



Energy Efficient Routing based on Cluster with hybrid Protocol in wireless Sensor Network

Shilpa P.Kamble*, Mrs. N.M.Thakare, Mr.C.R.Pote

Department of computer Technology

Nagpur University

India

Abstract— *Wireless sensor networks with thousands of small sensor nodes, are expected to locate wide applicability and increasing deployment in upcoming years, as they make possible reliable, monitoring and analysis of the environment. In this paper we proposed to improve clustering algorithm to minimize the overhead of control packets and efficient utilization of nodes near sink by using LEACH and HEED Clustering algorithm and to implement a Hybrid Protocol Better than Existing Hybrid Protocol.*

Keywords— *WSN, Routing Algorithms, Clustering algorithm., Hybrid protocol, Cluster head*

I INTRODUCTION

The rapid development in small, low-power, low-cost microelectronic and micro-electromechanical sensor technology along with the advances in wireless technology have enabled wireless sensors to be deployed in large quantities to form wireless sensor networks for a wide variety of purposes, e.g., image creation of a target field, intrusion detection, surveillance and monitoring. Wireless Sensor Networks consist of spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental situations such as temperature, noise, vibration, pressure, motion at various locations. The improvement of wireless sensor network was originally motivated by military applications for battlefield surveillance. Therefore, wireless sensor networks are used in many civilian applications, such as biological and habitat monitor, health-care application, home mechanization and traffic control. Wireless sensor network contains a large number of nodes which sense data from that area which is very difficult to get the data and send the result to the sink. Sink is also called as processing centre.

Since sensor nodes are power constrained devices, frequent and long-distance transmissions should be kept to a minimum in order to extend the network lifetime. Thus direct communication between nodes and the base station are not optimistic. There are several communication protocols that have been proposed to understand power-efficient communication in these networks. The process of finding path between source and destination for data transmission is called as routing. In Wireless Sensor Network, network layer is mostly used for implementing routing of incoming data and designing routing protocol is one of the challenging tasks in WSN. Due to node consumption recharging sensor node is normally unfeasible. Therefore, energy saving is one of the important design issues in wireless

sensor network. Also, data transmission and reception dominate the energy consumption of sensors. Therefore, ultimate objective behind designing the routing protocol should be energy efficient as possible to prolong the network lifetime

One efficient approach is that the network is divided into clusters, each electing one node as its cluster head. The cluster head collects data from sensors in the cluster which will be merged and transmitted to the base station. Some nodes are used to transmit the data for long distance and some nodes are used to transmit the data for short distance. Then additional energy is saved and overall network lifetime can be prolonged. Many energy efficient routing protocols are designed based on the clustering structure where cluster-heads are selected periodically. To form energy consumption, three basic states of a node can be identified: sensing, data processing and data communication. Experimental measurements have shown that data transmission is very expensive in terms of energy consumption, while data processing consumes considerably less. Minimizing the number of communications by eliminating or aggregating redundant sensed data saves much amount of energy. As a result, network performance decreases since the cluster head nodes go down prior to other nodes.

There are three basic data delivery models, event-driven, query-driven, and continuous delivery models. In event-driven delivery model, the sink is interested in an examination from the network when certain events occur. In query-driven data delivery model is like to the event-driven model apart from that data is pulled by the sink while the data is pushed to the sink in the event-driven model. In continuous delivery model, the sink is interested in the situation of the environment at all times and every node periodically sends data to the sink. Therefore, event-driven protocols are used to preserve the energy of the sensor nodes.

There are various hybrid routing protocols that have been proposed to meet the application requirements of wireless sensor network. ANHR is one of the hybrid routing protocols which is grouping of plane routing protocol with hierarchical routing protocol in WSN. This protocol moderates the current state of the node and routing selection through the

performance of residual energy of the node. There are some drawback associated with existing ANHR protocol. It uses RRSI value for selecting cluster head. So, there may be chances that cluster node may run out of energy. So, instead of RRSI value used remaining energy of node so node with highest energy is selected as cluster head. It results into increase in network lifetime. The protocol has highest generation efficiency of cluster head which can effectively reduce the network load and energy consumption. Also, it maximizes the network lifetime.

II. RELATED WORK

Many clustering algorithms was developed and used in wireless sensor network. Low Energy Adaptive Clustering Hierarchy (LEACH) is the first energy efficient routing protocol for hierarchical clustering. It reduce the energy significantly. LEACH is the first cluster based routing protocol for wireless sensor networks, which uses a stochastic model for cluster head selection. LEACH has encouraged the design of several other protocols which try to develop the cluster-head selection process by considering the residual energy of the nodes. The LEACH protocol make clusters in the sensor networks and randomly selects the Cluster-heads for each cluster. The non cluster-head nodes sense the data and transmit to the cluster-heads. The cluster-heads aggregate the received data and then forward the data to the sink. This aggregation process reduces the transmission of redundant data.

