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# Comparative Analysis on Atypical and Typical Hierarchical Protocol of Wireless Sensors: A Review Paper

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***Abstract:***

***Hierarchical routing in wireless sensor networks (WSNs) is a very important topic that has been attracting the research community in the last decade to pursue the research .Typical hierarchical routing is called clustering routing, in which the network is divided into multiple clusters. Hierarchical routing that consists of cluster based topology is a very favorable and economical approach for increased throughput and profitable performance with great efficiency. Wireless Sensor Networks (WSNs) consists of distributed networks consisting of sensors that are distributed randomly to inspect the inaccessible and difficult terrain. Wireless sensors are deployed for communication purpose. Whereas atypical hierarchical routings are the variants of cluster-base, routing and present special hierarchical architecture, including chain-based, tree-based, grid-based, and area-based routing.Recently, some types of atypical hierarchical routing technology hasarisen, including chain-based, tree-based, grid-based routing, and area-based routing in the field of wireless sensors technology. So in this review paper we discuss differences between atypical and typical hierarchical protocol of wireless sensors .Mainly focusing on difference between works of typical and atypical hierarchical protocol.Thus mainly focusing on difference between LEACH protocol and PEGASIS protocol. LEACH belongs to typical and PEGASIS belongs to atypical hierarchical protocol of wireless sensors.***

***Keywords: typical hierarchical protocol, atypical hierarchical protocol, wireless sensors, base stations, nodes, cluster heads***

## I. INTRODUCTION

WIRELESS sensor networks (WSNs) consist of a large number of low-budget, low-power and intelligent sensor nodes with one or more base stations .The sole purpose of these are to serve as medium for the transmission of signals. Those nodes are considerably small in size and can perform many considerable applications, that includes phenomena sensing, signal processing, and in the field of communications and also in military applications including load balancing. It has got various advantages such as flexibility in deployment, large transmission range, self-organization followed by flexibility in communications and military applications including with flexibility in size of the device .Sensors are generally equipped with non-rechargeable batteries. Data transmission is the major source of energy consumption and main reason behind deployment of battery .Sensors are small low-powered device which consists of computation, communication and long range transmission abilities with sensing ability.Hierarchical architecture is proved to be an effective solution to the problem of scalability and energy efficiency. Since as the network scale increases, the scalability of the network increases and thus becomes an obstacle.Sensor nodes when used in large amount and in collaboration to supervise large physical area give rise to a distributed collaborated system known as Wireless Sensor Network .In a hierarchical architecture, the network is divided into different layers, and nodes in different layers perform different tasks.The typical hierarchical routing technique is clustering, in which the network is divided into multiple clusters and nodes undertake two different tasks, cluster heads (CHs) and ordinary nodes (ONs). An ON only send its sensed data to its related CH, while a CH is responsible for collecting the data from its ONs and transferring data to the base station through the help of hierarchical routing. Thus the purpose of ON is to sense the data and send it to the related cluster head. LEACH is a leading typical hierarchical routing protocol for WSNs.In typical hierarchical protocol the networks are divided into the hierarchy of several nodes . Nodes present at different hierarchical level serve different purpose. For e.g. Level 0 nodes referred as sensor nodes which sense data and forward it to Level 1 nodes work as cluster heads. Level 1 nodes act as bridge node between Level 0 nodes and base stations. Several levels can be inserted between base station and sensor nodes. During comparison we derive that Hierarchical routing protocol is superior than flat based routing protocol since the latter one faces more signal traffic and more time delay . Thus this decreases the efficiency and throughput. In hierarchical protocol many clustering algorithm has come forward. The cluster heads are more powerful, experience more traffic and are less energy constrained devices rather than sensor nodes.Thus reducing duty cycling of nodes.. Typical hierarchical routing protocols works by dividing the network into clusters and to manage the energy consumption of sensor nodes and perform data aggregation order to decrease the number of transmitted messages to the cluster head and thus to the sink or base station.LEACH is one of the typical hierarchical routing protocolin which

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cluster head selection and cluster formation is random. But the function of cluster head (CH) is varied among the cluster components so as to distribute the energy dissipation .Also it distributes the work of each node. Decision taken by the sensor node depends on choosing a random number between 0 and 1.A particular node becomes a clusterhead only if random number generated is less than a threshold value denoted by T(n).Recently there arise some atypical hierarchical routings, which are variants of cluster-base routing and present special hierarchical architecture, including chain-based, tree-based, grid-based, and area-based routing. These are similar to the traditional clustering routing, but are more or less different in hierarchy division, communication scheme and applications. Thus there have been research studies on atypical hierarchical protocol but very few papers separately on atypical hierarchical protocol has come forward. These are similar to the traditional clustering routing, but are more or less different in hierarchy division, communication scheme and applications. This also varies in architecture of traditional ie typical hierarchical protocol. Now a days atypical hierarchical routing protocol is finding its applications in the various fields especially in the field of transmission of message. Since PEGASIS is also called an advanced version of LEACH protocol. PEGASIS being the atypical hierarchical protocol of wireless sensors while LEACH is of typical hierarchical protocol.

