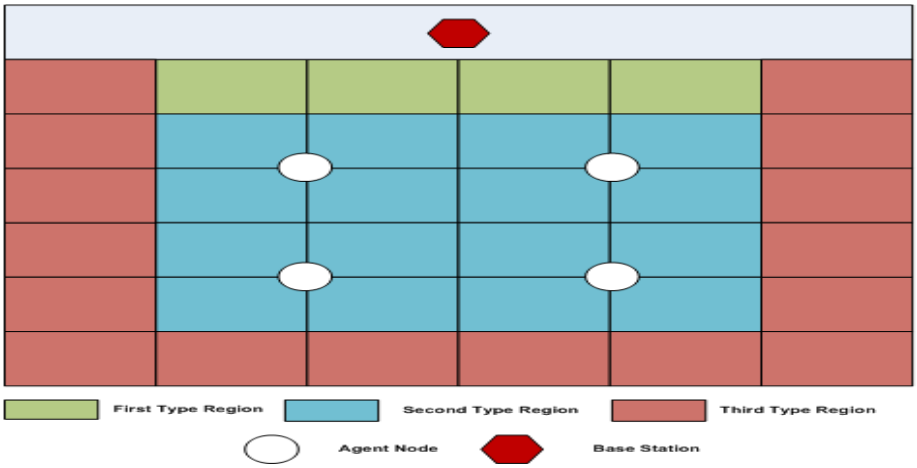

Figure 1 Division of Network Field

Initial Phase: We will use homogeneous sensor node with respect to energy and deployed it in our network field in uniformly random distributed way. The base station broadcast a hello packet; in response of this packet each sensor node will forward its location and other information to the base station. Now the base station has sensor node ID, energy information

of the node, and information about sensor node Euclidean distance from itself and also from Specific nodes.

Middle Phase: Now as base station has required information for dividing the whole network field into logical region based on location of sensor node in the network field. BS now divided the whole region in three type of region as shown in figure 3.3, the first type of region will directly send its gathered data to BS, the second type of region will communicate directly with Specific nodes and the third type of region will not associated with any Specific node or BS directly but they are divided into number of clusters and they choose their cluster head depending upon priori based probability, and the cluster head can communicate and send their data to Specific node or BS node directly i.e. via single hop or multi hop as required.

Final Phase: Now BS divided the network field into three types of logical region. The node residing in first type of region, which will be close to BS itself, can send their sensed data to BS directly leading to energy saving. The node residing in second type of region i.e. region closed to any Specific node will forward their data directly to an Specific node which leads to energy saving. The third type of area which is not associated with any Specific node or BS directly is divided in to small regions (cluster) by BS. So the cluster formed by third type region needs a cluster head for energy efficient communication which is chosen by LEACH protocol.

4 RESULTS AND ANALYSIS:

4.1 Performance Parameters

In this section, we present performance metrics. In this work, we evaluated three performance parameters given below.

i. **Network lifetime:** It is the time interval from the start of the network operation till the last node die.

ii. **Total Number of Packets Received at Base Station:** To evaluate the information gathering capacity of whole network, the numbers of packets received by BS has been calculated.

iii. **Residual Energy:** The residual battery energy of network is considered in order to analyze the energy consumption of nodes in each round. Residual energy ensures graceful degradation of network life.

4.2 Simulation parameters

Table 2 Simulation Parameters

Parameters	Value
E_0	0.5 J
E_{fs}	10 pJ/bit
E_{amp}	0.0013 pJ/bit
d_0	87.70 m
E_{T_X}	50 nJ/bit
E_{DA}	5 nJ/bit
B	2000 bits

