# Energy Efficient Clustering in Wireless Sensor Netorks

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***Abstract*- Wireless Sensor Networks (WSNs) is one of the greatest evolutions in wireless communication and used in real time applications. Sensor network is the collection of nodes each node is equipped with the ability to sense the environment conditions and transfer it to the dedicated nodes. The cost of WSN equipment is decreasing dramatically, and their application usage is increasing exponentially from military to commercial and industrial areas and this leads to biggest challenge to system designers and researchers to build a reliable network. Due to flexibility and maintenance wireless communication are preferred more than wired network. WSN operates with limited resources, energy is the scarcest resource in the sensor network. Performance plays a vital role in the sensor network. Clustering approach is one of the efficient techniques to increase the performance in the network. This paper proposes energy efficient clustering method which prolongs the lifetime of a network.**

***Keywords: WSNs, LEACH, Base station, Cluster head, Clusters.***

## I. INTRODUCTION

Wireless Sensor Networks (WSNs) is the collection of sensor nodes distributed over geographical area in an ad-hoc manner. Sensor network is the core to other domains such as big data and Internet of Things (IoT). Sensor node consists of sensors, actuators, memory, processor and they have communication ability. Nodes are light in weight and battery powered devices and used in various environment. Sensor node also known as motes or nodes monitor physical conditions such as light, heat, vibration, sound in various locations. Communication in the wireless medium can be of radio frequencies, infrared or any other medium. Resources of sensor network are energy, memory, bandwidth and processing power, one of the efficient resources is energy which determines the lifetime of a network [1].

Performance is the main factor in sensor network. Achieving energy optimization is the greatest issue in the research of the sensor networks. Many methods are used to enhance the performance but clustering mechanism is best among all methods [2]. Sensors main goal is to collect data and transfer data to dedicated node [2][3][4][5].

The rest of the paper is organized as follows section 2 represents clustering; section 3 and 4 gives the detail analysis of power dissipation in network with the simulated results.

## II. CLUSTERING IN WSN

Clustering is the best routing protocol used to minimize energy dissipation in the network and most efficient than other routing algorithms in sensor network, it also affect the lifetime of a network by focusing more on energy optimization method. Clustering is achieved by cluster head and clusters which aggregate the data and transfer data to base station; during communication they avoid redundant data which results in energy minimization and in turn increase the lifetime of a network. cluster head collects data from clusters and transmit the aggregated data to the base station directly or through multi-hop transmission[6][7].Cluster head spend more energy for communication than non cluster head, cluster head is selected randomly among sensor nodes to balance the energy load equally. Clustering protocols are LEACH, SEP, HEED, EBHC, and EEHC works on different scenarios [8][9][10].

The basic idea of clustering is achieved by Low Energy Adaptive Clustering Hierarchy (LEACH) protocol, is the energy conserving protocol. LEACH is the basic and standard protocol used on clustering and it is also self organizing adaptive protocol. In LEACH clusters are formed by distributed algorithm. The operation of LEACH is performed in the form of rounds; rounds consist of set-up phase and steady phase [11]. Cluster formation is performed in set up phase and data transmission takes place during steady phase using Time Division Multiple Access (TDMA) method which communicates with the clusters within the allocated time. Each sensor node selects its clusters based on the distance or signal strength, which means the nodes selects the shortest distance cluster or nearer cluster to them[11][12].

## III.RELATED WORK

This section presents about the analysis of the proposed work and network area of the protocol

