A COMPARATIVE STUDY ON LEACH AND RE REAC-IN PROTOCOL IN WIRELESS SENSING NETWORK

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ABSTRACT: Wireless sensor networks consist of sensor nodes which are powered by battery, to communicate with each other for various operations, energy efficiency is the main issue in wireless sensor networks. Therefore, to maximize network lifetime and maximum reliable and scalability routing techniques have been developed LEACH is the conventional hierarchical clustering protocol widely used in WSN, RE REAC-IN is protocol used on residual energy for clustering. In this paper we will compare LEACH protocol along with RE REAC-IN protocol with its advantages and disadvantages. The objective of this paper is to provide comparison results between LEACH and RE REAC-IN protocols.

Keywords: Wireless sensing network (WSN); LEACH (Low energy adaptive clustering hierarchy routing protocols); RE REAC-IN (Residual Regional aware clustering with isolated nodes); clustering; packet delivery ratio; uncovered nodes; throughput; remaining energy; energy efficiency.

I. INTRODUCTION

Wireless Sensor Networks (WSN) have increased overall consideration as of late because of the advances made in remote correspondence, data advances and hardware field. The idea of wireless sensor systems depends on a straightforward condition: Sensing + CPU + Radio = Thousands of potential applications.

![Fig 1.1: basic structure of wsn](image)

It is a detecting innovation where small, self-governing and minimal gadgets called sensor nodes sent in a remote territory to recognize events, gather and process information and transmit detected data to clients. The advancement of minimal effort, low-control, a multifunctional sensor has gotten expanding consideration from different commercial ventures. Sensor nodes in WSNs are little estimated and are fit for detecting, assembling and handling information while speaking with other associated nodes in the system, by means of radio. WSN term can be extensively detected as gadgets reach from portable workstations, PDAs or cell telephones to extremely little and basic detecting gadgets. At present, most accessible remote sensor gadgets are significantly obliged as far as computational force, memory, productivity and correspondence abilities because of financial and innovation reasons. That is the reason the vast majority of the exploration on WSNs has focused on the configuration of vitality and computationally productive calculations and conventions, and the application space has been bound to basic information situated checking and reporting applications. In the event that WSNs nodes are all the more capable or mains-fueled gadgets in the region, it is helpful to use their calculation and correspondence assets for complex calculations and as doors to different systems [1]

Clustering sensor nodes is a successful topology control technique to reduce energy consumption of the sensor nodes for maximizing lifetime of WSNs. Clustering the nodes has many advantages, such as scalability, energy efficiency and reducing routing delay. Cluster based routing involves the creation of clusters, election of cluster heads and routing through the Cluster Heads (CH). The energy can be conserved more by the CH by collecting the data in the cluster, compressing it and then transmitting the aggregated data to the base station. The two imperative steps in clustering scheme are CH determination and cluster formation. Improperly designed clustering algorithms can cause nodes to become isolated from CHs as shown in Fig. 1.2 Communication of these isolated nodes with the sink will consume more energy. If the sink is far away from these isolated nodes, then isolated nodes cannot directly communicate with the sink. If these isolated nodes are not in the range of nearby current cluster heads, then isolated nodes cannot communicate with the current cluster head also. This paper presents the brief study about past researches that have been by various authors in Section II. Further, Section III represents the proposed work and finally section IV and V represents results and conclusion part.
execution of the algorithms utilized as a part of REACIN to
the cluster head determination handle and takes care of the
delivery ratio and throughput. The proposed scheme has shown
better performance in terms of energy consumption, packet
topological point of view. The main thing that needs to be
given importance in such kind of networks is their lifetime
which tends to be very less as the nodes are battery operated
nodes. So if any of the sensors dies out because of energy
drainage it is very difficult to come up with their
replacement. The replacement of the drained out sensor
nodes tends to become a costly affair. In such scenarios the
focus must be given on reducing the energy consumption of
the sensor nodes so that they can transfer the data over a
longer period of time. The solution to this is clustering of
the nodes in groups based on some rules that would
eventually increase their working time in the network. The
rules laid out for clustering is usually defined in LEACH
protocol that tends to form the clusters and select their
leader’s randomly using threshold criterion. However, the
clustering of the network results should be optimal enough
such that all the nodes are included in the cluster. In
previous paper they explores the clustering protocol and
aims to optimize the clustering process to improve the
lifetime of the network. The proposed scheme has shown
better performance in terms of energy consumption, packet
delivery ratio and throughput.

