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Hybrid Approach For Wireless Sensor Network

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Abstract- ***The Wireless Sensor Network is a widely used approach mainly used for real time applications. Real time applications raise various fundamental problems like limited energy resources. We propose a paper on Hybrid approach which is the combination of Grid based approach and Cluster based approach. the main task of a sensor network is to minimize the energy consumption of wireless sensor network. So On Hybrid approach grid based network depends on the location where it is divided into different grid sizes. And in clusters, wireless sensor network, cluster head works like a base station that send all sense information to the sink node of the network. We are working on QualNet tools to simulate the scenario of the Grid based cluster network.***

Keywords-Hybrid; Cluster; Grid; Qualnet.

1. Introduction

Hybrid approach in wireless sensor network is a key technique for extending the life time of a network by reducing energy consumption. This also increases network's capacity, reduces the routing overhead and makes it more scalable when nodes are in large number. This chapter explained through four sections in first we describe the problem we faced during the research work. We reached at this point after surveying the related work in this field as explained in previous chapter. And in later sections we describe the solutions for that problem. This chapter also contains the detailed description of applied algorithm and work model of proposed work.

2. Hybrid Approach

The main motive of designing this approach is to combine all the benefits of two network model that is Grid based network and Cluster based network. In this proposed scheme firstly divides the whole network area into grid form and based on the grid structure, CH creates on the basis of FFD and RFD. FFD stands for Fully Functional Device and RFD stand for the Reduced Function Device. This CH takes information from other related nodes and forward it to the sink node through different other intermediate coordinator nodes. DSR routing protocol is used to route information from source node to the destination node. Therefore, the layered structure shown with a grid based clustering scheme in which energy can be conserved by a route between the data source and the sink.

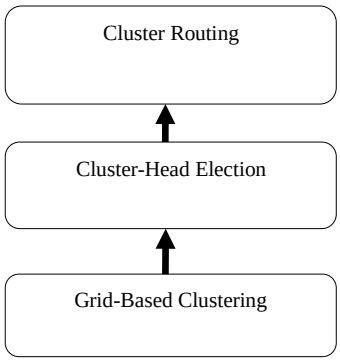


Figure 1. Layered Structure of Hybrid Approach

3. Layered structure of Hybrid Approach

In this paper work, we consider wireless sensor networks where energy is very important issue. Wireless sensor network is a form network which consists of autonomous sensor nodes where sensor nodes are characterized by their small in size, a low cost, limited amount of energy but advance in technology. This energy can be very expensive because it cannot be renewable or difficult to renew. Energy efficient strategies such as Energy efficient routing, node activity scheduling, and topology control by tuning node transmission power and at last reduction of the volume of information transferred are required in such networks to maximize network lifetime. Our contribution deals with energy efficient routing.

4. Justification of problem statement

In research work discussed many schemes to make energy consumption efficient for different types of network. For the

solution of energy based problems with grid based network, lots of approaches has been designed. But there are two main drawback with grid based network, first one is its size. Grid approach is not fully suitable for large area network. And second one in which corner nodes will die before other nodes. Because distance of corner nodes from sink nodes is too far to forward data. We propose a Hybrid approach only for stable nodes not for movable nodes. So locations of all nodes are already known. So it needs to design such a approach which can handle this problem.

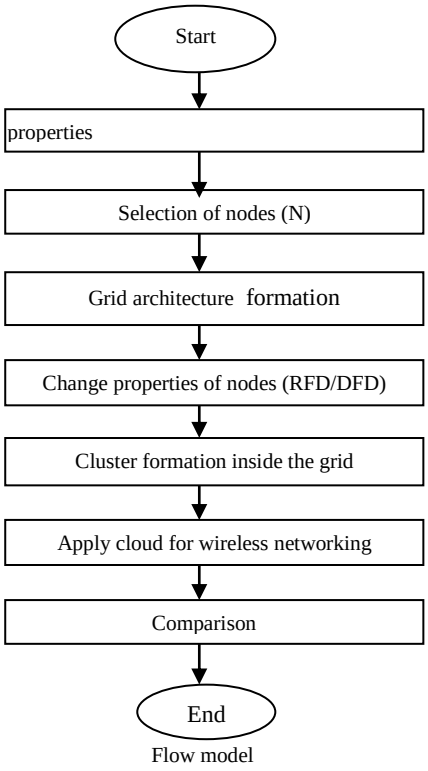
Here an approach is designed for better performance than the previous work. This approach is known as Hybrid Approach. The main motive for designing this approach is to combine the feature of both network Grid based network and Cluster based network. Grid divides the total area into different grid sizes and cluster approach is used to collect data from nodes and send it to the sink node as efficient as possible. So these combine approach makes the network energy consumption more efficient.