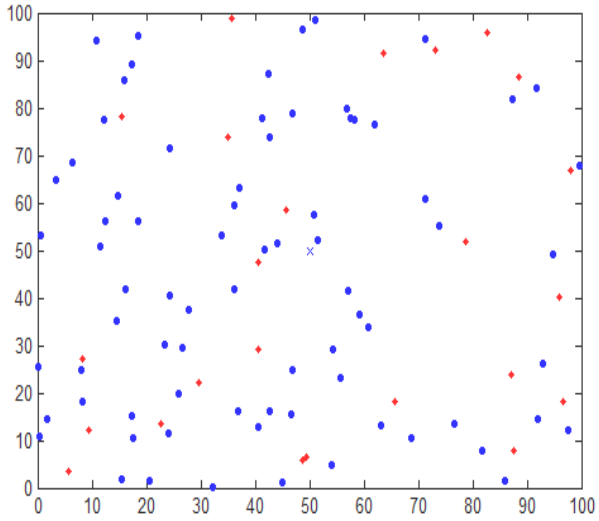

Fig 3.1: Network area of leach

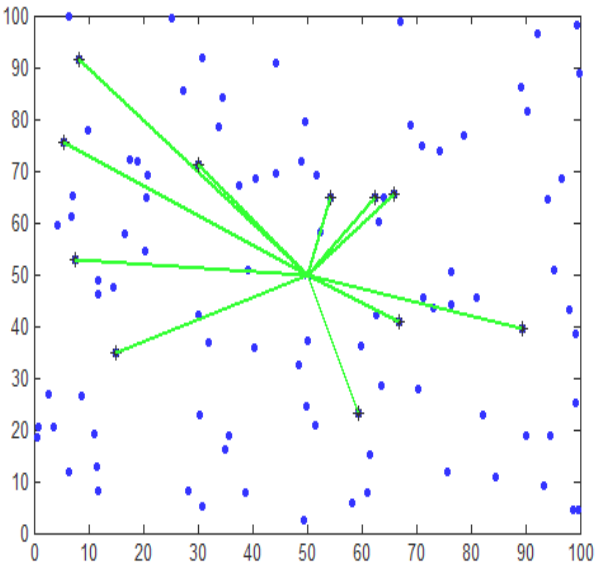

Fig 3.2: Clustering

Fig 2.1 and fig 2.2 shows the network area covered by the LEACH and dynamic energy method. In both the figures we have deployed the nodes for area 100X100,n=100,r=100,Eo=0.08.Figure 2.2 shows the network area of LEACH same as fig 2.1 but with clustering method.

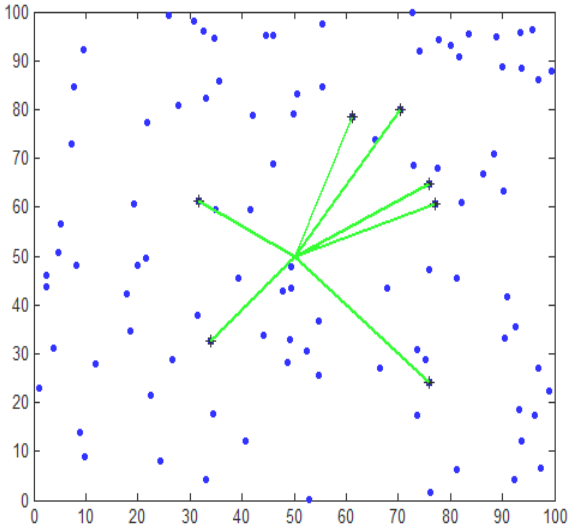

Fig 3.3: Clustering occurring within specified region

The above figure shows selecting cluster head within specified region doing this uniform election of cluster head is achieved. The figure shows the election of cluster head occurring within the specified axis points i.e. 20 to 80.

## IV. RESULTS AND DISCUSSIONS

This section presents the comparison of the lifetime of a network between the existing and proposed network with the simulation results of the clustering algorithm.

Parameters used are r, p, G.

Where: r is the number of rounds used for lifetime of the network

p is the probability of selecting as cluster head in a node.

G is to avoid cluster heads in consecutive rounds.

Where Eo is the initial energy value in network,

round –to round the values from the result.

Calculating Threshold value in proposed equation.

Equation below shows proposed threshold value T(n) for selecting cluster heads.

$$T(n) <= \frac{(p*Eo)}{\left(1-p*\mathrm{mod}\left(r,\mathrm{round}\left(\frac{1}{p}\right)\right)\right)}$$

