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Energy Comparison and Analysis for Cluster Based Environment in Wireless Sensor Networks

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***Abstract*—A Wireless sensor network(WSN) is a collection of tiny sensor nodes which are randomly deployed in distributed environment. Energy consumption is a major challenge in wireless sensor networks. This paper presents an analysis of energy consumption and power in the cluster based wireless sensor networks on variable cluster head with various node densities. Different models are created and compared with each other. The practical manipulations and theoretical calculation are compared and analyzed graphically.**

***Index Terms*—WSN, Energy and Power.**

I. INTRODUCTION

A Wireless Sensor Network(WSN) is a collection of small, lightweight sensor nodes deployed in large numbers to monitor the ambient conditions. WSN have a numerous advantages,but the available energy at each sensor nodes are treated as a constraint. Hence energy consumption is a major criteria[1] [2].Cluster is a collection of sensor nodes which are randomly deployed. Each cluster consists of one or more number of cluster heads[3].The cluster heads gathering all data from their cluster members. The collected informations are routed to the Base Station. The Base Station(BS) is a fixed node,which is capable to transmit and receive the data within the entire network[4]. The number of cluster head selection varies depends on the number of sensor nodes. Energy consumption is efficiently controlled by selecting more than one cluster head for cluster containing more number of nodes in the network [5] [6].Analysis of energy consumption is made depends on number of cluster heads are needed,when the number of nodes increased.

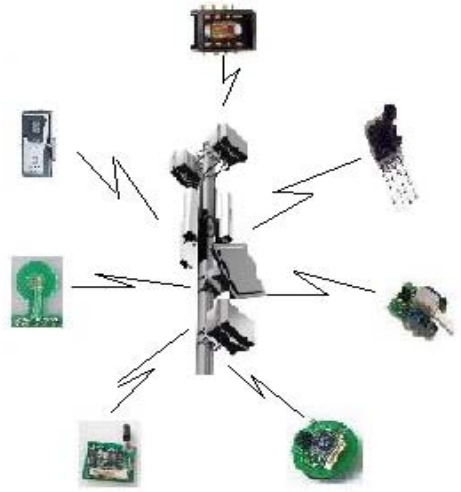

Figure 1. Wireless sensor networks

II. SIMULATION ENVIRONMENT

For simulation purpose,qualnet simulator is used (Evaluation version)[7].QualNet is a tool used to design and predict large wired and wireless networks[8].It uses simulation to analyze the performance of networks with large number of nodes. So QualNet network simulator was selected for analyzing purposes. The performance of four different models were analyzed with increasing number of nodes. Constant Bit Rate(CBR) is one of the client-server application which is used to send the data.

TABLE I.
USED SPECIFICATIONS

Serial No	Specifications	**Variation**
1	Routing Protocol	AODV
2	Voltage	3.5V to 5V
3	Number of nodes	10,20,30,40,50 and100

III. ASSSUMPTIVE FOR CONSUMPTION

Consumption of energy and power of dissimilar models based on varying cluster heads are to be considered here.

A. Energy Consumption in Transmit Mode

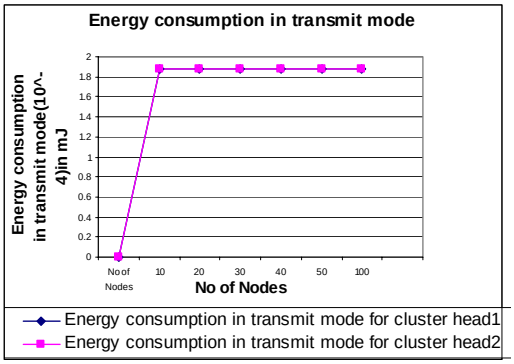

Figure 2. Energy consumption in transmit mode

Figure 2 shows the relevant consumption of energy by sensor nodes in transmit mode.The graph exhibits the energy consumed by the sensor nodes during the transmission of data.The energy consumption is varies proportional to the number of cluster head in each cluster.The analysis of energy consumption is made for various number of nodes like 10,20,30,40,50 and 100 nodes.All nodes are consumed same amount of energy in transmission mode for one cluster head and two cluster heads in the network. Utilization of energy is not same for all nodes [10].Here usage of energy is same for all sensor nodes in transmit mode.

