

# Dynamic Clustering Approach to Improve Reliability in Wireless Sensor Networks- A Survey

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**Abstract:** A wireless sensor network is generally defined under a standard architecture called clustering architecture. According to this architecture, the complete network is divided in small segments called clusters. Each cluster is defined with a cluster head. The cluster head is responsible to manage all the communication within the cluster. Each node defined in the cluster, communicate with cluster head and then the information from the cluster head is transferred to the base station in direction of multi hop path. The life of the network depends on the cluster head. The effective clustering decides the actual life of the network. In this work, we have defined a solution to improve the network life by presenting an effective clustering approach. In WSN, Network lifetime is one of the major concerned area. In this work, modification in existing V-Leach protocol is done to improve the network life. The cluster head selection is done on the basis of energy and distance parameters. At the same time, the Vice Cluster Head is also selected along with Cluster Head Selection. As the cluster head dies, it is replaced by Vice Cluster Head and a new Vice Cluster Head is selected. The proposed approach tries to keep the Cluster Heads alive for the maximum time, because of this the lifetime of network maximizes and the communication over the network will be maximized and hence, improved.

**Keywords:** Wireless sensor networks, sensor nodes, routing protocol, cluster head, energy efficiency, lifetime, clustering, multihop, adhoc Networks.

## I. INTRODUCTION

The original motivation for WSN came from the vision of smart dust in the late 1990's. In the past decades, it has received great attention in industry all over the world. A WSN consists of a large number of small, cheap and resource limited sensor and some base stations. In WSN settings sensors collect data from the environment and forward it to the base station in the Ad hoc manner. Through wireless medium these sensor nodes establish a communication path and work together to complete a common task. Power consumption for nodes using batteries, ability to cope with node failures, mobility of nodes, ability to withstand harsh environmental conditions are the main characteristics of a WSN. Coverage, connectivity and Lifetime are main goals of WSN. Challenges faced by WSN are to balance load evenly across network, to minimize unnecessary energy dissipation, minimize cost and energy, avoid long-range transmissions (multi-hop is less expensive). WSN always suffer from the problem of energy loss and the life time of the network. Such kind of network always requires power for efficient utilization of energy of battery operated devices, and routing optimization for energy efficiency is a good area for research work. We intend to optimize energy usage of battery operated devices and increase the lifetime of network in wireless sensor network. From this survey we have concluded some points as

- The most common problems in wireless sensor network is Network Life. Each node releases some amount of energy with each transmission.
- The energy reduction results in the short network lifetime. Lot of work is done in this direction, respective to different protocols.
- In a clustered network, the selection of cluster is one of the major WSN protocol. In this we have studied different approaches of cluster head selection based on distance, energy and other parameters.
- The another problem we studied is the localization of nodes. The node placement in different order or based on different topology also affect the network life.
- These papers shows that a network always need the improvement in QOS in WSN. Lot of work is done in this direction respective to protocol modification, etc.

## II. PROBLEM IDENTIFICATION

- The main problem with LEACH protocol lies in the arbitrary selection of cluster heads. There exists a probability that the cluster heads formed are unbalanced may stand one part network making some part of the network unreachable.

- This problem is solved by using the concept of V-Leach. V Leach uses the concept of proxy Cluster Head called Vice Cluster Head. When 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 starts reducing the energy at a fast pace and finally the network dies completely.
- The proposed work is an improvement over the V-Leach; in this proposed work we are trying to improve the network life. The cluster heads are chosen on the basis of energy and 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 lifetime and total communication over the network.

### III. CLUSTERED ARCHITECTURE

The basic objective on any routing protocol is to make the network useful and efficient. A cluster based routing protocol groups sensor nodes where each group of nodes has a CH or a gateway. Sensed data is sent to the cluster head rather than sending it to the base station; CH performs some aggregation function on the data it receives then sends it to the BS where the data is needed. Objective of Clustering are:

1. Maximizing network Life-time
2. Fault-tolerance
3. Load balancing

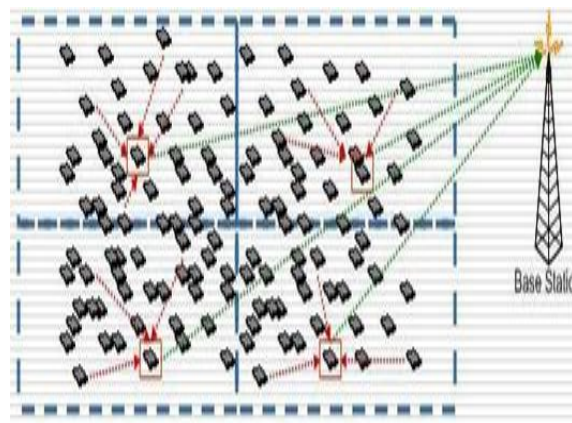


Figure1: Clustered Architecture

### IV. RESIDUAL ENERGY AS A FACTOR FOR NEXT NODE SELECTION IN WIRELESS SENSOR NETWORK

Residual energy means that energy of node which remains in node after transmission. When a node wants to transmit data then it communicates with the Next Node and Next Node forwards data packet to base station. Next Node is selected on the basis of energy which a node has. Initially all nodes are same, there is no Next Node. Later the node which possesses maximum energy, is selected as Next Node. When numbers of rounds of data transmission have been carried out then the residual energy of nodes decides which node will become the Next Node. This dynamic nature of changing Next Node provides better transmission and life time.