5. Proposed model-Hybrid Approach

The main motive of designing this approach is to combine all the benefits of two network model that is Grid based network and Cluster based network. In this proposed scheme firstly divides the whole network area into grid form and based on the grid structure, CH creates on the basis of FFD and RFD. FFD stands for Fully Functional Device and RFD stand for the Reduced Function Device. This CH takes information from other related nodes and forward it to the sink node through different other intermediate coordinator nodes. DSR routing protocol is used to route information from source node to the destination node. Therefore, the layered structure shown with a grid based clustering scheme in which energy can be conserved by a route between the data source and the sink.

6. Proposed work model

The Proposed model is designed for Hybrid approach to make energy efficient. For this approach a scenario is constructed to show how Grid based cluster approach flow data from sensor nodes to sink node. Grid is formed by dividing the total area into grid structure. This structure contains number of grid area's small in size. Then number of nodes deployed into the whole grid area. Now assign a coordinator node as a CH in each grid cell to apply clustering concept.



Flow model

The standard used in the proposed work is IEEE 802.15.4. 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 second one is RFD that is Reduced Functional Device. This is only Device. In proposed work assign node as FFD (PAN coordinator/ Coordinator / devices) or RFD (Devices). PAN Coordinator acts as a sink node. Coordinators are used to send information from device to PAN coordinator that is sink node. Because devices cannot directly communicate to sink node. It can communicate or send data to sink node only through coordinator nodes. After modifying the properties of nodes a routing algorithm is applied to route all information between nodes to sink node. In Proposed work DSR routing algorithm is applied. In which MAC and PHY layer properties of DSR routing protocol are modified. Properties are modified in proposed work are Reception model, Antenna model, Gain, Efficiency and Height of PHY layer and MAC protocol, Power save mode, Enable power save mode and Enable directional antenna mode of MAC layer. In proposed work Linear Battery model and MICA MOTES energy model are used. At last comparing the results of Default DSR with modified DSR on the basis of Energy consumed in Transmit mode, Energy consumed in Received mode and Energy consumed in Idle mode.

7. Advantages of Hybrid Approach

1. Hybrid approach is the combine approach of Grid and Cluster based network.
2. It gives the benefits of both types of networks.
3. The great advantage of grid-based clustering is its significant reduction of the computational complexity, especially for clustering very large data sets.

4. The grid-based clustering approach differs from the conventional clustering algorithm in that it is concerned not with the data points but with the value space that surrounds the data points.
5. In addition, the existence of multiple path between the source node and sink node in the grid topology makes the selection of forwarding path more flexible.

8. QualNet Tool 5.2

QualNet provides a comprehensive set of tools with all the components for custom network modeling and simulation projects. QualNet unparalleled speed, scalability, and fidelity make it easy for modelers to optimize existing networks through quick model setup and in-depth analysis tools. Models in source form provide developers with a solid library on which to build and experiment with new network functionality. The end result is accurate prediction of network performance for a diverse set of application requirements and uses. From wired LANs and WANs, to cellular, satellite, WLANs and mobile ad hoc networks, QualNet library is extensive. Because of its efficient kernel, QualNet models large scale networks with heavy traffic and mobility in reasonable simulation times. This chapter gives a brief introduction to the different components of QualNet, and introduces the protocol stack that forms the basis of QualNet architecture.

9. Simulation Senarios

9.1 Simulation Model of First Scenario

This section provides the simulation setup and scenario design. In this work Qualnet 5.0.2 simulator has been used to evaluate the performance of three different routing protocols. Table-1 shows the parameters for new simulation design of the scenario for different protocols.