2. EXISTING WORK
Mandeep Sidhu and Manpreet Singh [1] The nodes in
wireless sensor networks are usually deployed in the areas
where human approach is very difficult. In such cases, the
deployment of the nodes tends to be random from
topological point of view. The main thing that needs to be
given importance in such kind of networks is their lifetime
which tends to be very less as the nodes are battery operated
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delivery ratio and throughput.

Jenq-Shiou Leu et al. [4] A reasonable clustering algorithm
for gathering sensor nodes can build the vitality productivity
of WSNs. Notwithstanding, clustering requires extra
overhead, for example, cluster head choice and task, and
cluster development. This paper proposes another provincial
centralized clustering technique utilizing detached
nodes for WSNs, called Regional Energy Aware Clustering
with Isolated Nodes (REAC-IN). In REAC-IN, CHs are
chosen in view of weight. Weight is resolved by leftover
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given importance in such kind of networks is their lifetime
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M.Natarajan 2013 [5] proposed proper organization of
nodes becomes one of the major techniques to expand the
life span of the whole network through aggregating data at the
cluster head (CH). LEACH (Low Energy Adaptive
Clustering Hierarchy) and PSO (Particle Swarm
Optimization) are applied for producing energy-aware
clusters with optimal selection of cluster head. The
determination of a group head utilizing PSO minimizes the
intra cluster separation between group head and the cluster
part, and the improvement of vitality administration of the
system. From the recreation results, it is seen that Vitality
Mindful Optimal cluster head choice utilizing PSO approach
builds the system lifetime of the group in such a route by
diminishing the aggregate vitality utilization than Drain
execution.

D. J. Dechene et. al. [7] in this paper, they inspect at
present proposed clustering algorithms for Wireless Sensor
Networks. They examine the operations of these algorithms,
and also draw correlations on the execution between the
different plans. The present state of proposed clustering
conventions, particularly as for their energy and unswerving
quality necessities. In remote sensor systems, the vitality
confinements of nodes assume a significant part in outlining
any convention for execution. Likewise, Nature of Service
measurements, for example, delay, information misfortune
resistance, what’s more, system lifetime uncovers
dependability issues when outlining recuperation systems
for clustering plans.

Xia Li et al., 2013 [8] proposed technique in which they
join the enhanced molecule swarm grouping calculation
with the between bunch directing calculation to shape a
versatile vitality proficient grouping directing convention,
alluded to as AECRP. Reenactment results demonstrate that
this convention not just adjusts the vitality utilization of the
general system, postpones the demise time of the nodes,
additionally gives more dependable information conveyance.

Agam et al., 2014 [8] proposed the self-knowledge
implementation in which SCHP (sub cluster head protocol is used
to reduce delay occurs in link stability problem in SCHP.
Each node knows about its neighbors by using its self-
knowledge. Receiver will send its receiving capacity and
sender will send data according to that capacity. So link
becomes more stable. In Self-knowledge technique sender
keeps the information regarding its one hop neighbors. All-
important parameters like delay, threshold, packet size,
energy are considered before sending data to the next node.
A minimum criterion is set for all the parameters, among all
the neighboring nodes the nodes satisfying this minimum
criterion are considered for the candidates of relay node.
Among these nodes the node with lowest delay and
maximum energy is chosen as relay node. If this node dies
after sometime then the next eligible can didate is chosen as
relay node and attempt is made to reconfigure the dead
node. This technique provides a better link stability than
simple SCHP by avoiding congestion in the link because the
sender sends the data according to the receiving capacity of
enhance the lifetime and dependability of a system is more
good than that of the algorithms utilized as a part of
different conventions.

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3.1.1 The Setup Phase [1][4][6]: This stage is for data transmission where normal nodes sense data and send this sensed data to their respective cluster-head nodes. The processing of received data (data aggregation and data fusion) is done by cluster head.

3.1.2 The Steady-state [1][4][6]: This stage: In the classical LEACH protocol, LEACH protocol doesn’t take residual energy of each node into consideration for the selection of cluster head node as each node has equal probability of becoming cluster head. If low-energy node is being selected as cluster head node, then the network fails soon due to high energy consumption causes adverse to energy balancing among the network. This results data loss and lower in survival time of the network.

3.2.4 Unreasonable cluster head selection: LEACH protocol doesn’t take residual energy of each node into consideration for the selection of cluster head node as each node has equal probability of becoming cluster head. If low-energy node is being selected as cluster head node, then the network fails soon due to high energy consumption causes adverse to energy balancing among the network. This results data loss and lower in survival time of the network.