1)LEACH(Low Energy Adaptive Clustering Hierarchy):

There are two phases in LEACH protocol: 1) Setup phase 2) steady-state phase. In the setup phase the clusters are created and the cluster-heads (are selected. In the steady-state phase, the data from)non cluster heads are send to the sink. The sensor nodes communicate with the cluster-heads using TDMA schedule. The nodes communicate to the cluster-head only in their fixed slots. It avoid collision. The cluster-heads are selected arbitrarily for every round. The Power Efficient Gathering in Sensor information systems is a chain based power efficient protocol based on LEACH. The chain is created on the basis greedy algorithm .The chain starts from the farthest node to the nearest node to the sink. The node nearest to the sink is selected as a chain leader and aggregated and send and received data to the base station. Each node in the chain selected as chain leader to balance the energy consumption .

LEACH is the most accepted cluster-based routing protocol. A node becomes a CH for the current rotation round if the number is less than the following threshold:

$$T(n)=P/1-P[r \bmod 1/P], n \in G=0, \text{Otherwise} \quad (1)$$

Where p is the percentage of nodes that can be converted into Cluster Head, r is the current round and G is the set of nodes that have not served as cluster head in the past 1/p rounds.

As long as optimal energy consumption is concerned, it is not desirable to select a cluster head node randomly and construct clusters. However, repeating round can improve the total energy dissipation and performance in the sensor network. There are some problems with the LEACH protocol. The main problem is the residual energy of a node is not considered for cluster formation. The nodes are started with the same initial energy. The cluster-heads are randomly selected rotationally.

The advantage of LEACH protocol

- 1.LEACH protocol has a relatively good in energy consumption through dynamic clustering.
2. Data transmission in cluster which decrease the energy consumption by directly communication between nodes and the base station.
- 3.The LEACH protocol uses the mechanism of cluster-head rotation, select cluster-head randomly.
4. cluster-head or the nodes which are far away from the base station will consume more energy in transmitting data of the same length relatively

2)HEED(Hybrid Energy-Efficient Distributed Clustering):

HEED uses a hybrid approach based on residual energy and communication cost to select cluster heads. HEED was designed to select different cluster heads in a field according to the amount of energy that is distributed in relation to a adjacent node.

Goals of HEED:

There are four main goals:

- Extending network lifetime by distributing energy consumption.
- Clustering process will be terminating in a constant number of iteration.
- Overhead control minimize.
- producing well-circulated cluster heads and compact clusters.

Advantage:

- HEED distribution of energy extend the duration of the nodes within the network
- It does not require special node capabilities.
- HEED does not make assumption about node distribution

- Operates properly even when nodes are not synchronized.
- Create well distributed clusters
- Terminate in regular time
- Reduces energy load
- Extends network lifetime .

Disadvantages:

- The random selection of the cluster heads, may cause advanced communication overhead for:
 - The common member nodes in communicating with their equivalent cluster head
 - Cluster heads in establish the communication among them, or between a cluster head and a base station.

III PROTOCOL PERFORMANCE

LEACH protocol is suitable for the WSN under the following assumption

1. All sensor nodes are identical and charged with the same amount of initial energy. All nodes consume energy at the same rate and are able to know their residual energy and control transmission power and distance. Every node has the capability to support different MAC protocol and data processing. All communication channels are identical. The energy consumption of transferring data from node A to node B is the same as that of transferring the same amount of data from node B to node A.
2. Each and every node can directly communicate with other node including sink node.
3. The Sink node is fixed and far away from the wireless network.
4. Every node has data to transfer in every time frame. The data send by sobering nodes are related and can be fused.
5. Sensor nodes are static.

Routing protocols in wireless sensor network have to deal with number of challenges and design issues. WSN have some limitations on sensor nodes like limited battery power, bandwidth constraint, limited computation power and limited memory. Single routing protocol in WSN cannot perform all the application requirements. Thus, many routing protocols are proposed in WSN based on application and network architecture. Based on different classification standards, routing protocols are classified into different categories. In wireless sensor network, routing protocol can be categorized depending on network structure, protocol operation and path establishment. Routing path can be established in one of the three ways

namely proactive, reactive or hybrid . In proactive protocol all the routes are calculated before they are actually essential and then store these routing in a routing table in each node. In Reactive protocols computes routes only when they are essential i.e. dynamically. Hybrid routing protocol is combination of both the ideas.

1)HRP(Hybrid Routing Protocol):HRP is a hybrid protocol that divide the network into a number of zones, which makes a hierarchical protocol as the protocol ZHLS (zone-based hierarchical link state). HRP is based on GPS (Global positioning system), which allow each node to identify its physical position before mapping an area with table to identify it to which it belongs.

