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# ENERGY EFFICIENT ROUTING PROTOCOL

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***Abstract***

*The infrastructure-less multi-hop network which can be self-configured is Wireless Sensor Networks (WSNs). Physical as well as environmental conditions are controlled. WSNs consist of a large number of nodes, and these WSN nodes have sensing, processing, and networking capacities, and are usually multifunctional, low cost, and low power. The sensor nodes feel the data where it is used, compute the same data and then connect it with other nodes. A lot of energy is absorbed during this process. The power supply is provided by the batteries connected to the nodes and cannot be recharged or replaced in most situations, so energy usage is reduced. Therefore, in order to optimize network lifetime energy, successful routing protocols should be created. This paper focuses on different energy-efficient routing protocols used in WSN and aims to create a new innovative protocol that will outperform all previous protocols. This paper analyses the LEACH protocol and introduces an improved upgrading protocol.*

***Keywords:*** *Cluster Heads, Full Node Dead (FND), Low-energy Adaptive clustering Hierarchy (LEACH), wireless sensor and actuator networks (WSAN),*

## I. INTRODUCTION

WSN is a wireless network that is both self-configured and infrastructure-less. It is also known as a network for wireless sensors and actuators. It records both physical and environmental conditions, such as temperature, pressure, tone, etc. WSNs networks not only feel the data that is sent between the different networks, they also compute it. In order to execute particular tasks, WSNs interconnect separate sensor units [1]. Four essential components make up a sensor node:

1. A sensing unit
2. A processing unit

3. A transceiver unit
4. A power unit

To form a network that can communicate with each other in a wireless way, the sensor nodes can self-orientate. Each node gathers data from the network, shares with other nodes the data received, and eventually transfers the information to the destination node or the base station. Generally, a WSN comprises thousands of sensor nodes and these nodes may use radio signals to communicate with each other [2]. Sensing and computing units, control components and radio transceivers are the equipment used in wireless sensor nodes. They are responsible for the self-orientation of an effective network system after the use of sensor nodes, typically with multi-hop communication between them. After that, information gathering begins through onboard sensors. In a sensor node, the mode of operation is either event guided or constant. Energy use and the implementation of routing protocols in the WSN are major problems [3]. By using a routing algorithm, the choice of routes is chosen. Routing protocols specify the contact between the source and destination of a network between separate routers.

Until designing a routing protocol, the following things must be considered: Energy and Resource limitation:

1. Large life time
2. Less packet loss and delay
3. Vibrant adaptability of networks

The clustering approach used in WSNs achieves greater energy efficiency as well as a longer lifespan. In the clustering algorithm, the network is broken into separate clusters. There is a root node of each cluster that is known as the cluster head, and the remaining nodes are considered cluster members [4]. The clustering of sensors into smaller groups plays a critical role in conserving the energy of network sensors and thus extends the lifespan of the network. A large number of sensors are clustered into small clusters in the clustering process and each cluster has a cluster head and all other sensors are part of the cluster [5]. Sensors relay the sensed data to their corresponding CH with the aid of low-power short-distance transmission technologies. Using high-power long-distance transmission technique, more CHs pile up the data and transfer the captured data to the destination, so CHs run out of energy faster than other cluster members [6]. The correct size and number of clusters is critical for the efficacy of clustering, otherwise the network will not enjoy the clustering benefits. The large number of clusters results in the creation of a large number of CHs within the network and, with the aid of long-distance communication strategies, such CHs must connect with the destination. In the other hand, the creation of clusters with large diameters results in a limited number of clusters, which is why a large volume of energy is used when transmitting data from CMs to CHs. CHs should be spread equally across the network in order to maximize the performance of clustering.

There are two kinds of operations within clustering protocol:

1. Intra-cluster communication.
2. Inter-cluster communication.

A. **LEACH- A Cluster Based Routing Protocols: -**

The first and most significant hierarchical routing protocol that offers data fusion is the LEACH protocol. It is built on a round protocol and is both self-organized and self-adaptive. Every protocol is organized into two stages, i.e. the step of configuration and the stage of steady state [6][7]. The setup stage is kept smaller than the step of the steady state. The setup process has benefits over the steady state phase, as the sensor node itself randomly selects the cluster heads in the setup phase and the various network clusters are created, and later these cluster heads schedule a TDMA schedule for their cluster node members.

**Advantages**:

The benefits of LEACH protocol are:

1. Improves the lifetime
2. Does not need a central node
3. It is totally distributed and doesn't need any worldwide knowledge of the network
4. It powerfully distributes the energy burden to each sensor nodes
5. Reduces the movement in the network
6. To create cluster site information of nodes are not essential

**Disadvantages**:

The chief drawbacks of LEACH are:

1. It is uninformed about the total number of CH in the complete network
2. If the CH die due to certain cause the cluster become headless
3. There is irregular distribution of clusters

## II. LITERATURE SURVEY

"In Wireless Sensor Networks Routing Techniques: A Survey" research paper by Jamal N. Al-Karaki et.al. The implementation problems for routing protocols in WSNs are highlighted, and a detailed survey of routing strategies is also presented. It tackles the architecture trade-offs between energy and overhead connectivity [8]. This paper highlights the benefits of each routing protocol, as well as efficiency challenges. The potential future viewpoints for study are also concluded in this paper. Monika Raghatate et.al's research paper 'An Energy Saving Algorithm To Extend The Lifetime Of Wireless Sensor Network' focuses on improving the lifetime of WSNs, thereby minimizing energy consumption by creating an energy saving algorithm in which clusters are built as a CH on the basis of a subset of high-energy nodes and another subset of powerful nodes are needed to go to sleep. Another sub-set of nodes becomes involved and behaves as a CH when CH absorbs all its resources [9]. In MATLAB, the

suggested approach is applied and the simulation results affirm that, relative to the LEACH protocol, it effectively prolongs the network lifespan.

Wireless Sensor Networks Routing Protocols: Classifications and Challenges" research paper by Manal Abdullah et.al." Classifies the protocols for routing proposed for WSNs. The classification is carried out on the basis of five key factors: energy efficiency, priorities of routing, operating model, choice of route and design of the network. Any of these specifications are further categorized in detail [10]. This paper also outlined some of some protocols' contrasting characteristics. Along with its field of application, the interface problems of WSNs are addressed. Study paper by Shraddha Fulkar et. al. 'Energy Efficient Resource Utilization in Wireless Sensor Networks' In addition to SSMTT (sleep scheduling multiple target tracking) algorithms, the mc-ACO (ant colony optimization) method is proposed. The sensor nodes are scheduled with the aid of both methods so they wake up whenever possible from sleep mode to active mode. This not only gives better resource allocation of sensor nodes but also prolongs the network lifetime.

## III. CONCLUSION

Considering the network lifetime that is measured using FND and HND metrics, the efficiency of the proposed hypothesis is compared to LEACH. Compared to the LEACH routing protocol, the suggested principle distributes the energy consumption between the sensor nodes and thus increases the network lifespan to a greater degree. CH is not set in this suggested theory, but it changes its location between the sensor nodes and thus avoids the problem of battery drainage of the CH node. Therefore, the implied principle of iLEACH not only offers a substantial change in network life, but also achieves greater network reliability.

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