B. Energy Consumption in Receive Mode

Figure3 implies that the sensor nodes uses the energy in receive mode. Using one cluster head in each cluster does not consume same amount of energy for all nodes.

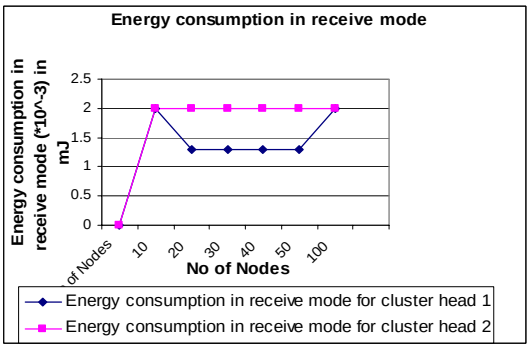

Figure 3. Energy consumption in receive mode

But for two cluster heads the energy consumption is same for all nodes. If the number of nodes increases the usage of energy will be equal for cluster head 2.

C. Power Consumption in Transmit Mode

As in equation (1) Power consumption in transmit $P(t_x)$ mode is the ratio between energy consumption in transmit mode $E(r_x)$ and time in transmit mode $T(t_x)$

$$P(t_x) = E(t_x)/T(t_x) \qquad (1)$$

The above equation is important,power is the rate at which energy is transferred,It is measured in watts.The amount of energy used depends on the power and time which it is used.

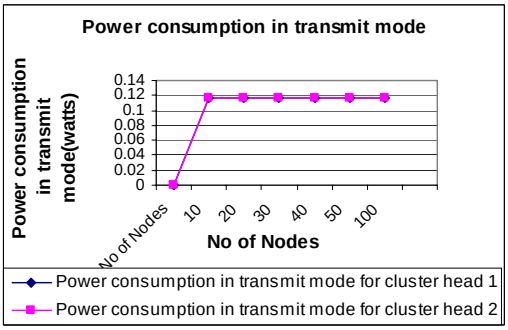

Figure 4. Power consumption in transmit mode

Figure 4 indicates the power consumption in transmit mode.As stated earlier power consumption is also made fordifferent number of nodes such as 10,20,30,40,50 and 100.

It gradually increases from zero onwards.The power consumption is same for both cluster head 1 and cluster head 2.

D. Power Consumption in Receive Mode

The equation (2) stated that Power consumption in receive $P(r_x)$ mode is the ratio between energy consumption in receive mode $E(r_x)$ and time in receive mode $T(r_x)$.

$$P(r_x) = E(r_x) / T(r_x) \quad (2)$$

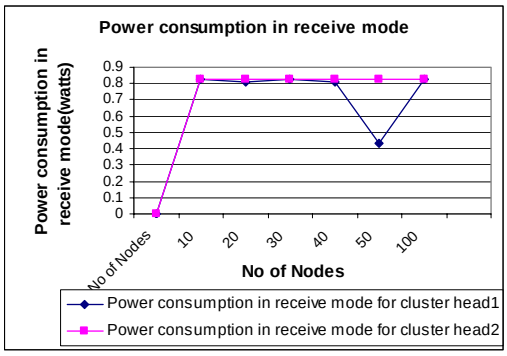

Figure 5. Power consumption in receive mode

Figure 5 shows, power consumed by all sensor nodes in receive mode. It shows an anomalous result for node densities 50 in cluster head one.For node density 100,it will retrieve to its normal position.By using two cluster head,the sensor node consumes same amount of power.

The average of all nodes clearly implies the overall consumption of energy and power of both transmit and receive modes in the network. Optimizing the energy by properly selecting cluster head with respect to the number of sensor nodes. Small number of cluster head for large number of sensor nodes will result in poor energy and power consumption.Whenever the number of node increases,correspondingly cluster head must be increased.

CONCLUSION & FUTURE WORK

We conducted the simulation of sensor nodes with Cluster head formation and compared its performances. Comparisons produce the graphical results. The results clearly show the importance of Cluster head selection in the consumption of Energy and Power for sensor nodes. Further investigation on mobility of nodes are needed to improve the Cluster head formation.In future,we will continue the work in Layered Architecture.

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