Simulation parameters	
MAC Type	IEEE 802.15.4
Protocols under studies	DSR
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	33 nodes
Simulation time	30sec.
Energy model	MICA MOTES
No. of CBR	43
PAN co-ordinator (FFD)	1
Co-ordinator (FFD)	4
Devices (RFD)	28
Performance metrics in physical layer	Energy consumed in transmit mode Energy consumed in received mode Energy consumed in idle mode

Table 1: Simulation parameters for first scenario

In this work Qualnet 5.2 simulator has been used to evaluate the performance of the scenario. The nodes is deploying in terrain 1500m X 1500m. CBR is used data traffic application. These scenario nodes (1 to 16) made a grid, this node is reduced function device (RFDs) and centre node is PAN coordinator (FFDs), other four nodes is coordinator (FFDs) to connect PAN coordinator through CBR traffic and devices (RFDs) connect coordinators. In this scenario we are comparing Grid architecture without clustering with Grid architecture based on clustering and at last comparing the results based on Energy consumed in Transmit, Received and Idle modes.

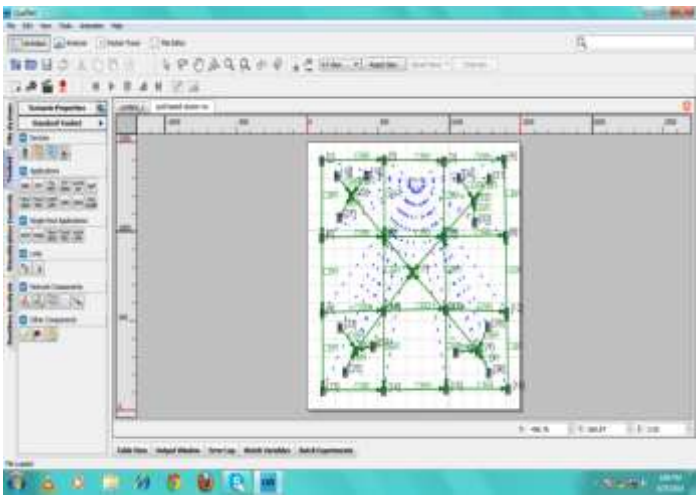


Figure 2: Snapshot for first Grid cluster based scenario

9.2 Simulation Result &Analysis

This section evaluates the performance results of grid based cluster network and grid based network without clustering in WSN. A simulation performance is performed using Qualnet 5.2 simulator. In this simulation compare and analysis performance of energy consumed (in mWh) in Transmit, Receive and Idle mode.

a) Energy consumed in transmit mode*:*

In transmit nodes; packets transmitted source nodes to destination nodes. Figure shows how energy consumed in transmit mode and analysis the performance of each node. In transmit mode Grid network with clustering provide better results compare to Grid network without clustering. It consumes less energy than other.

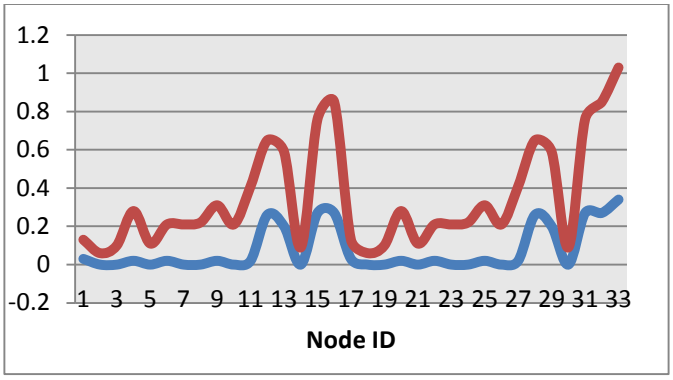


Figure 3: Energy consumed in transmit mode (33 nodes)

b) Energy consumed in received mode:

In received nodes; packets received source nodes to destination nodes. Figure shows how energy consumed in received mode and analysis the performance of each node. In receive mode Grid network with clustering provide better results compare to Grid network without clustering. It consumes less energy than other.