4. DEFICIENCIES IN CLASSICAL LEACH PROTOCOL [6]

4.1. Unreasonable cluster head selection: LEACH protocol doesn’t take residual energy of each node into consideration for the selection of cluster head node as each node has equal probability of becoming cluster head. If low-energy node is being selected as cluster head node, then the network fails soon due to high energy consumption causes adverse to energy balancing among the network. This results data loss and lower in survival time of the network.

4.2. Unreasonable distribution of cluster heads: The random selection algorithm of cluster head node causes problem of imbalance in energy load. Distance factor is not considered in cluster formation due to which sometimes very big clusters and very class clusters exist at the same time in the network. More the distance between cluster head node and base station, more the energy consumption of that node.

4.3. More responsibility on Cluster Head node: Cluster head nodes perform data aggregation and send processed data to the base station in single-hop due to which cluster head nodes deplete their energy too fast as compared to normal nodes. Also if a cluster head node fails, the whole nodes linked to it will deplete their energy to nodes and processed data will be sent to the base station.

5. RE REAC-IN PROTOCOL [1][4]

A reasonable clustering algorithm for gathering sensor nodes can build the vitality productivity of WSNs. Notwithstanding, clustering requires extra overhead, for example, cluster head choice and task, and cluster development. Here another clustering technique utilizing detached nodes for WSNs, called Regional Energy Aware Clustering with Isolated Nodes (REAC-IN). In REAC-IN, CHs are chosen in view of weight. Weight is resolved by leftover vitality of every sensor and the territorial normal vitality of all sensors in every cluster. Dishonorably planned circulated clustering algorithms can make nodes get to be detached from CHs. Such detached nodes speak with the sink by devouring abundance measure of vitality. To drag out system lifetime, the provincial normal vitality and the separation amongst sensors and the sink are utilized to figure out if the detached node sends its information to a CH.
node in the past round or to the sink. A WSN is a blend of remote correspondence and sensor nodes. The system must be vitality proficient and stable, and have a long lifetime. The REAC-IN convention displayed in this paper enhances the cluster head determination handle and takes care of the issue of node isolation. The outcomes uncovered that the execution of the algorithms utilized as a part of REACIN to enhance the lifetime and dependability of a system is more good than that of the algorithms utilized as a part of different conventions.

6. RESULTS

The whole scheme has been implemented in NS2.35. The parameters used for simulation has been shown in the table below:

| Parameter          | Value                  |
|--------------------|------------------------|
| Channel            | Wireless               |
| Propagation Model  | Two Ray Ground         |
| Mac                | 802.11                 |
| Number of nodes    | 100                    |
| Queue              | Drop Tail              |
| Antenna            | Omni Directional       |
| Initial Energy     | 10 J                   |
| Area               | 600 * 600 sq. m        |

The comparison was done on the basis of energy consumption, throughput, packet delivery ratio and number of uncovered nodes.

The energy consumption signifies the network lifetime, as lesser is the energy consumed in the network more is the lifetime and vice-versa.

Packet delivery ratio is the percentage of the packets successfully delivered in the network. Mathematically it is ratio of number of packets received to the number of packets sent in the network.

Throughput is defined as the amount of data received at the base station per unit of time.

The graphs shown below represents the values of these parameters achieved by simulation of the network under existing scheme and the proposed scheme.

7. GRAPH REPRESENTATION:
8. COMPARISON BETWEEN LEACH AND RE REAC-IN

| Parameter          | LEACH            | REREAC –IN        |
|--------------------|------------------|-------------------|
| Remaining Energy   | 3.6166 Joules    | 4.52137 Joules    |
| Throughput         | 4085.76 Kbps     | 5142.53 kbps      |
| Packet Delivery    | 0.749692         | 0.909861          |
| Ratio              |                  |                   |
| Number of nodes    | 50,35,36         | 20,9,8            |

9. CONCLUSION:

Leach                | REAC-IN          | RE REAC-IN        |
---------------------|------------------|-------------------|
Random head selection| Selection According to regional energy | Selection according to regional energy |
Isolated nodes not considered for connectivity | Isolated nodes already connected to nearest cluster head | Isolated nodes already connected to nearest cluster head |

The comparison was done on the basis of four parameters; all these showed an improvement over the existing scheme. Graph 4: shows that in Re Reac-IN number of unconnected nodes has been less. Thus it can be fairly concluded that more and more number of nodes have been provided connectivity to forward the data. This eventually reduces their communication distance with the base station. This results in lesser energy consumption in the network. Also, over a shorter range communication the packets are transmitted correctly, thus leading to improvement in packet delivery ratio as well as throughput of the network.

In future, this scheme can be analyzed against various security attacks that wireless sensor network is prone to.

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