The number of messages exchanged in high ZHLS is what influences the occupation of the bandwidth. Our protocol attempts to reduce the number of messages exchanged, thus increasing network performance and service life.

Operation of the Protocol HRP:

HRP is a protocol that is based on the concept of zones; each zone can include multiple nodes as illustrated in Figure So we can define tree levels:

- Level node.
- Level Getaway.
- Level Cluster Head

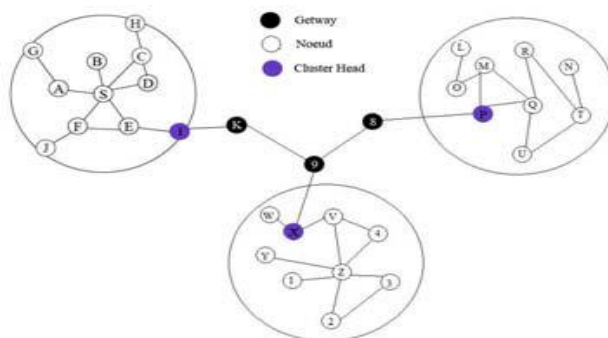


fig 1: Architecture Hybrid Routing Protocol

Each node deploy a relocation method to find its physical location and determines its zone ID by mapping its physical location to the zone map. Equipped with this zone ID, the node can start the intrazone (level of node) clustering and then the interzone (level of gateway) clustering procedures to build its routing tables. Each asynchronously broadcasts a link request. Nodes within its communication range in turn reply with link responses node ID, zone ID. After all link responses are received, the node generates its node LSP that contains the node ID of its neighbors of the same zone and the zone ID of its neighbors of different zones. Nodes may receive link responses from the nodes of their adjacent zones. After LSP receipt, cluster head communicates with the gateway that is sending a scope on the table containing the nodes belonging to the area. Their gateways change the tables received by the cluster head and update their routing table. For cluster-head and gateways are devices performance at the scope and power.

A typical hybrid routing protocol is Zone Based Routing (ZBR). ZBR combines the proactive and reactive routing approaches. It divide the network into routing zones. The routing zone of a node A includes all nodes within hop distance at most d from node A. All nodes at hop distance exactly d are said to be the peripheral nodes of node A's routing zone. The parameter d is the zone radius. ZBR maintain the routes within the routing zones) and reactively searches for routes to destinations beyond a node's routing zone. Route discovery is similar to that in DSR with the difference that route requests are propagated only via peripheral nodes. ZBR can be with dynamism configured to a particular network through adjustment of the parameter r .

ZBR will be a purely reactive routing protocol when $d=0$ and a purely proactive routing protocol when d is set to the diameter of the network. ZBR discovers routes as follows. When a source node wants to transmit data to a destination, it first checks whether or not the destination is within its routing zone. If it is, then a way can be obtained directly. Otherwise, it flood a route request to its secondary nodes. The peripheral nodes in turn execute the same algorithm to check whether the destination is within their routing zone. If it is, a route reply message is sent back to the source. Otherwise, the peripheral node floods the route request to its peripheral nodes again. This procedure is repetitive until a route is found.

2) A New Hybrid Routing Protocol (ANHR):

A new hybrid routing in WSN combine the plane routing protocols with hierarchical routing protocols and determines the current state of last hop node and the current residual energy according to the received signal strength of the node. This protocol judge the suitability of the node and route selecting through the value of remaining energy of node. Every node in the network communicates with other by best effort to transmit data as well as forced to establish adaptive dynamic cluster head

Advantage:

- 1) successful packet delivery rate
- 2) Network load of ANHR is relatively small.
- 3) Energy consumption of ANHR is minimum

Dis-advantage:

- 1) There may be chances that cluster node may run out of energy.
- 2) Efficiency of cluster head declaration may be improved by using ant colony optimization (ACO)

IV SIMULATION RESULT

In this Paper, we evaluate the performance of our proposed algorithm and implement hybrid protocol better than existing protocol and compare with a Hybrid Routing Protocol and A New Hybrid routing Protocol using NS2(Network Simulator). In simulations, we assumes an error free physical layer links and ideal MAC layer. In this paper, we consider the each node's energy consumption as the summation of energy consumed in the transmission and reception of data packets per section. We compare CBER with LEACH and HEED.

V CONCLUSION

CBER creates overhead of control packets during the end-to-end packet transmission and unbalanced utilization of nodes near sink. In this paper we proposed to improve clustering algorithm to minimize the overhead of control packets and efficient utilization of nodes near sink by using LEACH and HEED Clustering algorithm and to implement a Hybrid Protocol Better than Existing Hybrid Protocol. Hence, it is concluded that Hybrid Routing Protocol (HRP) and A New Hybrid Routing Protocol (AHR) are used. HRP and AHR are better than APTEEN and HEED in reducing the energy consumption and extend the lifetime of the cluster head in the network.

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