Energy Efficient Clustering and Secure Protocol in Wireless Sensor Networks

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Abstract- **Sensors are the building blocks of Wireless Sensor Networks (WSNs). Sensor is a transducer converts pressure, heat, vibration, sound, light, and motion etc into electrical signals. Sensor nodes sense the information and transmit it to the dedicated sink node. Main drawback in WSNs is they have limited resources. Clustering approach proposed by researchers balances the energy load evenly and reduces the overhead in the network which in turn increases the performance in the networks. Leach is the first and most popular protocol used in clustering routing. As WSNs is gaining attention from users day by day so security is must for WSNs. Security offer services such as confidentiality, authentication, and integrity. Deploying watchdog leach provides the needed security in sensor networks and clustering approach prolong the sensor nodes lifetime. This paper aims at providing energy efficiency and security method in WSNs.**

Keywords: Wireless Sensor Networks, Clustering, LEACH protocol, Watchdog.

I.INTRODUCTION

Wireless Sensor Network (WSNs) is a collection of sensor nodes. They are equipped with the capabilities of sensing, computing, and communication among nodes. WSNs applications are used in variety of applications mainly divided into tracking and surveillance or monitoring. Used in Military applications, Hospitals, IT fields, animal tracking and so on. One of the main drawback of sensor network is they have a very limited resources such as energy, memory, power, and communication module. The scarcest resource in WSNs in energy.[1]
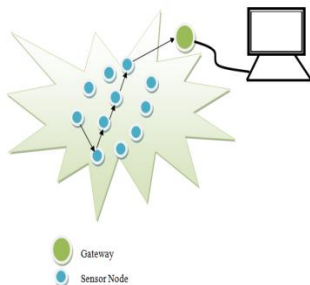

Fig.1. Wireless Sensor Network

Minimizing energy dissipation and maximizing security is the big task for researchers. Clustering routing algorithm is most appropriate and efficient way to minimize energy consumption in sensor networks [4]. There are many clustering algorithms like SEP [5], HEED [6], EBHC [7], EEHC [8], each work on different scenarios.

Paper is organized as follows: Section 2 represents clustering algorithm. Section 3 gives the analysis of power dissipation.

II.CLUSTERING TECHNIQUE

To minimize the power consumption in network clustering is one of the best routing protocols it aggregates the data from cluster head to sink node. Clustering is divided into inter clustering and intra clustering. LEACH protocol gives the detail understanding of clustering algorithm [2][3].

LEACH-Low Energy Adaptive Clustering Hierarchy

It is the adaptive clustering, self organized and standard protocol used to increase the performance in the network. LEACH operations are mainly divided into rounds, where each rounds consists of set up phase, and steady phase. These phases are discussed below [9][11].

Setup Phase
- Clusters are formed by network, consisting of cluster members and cluster heads.
- Cluster heads advertise itself for the formation of the clusters with non-cluster head based on the signal strength i.e. on the distance cluster selects cluster head.
- Finally leads to forming n number of clusters in the network.

Steady Phase
- Cluster members transmit aggregated data to cluster head using Time Division Multiple Access (TDMA) where nodes communicate within specified time.
  - Cluster head sense the total data from clusters and transmit to dedicated sink node.
  - The nodes which are neither cluster head nor cluster member will transmit data directly to the base station.

These phases in LEACH help in reducing the amount of energy dissipated in the network and avoid the redundant data transmission. [9][10][11][12][13][14].
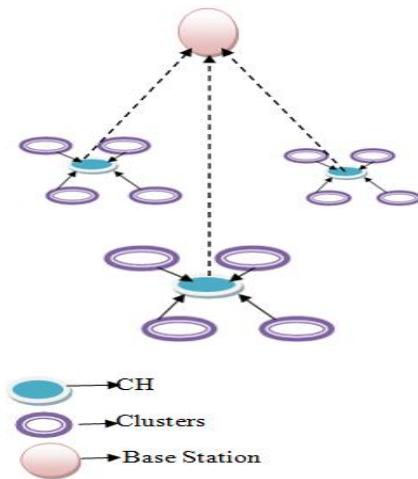
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Fig. 2. Structure of LEACH

III. RESULTS AND DISCUSSIONS

Parameters used are p, r, G.

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.

Calculating Threshold value in proposed equation

Equation Eq.1 shows proposed threshold value T(n) for selecting cluster heads.

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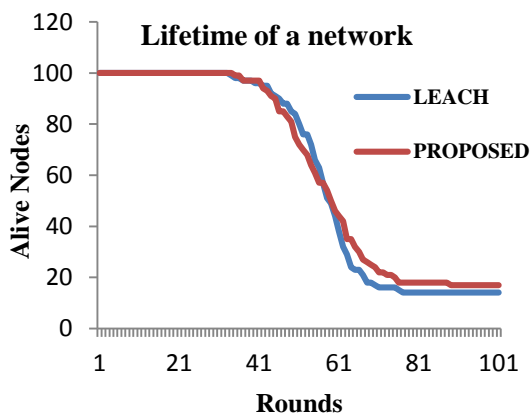

Fig. 3.Life time of a network, m=0.2

Figure 3 shows the network lifetime of LEACH. The simulation set up is done for 100 nodes; area of 100 sqm and 100 rounds, p=0.5, Eo is 0.03.

Numbers of alive nodes are more than LEACH this shows increase in the performance of network.

IV. SECURITY-WATCHDOG-LEACH

Watchdog-LEACH method adds some nodes in LEACH to be more secure. It works in heterogeneous environment.[15] Spontaneous watchdog approach is used in for selecting Watchdog-LEACH which is to done before steady phase[16]. In setup and steady phase for intrusion detection we have Decentralized Intrusion Detection method [17].Each node has the monitoring module that is activated based on watchdog node. These watchdogs must analyze the packet received and transmitted in the neighbors of clusters. Due to nature of broadcast communication every watchdog receives every packet sent into cluster. If a node is elected as CH in previous phase it is not elected as watchdog in cluster.

V. CONCLUSION

This paper aims at enhancing energy efficiency in network using clustering algorithm. Analysis of the factors affecting the lifetime of network has been carried. Watchdog-LEACH which is used to increase the security in WSNs with authentication, integrity and confidentiality methods etc. Compared to LEACH the proposed algorithm achieves 3% better lifetime in the network and there is increased number of alive nodes in the network.

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