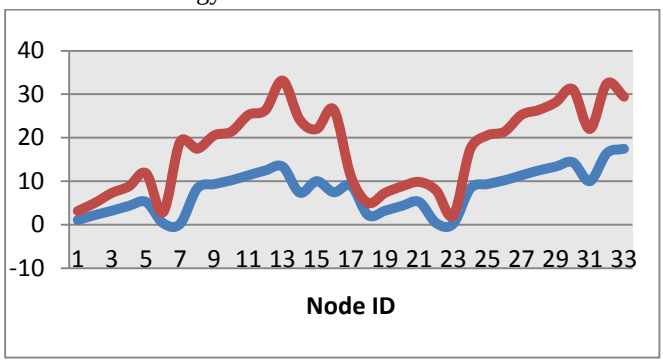


Figure 4 : Energy consumed in receive mode(33 nodes)

c) Energy consumed in idle mode:

In Idle modes Figure shows how energy consumed in Idle mode and analysis the performance of each node. In Idle mode Grid network with clustering provide better results compare to Grid network without clustering. It consumes less energy than other.

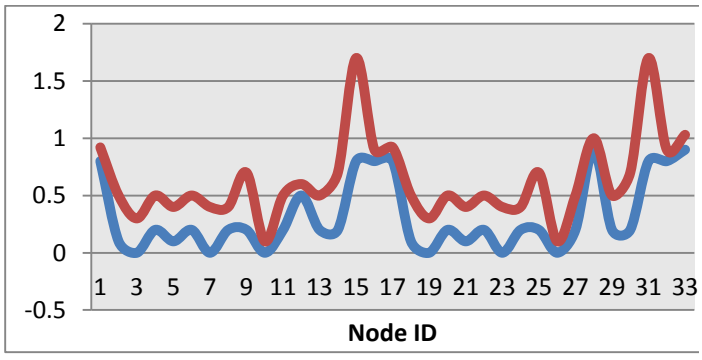


Figure 5 : Energy consumed in idle mode (33 nodes)

10. Performance Comparisons

MODES	M_DSR (%)	DSR (%)
Energy consumed in Transmit mode	11.44	19.31
Energy consumed in Received mode	14.66	29.10
Energy consumed in Idle mode	09.11	17.98

Table 2: Comparison table between M_DSR and default DSR (33 nodes)

11. Simulation Model of Third Scenario

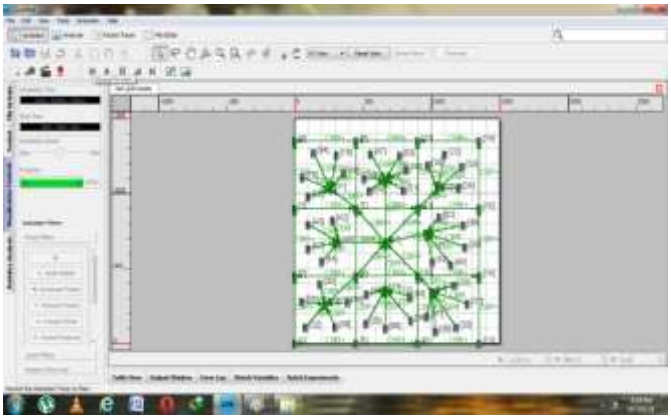


Figure 6: Snapshot for first Grid cluster based scenario

This section provides the simulation setup and scenario design. In this work Qualnet 5.0.2 simulator has been used to evaluate the performance of DSR routing protocol to make energy consumption efficient. The nodes is deploying in terrain 1500m X 1500m. CBR is used data traffic application. These scenario nodes (1 to 16) made a grid, this nodes is reduced function device (RFDs) and centre node is PAN coordinator (FFDs), other four nodes is coordinator (FFDs) to connect PAN coordinator through CBR traffic and devices (RFDs) connect coordinators. In this scenario we are taking the same scenario Grid architecture based on clustering but increases the no. of nodes per grid area and compared the result based on default to modified parameters based on energy consumed in transmit mode, received mode and idle mode.