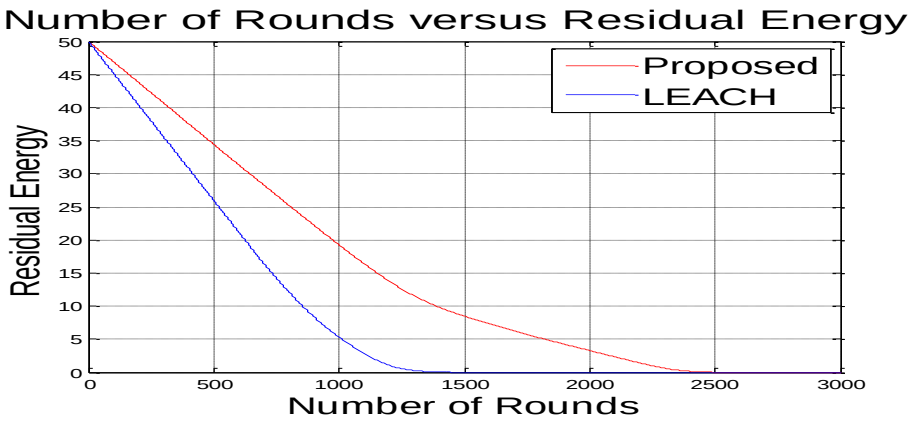

Figure 2 Number of round vs residual energy

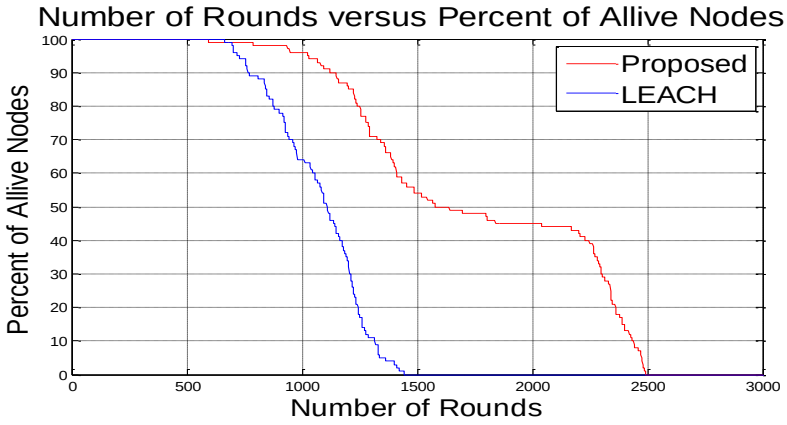

Figure 3 Number of rounds vs Percentage of alive node

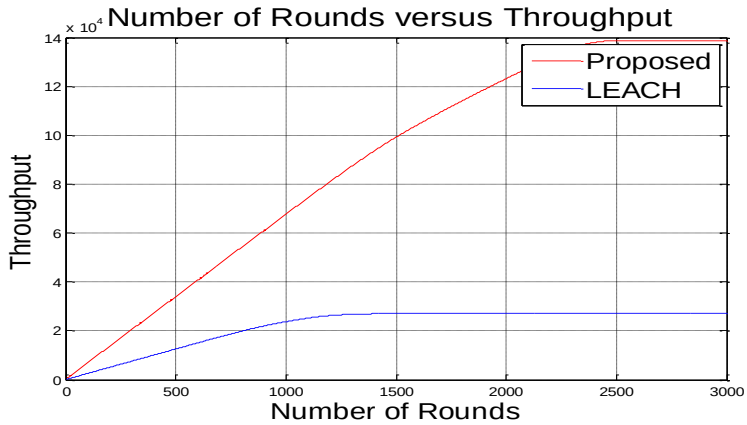

Figure 4 Total number of packet received by base station

5 CONCLUSIONS

5.1 Conclusions

In this paper we have proposed an Specific Node Based Clustering Protocol for energy efficient WSN. In act of simulation we have assumed that Specific node is equipped with better power resource or it has recharging capability as we know that providing recharging capability to some node is cost efficient than the cost of sensor node itself so it will be not be a constrained. In this section of the section we will conclude our paper. The

Specific Based Clustering Protocol is efficient in following way then traditional LEACH protocol:

Network Lifetime: We have seen that the network lifetime using Specific Based Clustering Protocol is almost double then the network using LEACH protocol which is very efficient for the energy constrained WSNs

Total Packets Received at BS: The overall packet received by base station using ABC protocol is very high as compared to network using LEACH protocol which is an added advantage of Specific Based Clustering Protocol.

Residual Energy: The residual energy rest within the ABC protocol compared to LEACH protocol is more after end of each round and network using ABC protocol retain almost 16 percent of total energy provided to it when the network using LEACH protocol is out of energy.

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