www.ijecs.in
International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume 3 Issue 11 November, 2014 Page No. 9284-9288

Energy Efficient Clustering Approach For Wireless Sensor Network

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Abstract- In the modern era of computing, wireless network plays vital role in building a strong infrastructure for faster and improved communication. Recent developments in the field of sensor devices have broadened the area of sensor networks, which leads to new protocol design, specifically for energy consumption with wireless sensor networks (WSNs). These sensor nodes are low power, light weighted and energy efficient.WSNs with hundreds or thousands of sensor nodes can sense data from multiple locations and forward it to a particular user's location. Such data are routed using several routing algorithms. In this work, we discuss the several routing aspects in regards to the energy model of wireless sensor networks for IEEE 802.15.4. Further, This IEEE 802.15.4 standard contain two types of devices first one is FFD that if Fully Functional Device. This device is further classified into three categories PAN coordinator, Coordinator and Devices. And also compare the results of default AODV with modified AODV to make energy consumption efficient.

Keywords— **WSN, Cluster, QualNet, AODV.**

1. Introduction

Wireless ad-hoc network is an infrastructure less network also it is a decentralized network. This network has a dynamic topology because of which nodes are connected dynamically. Nodes in a network not only act as a host but also as router that route a data in a network. Because of stale routes information routing table leads to routing overhead, which also increased energy consumption.

A flat routing in wireless Ad-Hoc network is based on proactive and reactive routing protocol. Which do not perform well in large network because of dynamic topology. Is we increases the size of the network, the performance of the start decreases. Flat routing face a scalability problem as we increased the size of the network, which leads to overhead problems. To reduce the routing overhead, we introduce a clustering structure by using a clustering topology. We have deployed a node as cluster and used AODV routing protocol.

The first problem with AODV is overhead on the bandwidth. When RREQ moves from node to node in the process of discovering the routes on demand at the same time it sets a reverse path to the address of all nodes through which it has passed. The second problem with AODV is same routing information is not used again as routing information is always obtained on demand.

In research work many routing algorithms have been discussed for making the cluster structure. To come up with the solutions of problems on AODV lots of other algorithm has been designed. For the solution of the problem of AODV, AODV routing protocol we have made changes in MAC layer and PHY layer properties with the help of QUALNET. Properties which we have changed in MAC layer are power save mode, enable power save mode and enable directional

antenna mode. PHY layer properties in which we have made changes reception model, antenna model, gain efficiency and height. Battery model used in this algorithm is linear and energy model is MICA MOTE. Specified each node as FFD and RFD.

2. Clustering Approach

In this work Cluster is formed by diving the network into a number of groups. Each group having a leader called Cluster Head (CH). Communication takes place in two phases: Set up phase and Steady state phase.In Setup phase cluster head formation takes place and in Steady state phase main communication takes place. Every cluster has a leader called CH (cluster head). Nodes joining the CH sense the physical environment and sense the data to CH. Now CH aggregates the data and sends to sink node. This aggregation process reduces the overhead problem.

3. Goal of Clustering

- Scalability
- System capacity is increased
- Collision and retransmission is reduced
- Resources are used equally
- Because of CH and GW inter cluster communication is restricted.

4. Proposed Energy Efficient Approach

This proposed work is comprises the clustering approach to make an energy efficient network for sensor devices. Demonstrate a scenario that shows how clustering approach flow data from sensor nodes to sink node. The standard protocol used in proposed work is IEEE 802.15.4.This IEEE 802.15.4 protocol standard contains two types of devices first one is FFD Fully Functional Device. This device is further classified into three categories PAN coordinator, Coordinator and Devices. And the second one is RFD that is Reduced Functional Device. We can change the node properties by allotting them as a FFD (PAN coordinator/ Coordinator / devices) or RFD (Devices).PAN Coordinator acts as a sink node in this scenario. Coordinators are used to send information from device to PAN coordinator that is sink node and devices cannot directly communicate to sink node. . An important milestone in the IEEE 802.15.4 standard that specifies interoperable wireless physical and medium access control layers targeted to sensor node radios. It evaluates the potential of an IEEE 802.15.4 radio for use in an ultra-low power sensor node operating in a dense network. Starting from measurements carried out on the off-the-shelf radio, effective radio activation and link adaptation policies are derived. With a typical sensor network scenario, the average power per node can be reduced down. Further, the energy consumption breakdown between the different phases of a packet transmission is presented, indicating which part of the transceiver architecture can most effectively be optimized in order to further reduce the radio power, enabling efficient energy wireless sensor networks. Demonstrate the scenario of clustering approach with various node and analyzed the result by increasing the number of cluster head like to propose three scenarios in first taken twenty four nodes with four cluster head, in second scenario taken thirty five nodes with five cluster head and in a third scenario taken sixty five nodes with nine cluster head. In the third scenario distance between the cluster head and sink is reduced so that energy consumption reduces by connecting the cluster head of long distance to cluster head which is close to sink node. . After modifying the properties of nodes a routing algorithm is applied to route all information between nodes to sink node. In this dissertation used AODV routing algorithm. In which MAC and PHY layer properties of the AODV routing protocol are changed. Like reception model, Antenna model, Gain, Efficiency and Height of Enable directional antenna mode of MAC layer.