Simulation parameters	
MAC Type	IEEE 802.15.4
Protocols under studies	DSR
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	64 nodes

Simulation time	30sec.
Energy model	MICA MOTES
PAN co-ordinator (FFD)	1
Co-ordinator (FFD)	4
Devices (RFD)	59
Performance metrics in physical layer	Energy consumed in transmit mode Energy consumed in received mode Energy consumed in idle mode

Table 3: Simulation parameter for third scenario

12. Simulation results and analysis

12.1 Energy consumed in Transmit mode

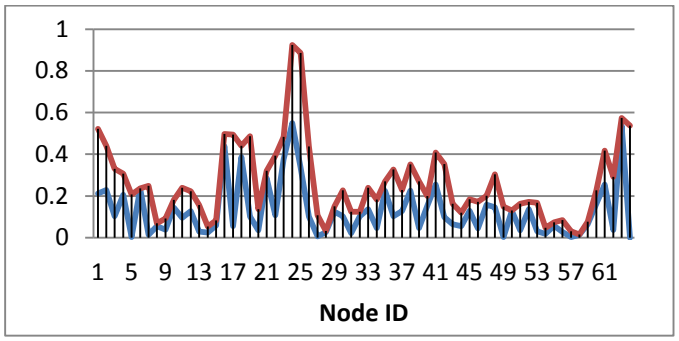


Figure 7: Energy consumption in transmit mode (64 nodes)

Above graph represents the relationship of Energy consumed in transmit mode between energy model and modified energy model. M_energy model represents the modified properties of Dynamic Source Routing algorithm. In above graph when we applied different parameters value that is user specified it will results energy consumption in transmit mode is more efficient than predefined value.

12.2 Energy consumed in Received mode

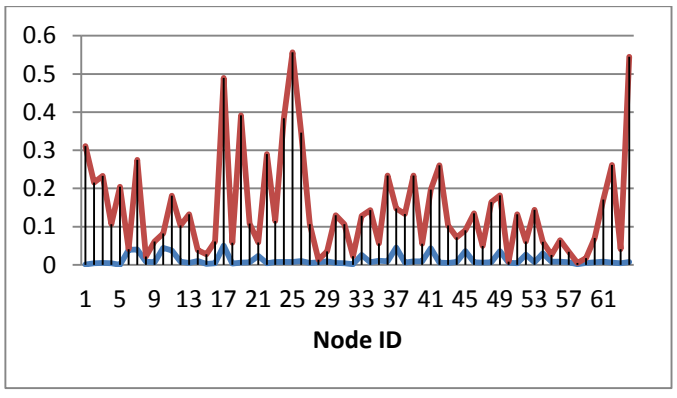


Figure 8 : Energy consumed in Received mode

Above graph represents the relationship of Energy consumed in received mode between energy model and M_energy model. M_energy model represents the modified properties of Dynamic Source Routing algorithm. In above graph when we applied different parameters value that is user specified it will results energy consumption in received mode is more efficient than predefined value.

12.3 Energy consumed in Idle mode

This graph represents the relationship of Energy consumed in idle mode between energy model and M_energy model. M_energy model represents the modified properties of Dynamic Source Routing algorithm. In above graph when we applied different parameters value that is user specified it will results energy consumption in idle mode is more efficient than predefined value.

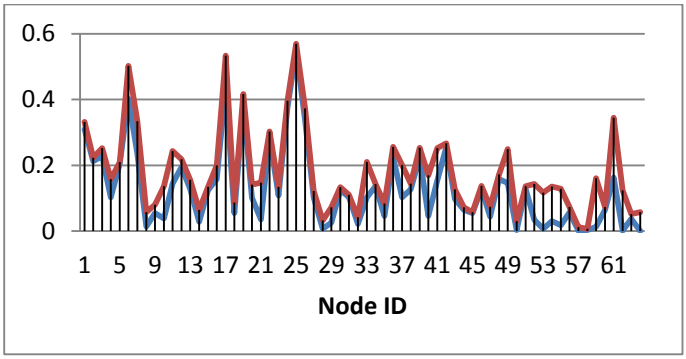


Figure 9 : Energy consumed in Idle mode (64 nodes)

13. Performance Comparisons

MODES	M_DSR (%)	DSR (%)
Energy consumed in Transmit mode	15.64	29.11
Energy consumed in Received mode	17.36	37.10
Energy consumed in Idle mode	11.11	22.44

Table 4 : Comparision results for all modes of DSR and M_DSR (for 64 nodes)

14. Comparison of Scenarios (between 33 nodes and 64 nodes)

In this section we have shown the overall results of 33 nodes and 64 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.