### V. PROBLEM DEFINITION

The main problem in the LEACH protocol lies in the process of random selection of cluster heads. There lies a possibility that the cluster heads formed are not balanced and may lasts in one part of the network making some part of the network unavailable. This problem is solved by using the approach of V-Leach. V-Leach uses the concept of alternate Cluster Head called Vice Cluster Head. When a Cluster Head dies, it is replaced by the Vice Cluster Head. But in case the Vice Cluster Head also dies, it does not provide solution for that and the network starts losing the energy at a fast pace and finally the network dies completely. The proposed work is an improvement over the V-Leach. In the proposed work we are trying to improve the network lifetime. In this work, initially when the Cluster Heads are selected based on the their energy and the distance parameters, we also select the Vice Cluster Heads.

## VI. MOTIVATION

The proposed work is about the implementation of cluster head selection approach for wireless sensor network. Each cluster is controlled by the cluster head. The basic parameters for cluster head selection are energy and the distance. In this work, Vice Cluster Head is suggested along with Cluster Head selection. We will define three main parameters for the Cluster Head selection, and they are called energy, distance and residual energy. With foremost implementation, the Cluster Head and Vice Cluster Head will be selected and as the cluster head will die, it will be replaced by the Vice Cluster Head and the algorithmic implementation will be performed for the selection of Vice Cluster Head.

## VII. OBJECTIVES

The proposed work will cover the following research objectives

- Design of the sensor network under the defined parameters.
- Study of Different parameters that can influence the cluster head selection mechanism.
- Implementation of existing cluster head selection approach.
- Design of new parameters based algorithm for the Cluster Head and Vice Cluster Head selection approach.
- Implementation of proposed approach in MATLAB environment.
- Comparative analysis of proposed approach.

## VIII. SOURCES OF DATA AND RESEARCH DESIGN

To perform the defined work we need to do parameters' selection, for the existing and the new work. Such kind of parameters will be selected from the study of existing work done by earlier researchers. Respective to the network definition, the parameters will be selected based on the literature study.

LEACH has two phases: the set-up and steady-state. In the set-up phase, the CHs are chosen "statistically", which is randomly based on an algorithm. A threshold is determined based on this algorithm.

- Initialize all the parameters.
- **Cluster head selection:-** A sensor node chooses a random number,  $r$ , between 0 and 1. If this random number is less than a threshold value,  $T(n)$ , then the node becomes a CH for the present round. This threshold value is calculated by using the formula:-

$$T(n) = \begin{cases} \frac{p}{(1 - p(r \bmod (1/p)))} & , \text{if } n \in G \\ 0 & , \text{otherwise} \end{cases}$$

Where,  $p$  = predetermined fraction of nodes that elect themselves as CHs.

$G$  = The set of nodes that have not been selected as a cluster-head in the last  $(1/P)$  rounds.

$r$  = number of current round.

- **Formation of the cluster:-** calculate the distance between the Cluster Heads and the sensor nodes, the node which has the shortest distance from a particular Cluster Head that node joins that cluster. The second parameter is the energy and third parameter is residual Energy. The cluster head will be selected with the minimum distance and maximum energy and also the Vice Cluster Head. The Vice Cluster head is that alternate head that will work only when the current Cluster Head will die.
- Now Cluster Head receives data from Non-CH nodes and aggregates all the data. And then sends the aggregated data to the BS. If the distance between the Cluster Head and the Base Station is quite large, then here we use multi-hopping concept, according to this if the distance between the Cluster Head and the Base Station is large then one Cluster Head sends its data to the next Cluster Head which is more closer to the Base Station.
- Now energy dissipated is calculated and subtracted from the remaining energy of every node and if some nodes are having energy less than minimum than those nodes are deleted from the network and their lifetime ends and then we get the output. Hence this round will be completed.
- If the Energy (Cluster Head)  $\leq 0$ , then we set the Cluster Head = Vice Cluster Head. And also find the Next Vice Cluster Head as the next option.
- The process of Cluster Head selection uses different criteria. It is on the basis of three factors i.e. Maximum energy, Minimum distance, maximum residual energy. Based on received signal strength, each non-cluster head node determine its Cluster Head, greater the signal strength means shorter the distance between them and if distance is small then for the transmission, less energy is required.

The proposed approach will improve the network life as the cluster head will never die. As a cluster head will die it will be replaced by the Vice Cluster Head.

## IX. CONCLUSION

The proposed work is carry out on Wireless Sensor networks to improve the network life in case of the clustered networks. The main problem with the clustered networks is to find the cluster head for each cluster. Here, the improvement is done in the V-Leach protocol. In this work, we have included one parameter to select the cluster head and the vice cluster head. This parameter is the "residual energy". The selection of the Cluster Head and the Vice Cluster Head is completely dynamic and parameter based. That's why, when the Cluster Head dies, it is altered by Vice Cluster Head and to improve the network lifetime, a New Vice Cluster Head is also selected.

In the earlier chapter, we can see the comparison between the existing work and proposed work in terms of network lifetime and the number of packets transmitted over the network.

## X. FUTURE SCOPE

In this work, an improvement in the V-LEACH protocol is proposed, that will increase the network lifetime and improve the communication over the network. This work is performed over a homogenous network. The proposed work can be extended to work over heterogeneous networks also. The heterogeneity will be in terms of the type of sensor nodes, environment and the node parameters.

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