5. Proposed Scenario's

5.1 Scenario Snapshot for 25 nodes

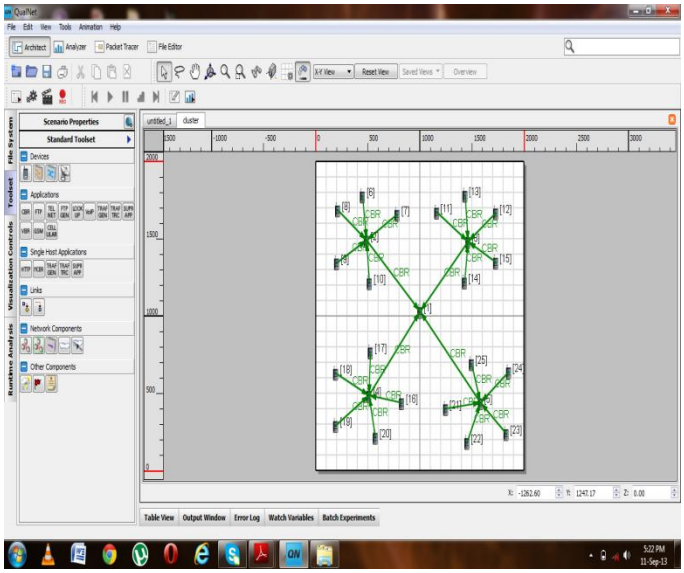

Figure 1: Cluster approach using 25 nodes

5.2 Scenario Snapshot for 35 nodes

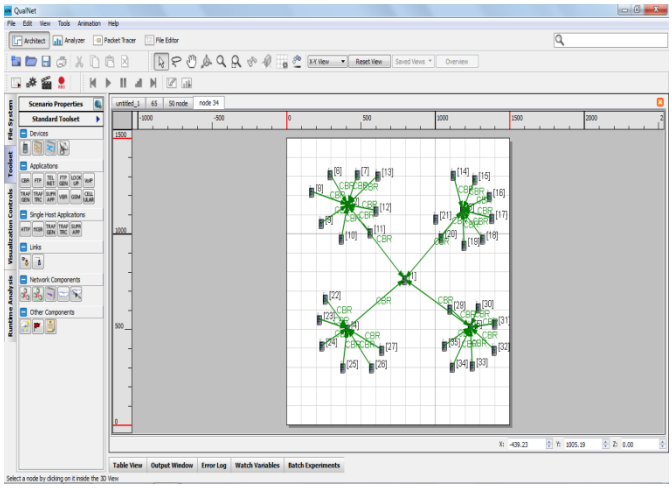

Figure 2: Cluster approach using 35 nodes

5.3 Scenario Snapshot for 64 nodes

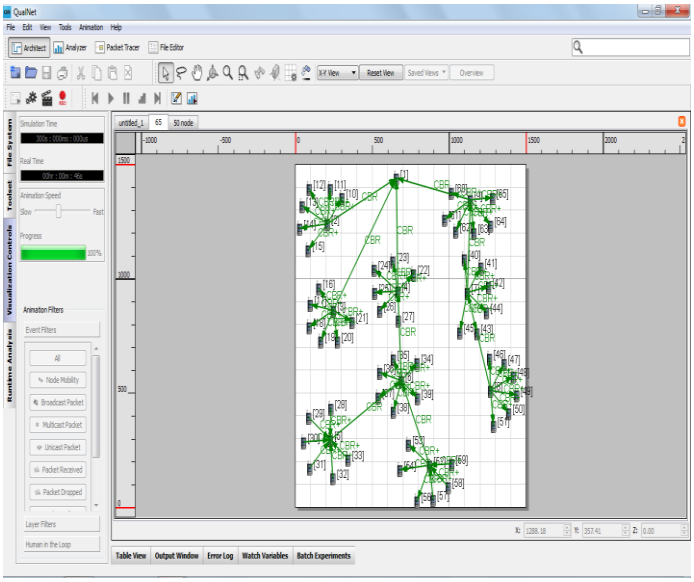

Figure 3: Cluster approach using 65 nodes

6. Simulation Parameters

TABLE I

Simulation parameters	
MAC Type	IEEE 802.15.4
Protocol used	AODV
Area size	1500x1500
Traffic type	CBR
Antenna	Omni- directional
Propagation model	Two ray
Node movement model	Random way point
Battery charge interval	60 sec.
Full battery capacity	100 (mA, h)
Battery model	Linear model
No. of nodes	25, 35,65
Simulation time	30sec.
Energy model	Generic