14.1 Energy consumed in Transmit mode

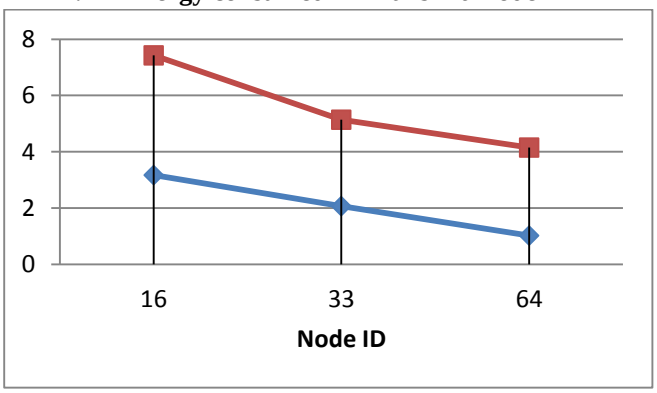


Figure 10: Energy consumed in Transmit mode (33, 64)

In this compmared the results of node 33 and node 34 on the basis of energy consumed in transmit mode by comapring default results with modifies results. And graph showed that the energy consumption in transmit mode can be decreased by increasing the no of nodes in the network.

14.2 Energy consumption in Received mode

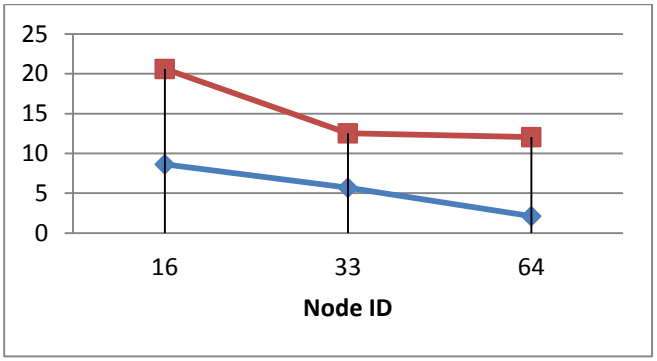


Figure 11: Energy consumed in Received mode (33, 64)

In this Figure compmared the results of node 33 and node 34 on the basis of energy consumed in transmit mode by comapring default results with modifies results. And graph showed that the energy consumption in received mode can be decreased by increasing the no of nodes in the network

14.3 Energy consumed in Idle mode

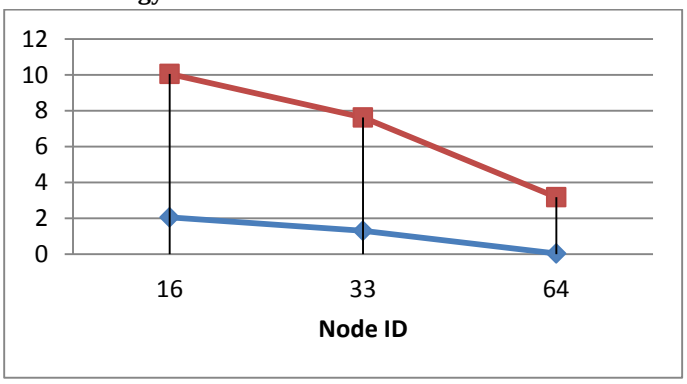


Figure 12 : Energy consumed in Idle mode (node 33, 64)

In this Figure compmared the results of node 34 on the basis of energy consumed in transmit mode by comapring default results with modifies results. And graph showed that the energy consumption in idle mode can be decreased by increasing the no of nodes in the network

15. Conclusion

This paper present and discuss the results obtained by the proposed work. Many protocols were develpoed to tackle the challenges posed by wireless sensor network. Here comparison is done in three different scenario based on grid-cluster network that is called as Hybrid network. In first scenario we have taken 33 nodes and also applied the clustering concept to make node energy more efficient. And comapre the results of default with modified DSR. And in the second scenario we only increased the no of nodes in the Grid cluster based network to show the same comparison of results between defalt with modified. And at last compared all three scenario resullts to prove that energy consumption can be decreased by increasing the no. of nodes in the network by using Hybrid network.

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