## II. WORKING

Here we will compare and discuss the working of both atypical and typical hierarchical routing protocol of wireless sensors .While discussing the working of atypical hierarchical routing protocol we will see the working according to the classification of atypical hierarchical routing protocol Classification of Atypical Hierarchical Routing Protocols are of four categories that are chain based , tree-based, grid-based, and area-based.

### *A. Chain-BasedRouting*

In chain-based topology , one or more chains are constructed to connect the deployed sensor nodes to serve the purpose of data transmission and receiving. In a chain, to perform the task of data collecting a sink is provided. Data is delivered along the chain, and ultimately to the sink.

### *B. Tree-BasedRouting*

In this type of routing ,a logical tree is constructed by all sensor nodes. Data is delivered from leaf nodes to their parent nodes. In return the parent nodes send the received data to their parent nodes towards to root nodes. Data accumulation is performed in each node that are involved in transmission.

### *C. Grid-BasedRouting*

In a grid-based topology, the network is divided into various grids by geography approach. So grid-based routing is basically location based routing.In grid based routing operation is performed without any routing table. All routing operations are locally performed once the destination is reached.

### *D. Area-BasedRouting*

Area-based topology has some sensor nodes are assigned in a specific area and act as high-tier nodes. Generally, such nodes perform the task of data collection from ONs and data transmission to the sink. Such topology is always used in mobile WSNs.

Now we will see the working of typical wireless sensors and thus we will see first the working. Then we will see the parameters that determines the performance of wireless sensors. In a typical hierarchical architecture, the network is divided into different layers, and nodes in different layers perform different tasks.The typical hierarchical routing technique is clustering, in which the network is divided into multiple clusters and nodes undertake two different tasks, cluster heads (CHs) and ordinary nodes (ONs). An ON only send its sensed data and information to its related CH, while a CH is responsible for collecting the data from its ONs and transferring data to the base station through the help of typical hierarchical routing protocol. Thus the purpose of ON is to sense and analyze the data and send it to the related cluster head via wireless routing.In typical hierarchical protocol the networks are divided into the hierarchy of several nodes . Nodes present at different hierarchical level serve different purpose . For e.g. Level 0 nodes referred as sensor nodes which sense data and forward it to Level 1 nodes work as cluster heads. Level 1 nodes act as bridge node between Level 0 nodes and base stations. Several levels can be inserted between base station and sensor nodes.

Various parameters used to check the performance and efficiency of typical hierarchical routing protocols include the following:

1) Minimum Hop- Sensor network mostly consist of collection of nodes. So, the routing protocols tries to find a way which consists of least number of nodes from sender to receiver path of transmission.
2) Energy- Energy being the main constraint and needs to be minimized as sensors operate on limited battery supply and for long time span.
3) Throughput- Network throughput and lifetime of nodes provides Network details for putting nodes into action thus playing the major role in the transmission and reception of the signal through nodes.
4) Robustness- Sensor nodes make use of routes that are estimated to be stable and efficient by the estimation of link quality and quantity of each of its surroundings and then choosing the best among them.
5) Latency- In sensor network, sensor nodes have to perform the job of transmission to the base station. The transmission and reception of data is completely time dependent. So the routing design should be doe such that there should be less time as possible also the simplicity should be there in the design

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## III. COMPONENTS USED

1. NODES: These are low powered and low budget components that act as medium for communication and transmission of signals and message. These are very small in size and basic building block of wireless sensors.
2. ORDINARY NODES: (ON's) They are used to sense and analyze the data. They send the data to cluster head.
3. CLUSTER HEAD: Cluster heads(CH's) are head of the nodes. They collect the data from on's and then send it to base station.They are also called parent node in atypical hierarchical protocol.
4. Other micleneous nodes such as leaf nodes and root nodes which are type of ordinary nodes.

## IV. SYSTEM DESIGN

In the design section we shall see the difference between LEACH and PEGASIS protocol of wireless sensors.