In this work Qualnet 5.2 simulator has been used to evaluate the performance of the three reactive routing in grid based wireless sensor network. The nodes are deployed in the terrain 1500m X 1500m. CBR has used data traffic application. These scenario nodes (1 to 16) made a grid, this node is reduced function device (RFDs) and center node is the PAN

coordinator (FFDs), other four nodes is the coordinator (FFDs) to connect PAN coordinator through CBR traffic and devices (RFDs) connect coordinators.

7. Comparison of Scenario's

In this section we have shown the overall results of 25 nodes, 35 nodes and 65 nodes in one graph by comparing default results with modified results in terms of energy consumed in transmit mode, energy consumed in received mode and energy consumed in idle mode.

7.1 Energy consumed in Transmit mode

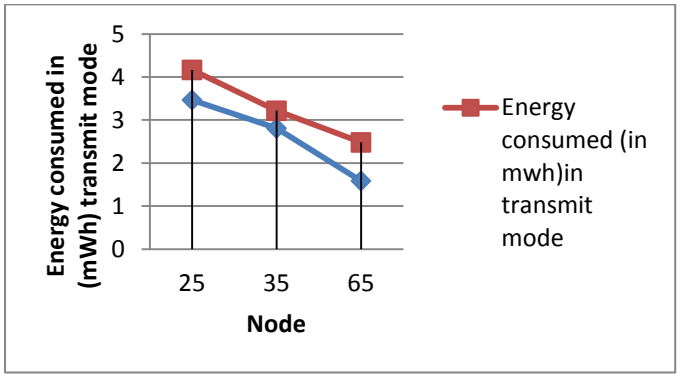

Figure 4: Energy consumed in transmit mode (node 25, 35 and 65*)*

In this Figure 4 compared the results of node 25, node 35 and node 64 on the basis of energy consumed in transmit mode by comparing default results with modifies the results. And graph showed that the energy consumption in transmit mode can be decreased by increasing the no of nodes in the network.

7.2 Energy Consumed in Received mode

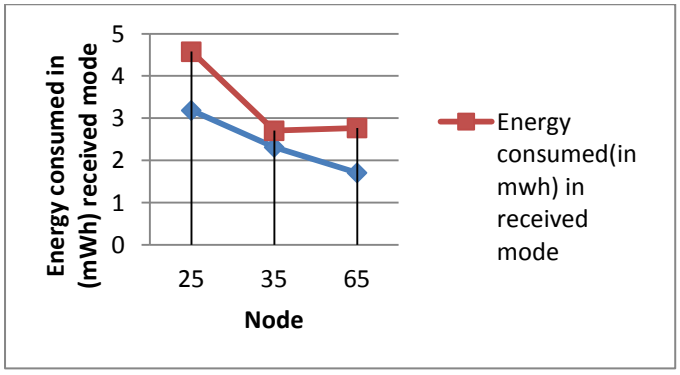

Figure5: *Energy consumed in received mode (node 25, 35 and 65)*

In this Figure 5 compared the results of node 25, node 35 and node 64 on the basis of energy consumed in receiving mode by comparing default results with modifies the results. And graph showed that the energy consumption in received mode can be decreased by increasing the no of nodes in the network.

8. Comparison Values of all Scenario's

No. Of nodes	Energy consumed in Transmit mode		Energy consumed in received mode	
	Modified values	Default Values	Modified Values	Default Values
25	3.46521	0.69942	3.185619	1.390496
35	2.806553	0.40887	2.314025	0.390496
65	1.584437	0.895313	1.708397	1.062344

9. Conclusion

This chapter present and discuss the results obtained by the proposed work. Many protocols were developed to tackle the challenges posed by wireless sensor network. Here comparison is done in three different scenarios based on cluster network. The first scenario is cluster considering 25 nodes. We have changed the MAC and PHY layer properties by applying a routing algorithm known as AODV which is used to route data between numbers of nodes. And at least compared the results of default AODV with modified AODV results. In the second scenario we have taken 35 nodes and also applying the clustering concept to make node energy more efficient. And compare the results of default with modified AODV. And in the third scenario we increased the number of nodes in the cluster network to show the same comparison of results between default and modified. And at least compared all three scenario results to prove that energy consumption can be decreased by increasing the no. of nodes in the network by using the cluster network.

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Priyanka Tripathi received the B.E.in information technology from Gwalior Engineering College and M.Tech. degrees in Computer Science Engineering from Shri Ram College of Engineering and Management 2010 and 2014, respectively.