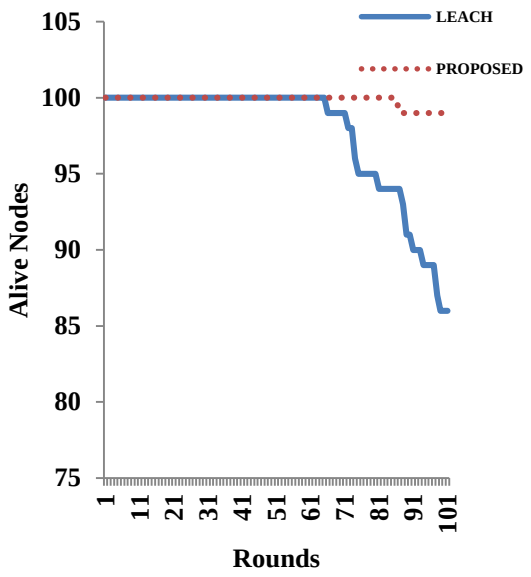


Fig 4.1: Lifetime of a network

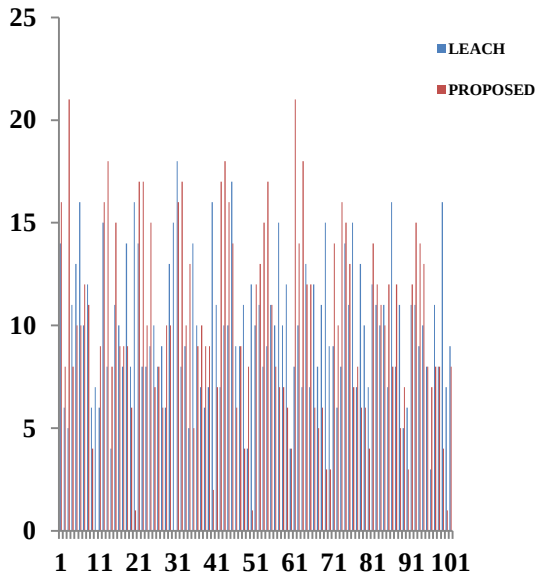


Fig 4.2: Packets transmission to Base Station

Figure 4.1 shows the network lifetime in LEACH. Matlab tool is used for simulation and it is set up to 100 nodes; area of 100 sqm, 100 rounds, p=0.1, Eo is 0.05, and m=0

Numbers of alive nodes are more in proposed algorithm than LEACH this shows there is increase in the performance of a network.

To increase the number of packets in base station and cluster head following equation is used.

$$T(n) <= \frac{(p+Eo)}{\left(1-p*\mathrm{mod}\left(r,\mathrm{round}\left(\frac{1}{p}\right)\right)\right)}$$

Where:

**p** is the probability of selecting as cluster head in a node.

**r** is the number of rounds used in lifetime of a network,

**G** is to avoid cluster heads in consecutive rounds,

Where Eo is the initial energy value in network, round –to round the values from the result.

Below figure shows, In proposed algorithm there is increase in the amount of packets sent to the base station and cluster head than in LEACH and lifetime of a network.

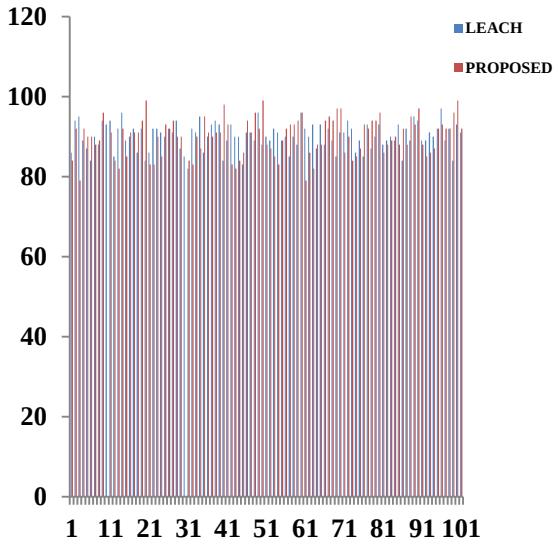


Fig 4.3: Packets transmission to Cluster Head

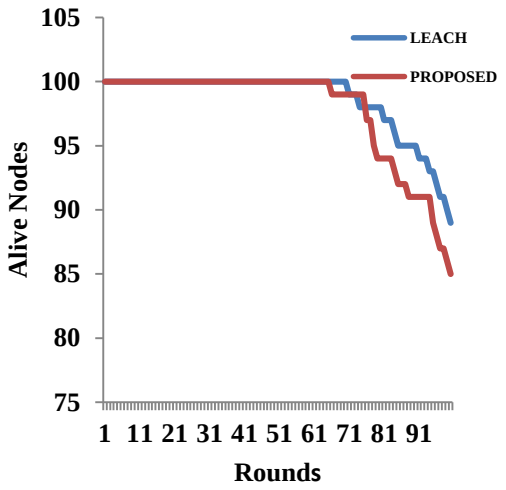


Fig 4.4: Lifetime of a network

## CONCLUSION

This paper analyzes the factors affecting the lifetime of a network and proposes an enhance energy efficiency clustering algorithm.The result of simulation in proposed algorithm shows there is 3 to 4% better lifetime in the network than compared to existing LEACH.

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