LEACH is one of the hierarchical routing protocolin which cluster head selection and cluster formation is random. But the work of cluster head (CH) is different among the cluster components so as to distribute and divide the energy consumption and the work of each sensor node . ManyLEACH protocol technology have been implemented on multiple areas and are used as important part of communication and transmission of message. A particular node becomes a clusterhead for the current round if random number generated is less than a threshold value denoted by T(n) .Factors such as the percentage to become a cluster head and the set of nodes that have not been elected as a cluster head denoted by G, the value of T(n) is calculated as follows: Hybrid, Energy Efficient Distributed protocol selects clusterheads periodically according to a hybrid of the T(n) = 1 − p p(r mod 1 ) if nEG node residual energy and initial electric power, Emax.

The node containing moreelectric power is more dominant to become cluster head.. This protocol uses less number of transmissions. It comprises localized control for data transfers; randomized, adaptive and self-organizing techniques for cluster formation and random selection of cluster heads. The cluster heads aggregates and compress data before transmitting it to the base station for processing and further development.

The operation of LEACH is usually divided into rounds

### 1) Installation Phase

- Cluster head Selection method Algorithm: In this phase, clusters are organized using a distributed method algorithm. Each node makes its own decision whether or not to become a cluster head in accordance with present selection. The final decision made by the sensor node depends on choosing a random number between 0 and 1. A particular node becomes a cluster head if random number generated is less than a threshold value denoted by T(n). Considering the factors such as the probability percentage to become a cluster head, the present round selection and the set of nodes that have not been chosen as a cluster head denoted by G, the value of T(n) is calculated as follows:
  T(n) =p/1 − p p(r mod (1/p) ) if nEG (1)
  (1/p) ensures that each node on an average becomes a cluster head once.
- Cluster Formation technique Algorithm: After appropriate cluster head selection, each cluster head node sends advertisement message. All non cluster head nodes combines to one of the cluster heads and transmits request message . Then the cluster heads set-up and transmit a schedule signal to assign separate time slots to each of its cluster members. After this the network joins a steady state phase.
  2) Steady-State Phase: This phase of transmitting data from cluster members to their respective cluster heads, during their alloted time slots. Furthermore, the radio of each cluster member is turned off after transmission and Thus cluster head collects the data received and send it to the sink.

**Drawbacks of LEACH-**

1. Additional overhead occured while reforming clusters.
2. Random selection and uneven distribution of cluster heads as random selection of cluster heads leads to long transmission distance and wastage of energy.
3. There is no provision of selecting another cluster head during any failure.
4. Affects the limited power supply in wireless sensors
5. This protocol does not give any idea about the number of cluster heads in the network.
6. When due to any reason Cluster head dies, the cluster will become useless because the data gathered by the cluster nodes would never reach base station. Thus the signal transmission gets inturpted.

**PEGASIS:**

PEGASIS (power-efficient gathering in sensor information systems) isa atypical chain-based hierarchical protocol. All nodes are organized in a linear chain manner for data transmission and data receiving that takes place in a linear manner. The chain can be formed by the sink with a centralized approach algorithm following the linear formation approach. It is assumed in both cases that all nodes have global knowledge of the network topology. The chain construction is begun with the furthest node from the sink. One of the node is selected as leader or main node which transmits the message to the sink. The closest neighbor node is selected as the next node of the chain of the node. If a node dies, the chain will be rebuilt to remove the dead node. Data is delivered from each node to its neighbor node, and nodes act as leaders which communicate to the sink . Every node mingles its neighbor's data with its own to generate a new packet and then sends it to its next neighbor. Its like passing the message in a turn from one to the other. This is a

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repeated course until all data are gathered at the leader, which then directly transmits the final data packet to the sink. Compared with LEACH, PEGASIS reduces the overhead of clustering process and decreases the chance of data aggregation. However, it is difficult for all nodes to achieve global knowledge of node positions to select closest neighbors and minimize energy depletion. Moreover, as leaders, all nodes must be able to directly communicate with the sink. So, PEGASIS is not suitable for such networks with time varying topology [39]. In addition, the long chain structure suffers from large transmission delay. The increase of the network scale will make the above problems be worse. In other words, PEGASIS suffers from the problem of scalability.To improve the energy efficiency of PEGASIS CCS (concentric clustering scheme) is used.

## V. RESULT

Thus after the comparison of both atypical and typical hierarchical protocol we conclude that atypical is better choice than typical hierarchical protocol of wireless sensors. Since this can be derived from comparison between PEGASIS and LEACH. But we also conclude that CCS is better than PEGASIS. But the final conclusion is that atypical is better than typical hierarchical protocol. Now we can analyse more on atypical sice it is more better.

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