Compare Three Reactive Routing Protocols In Grid Based Clusterwireless Sensor Network Using Qualnet Simulator

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Abstract- This paper is comparingthe performance of three different routing protocols in grid based clustering for wireless sensor network. Sensor network iskeeping limited energy of sensor nodesand limited battery power. However the main task of sensor network energy consumption for sensor nodes. Furthermore grid based sensor working depend on location based that is divided into different parts. In grid based wireless sensor network, cluster head it works like a base station. Cluster zones are collecting all information that is passing through sensor nodes. In this paper, three routing protocols AODV (Ad-hoc on demand distance vector routing), DYMO (Dynamic Manet on demand routing) and DSR (Dynamic source routing) are analyzed and compared by using Qualnet simulator on the basis of performance metrics such as energy consumption in transmit mode, receive mode, idle mode, and residual battery capacity.

Key words- wireless sensor network, IEEE 802.15.4, Routing protocols (AODV, DYMO, DSR), Qualnet 5.2 simulator, CBR.

I. Introduction

Nowadays, Wireless Sensor Networks (WSN) is one of the most important technologies for the twenty-first century. WSN consist of small nodes with sensing, computation, and communication capabilities. Sensor nodes have a limited transmission range, limited energy, limited processing capability and limited memory storage. In WSN, most of data are loss when nodes fail due to lack of power or due to undesirable physical and environmental damage or are blocked by any obstacle [1]. Energy usage is an important issue in the design of WSNs that typically depends on portable energy sources like batteries for power .WSNs is large scale networks of small embedded devices, each with sensing, computation and communication capabilities. They have been widely discussed in recent years [2-4]. Micro-Electro-Mechanical System (MEMS) sensor technology has facilitated the development of smart sensors, these smart sensors nodes are small devices with limited power, processing and computation resources. Smart sensors are power constrained devices that have one or more sensors, memory unit, processor, power supply and actuator [5]. Grid based clustering is more simple and feasible, and has so much advantage with respect to other clustering method. In grid based wireless sensor network, cluster head it works like a base station. Cluster zones are collecting all information which is passing through sensor nodes. Every zone is dividing into own their square shape area for particular one small zone. Every zone is the combination of several sensor nodes. Every cluster head and node is doing work in each zone. A zone does not interact next to near zone. Therefore it consumes more energy in this process. It is connected by each other. A smart grid is save the energy, reduce cost and increase reliability of the network.

The present simulation analysis discussed about three the routing protocols AODV (ad-hoc on demand distance vector routing), DYMO (Dynamic Manet on demand routing) and DSR (Dynamic source routing) for sensor network and evaluated the energy performance metrics in all three modes (transmitting, receiving and idle) and residual energy using CBR traffic. The simulation has been carried out using Qualnet 5.2 simulator. The paper is organized as follows. Sections II briefly describe three routing protocols. Section III introduced the network model. Section IV gives the details of simulation setup, simulation scenario and section V is show simulation result and simulation analysis. The last section discussed theconclusion.

II. Routing protocols

Routing is the act of sending the information source to destination [6]. This section described thethree Routing protocols these are AODV (Ad-hoc on demand vector routing) [7], DYMO (Dynamic manet on demand routing)[8]and DSR (Dynamic source routing).[7]
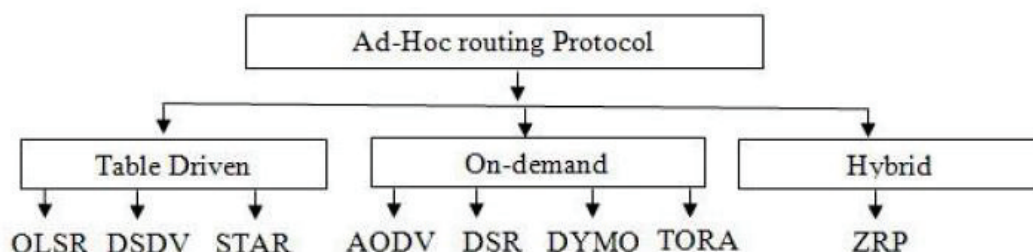
Figure 1: Classification of Ad-Hoc routing protocols

Reactive Routing Protocols

Reactive routing protocols called as demand routing [9]. In reactive routing protocols use two operations. ***Routes discover*** and ***Route maintain.*** Routes discover is found all possible routes and examined Route maintains is maintained route procedure. On demand routing protocols reduced the control over head, and increase the bandwidth of mobile station.[10]

Examples- AODV, DSR, DYMO, TORA.

  A. Ad-hoc on demand distance vector routing(AODV)

The AODV protocol accomplish a route discovery task with the help of control message that collect information about route request and route reply from sender to receive packet. However if source node finds any route error message then it has ability to restart route process. It working likea flat routing protocol therefore it does not need any central administrative infrastructure for handle routing system [11]. The AODV routing follows two step in routing. First one is route discovery and second is route maintenance. If some nodes who want to wish communicate with the nearest nodes before they have to be start route discovery process. However if they do not available in route to destination then it is called route request packet [12].

  B. Dynamic source routing(DSR)

In dynamic source routing, source nodes are forwarding route request towards all nodes which are under wireless transmission range. The source nodes generate unique request identification number for route request packet. When source node is not able to utilize current route for destination because of the change network topology then it use the route maintenance mechanism. The target node before sending the route reply request close to the source it scans own route for the route request [11].

  C. Dynamic Manet on demand routing (DYMO)

The DYMO is working like reactive routing protocol that would be helpful for multihop wireless networks. It was mostly used in the scope of IEFT's and MANET working group. The DYMO is proved as a beneficiary fo the AODV routing protocol. The designing model of DYMO is very simple and it is easy to implement. The primary task of DYMO protocol is route discovery and route maintenance. Whenever node would like to connect with path, it begins a route discovery process [13]. The DYMO routing is using for handle the wireless communication between mobile clients and several different clients through transported [12].

III. Propose Grid based cluster Network model

The following section represent the concept of grid based cluster network. Grid based cluster WSN main aim is reduced the power consumption in each sensor nodes for reducing traffic load. In network model grid has squared shaped, each squared shaped made by zone. Grid n ×n grid from set of each node.[11] The n×n is the

number Row and column. Grid represents the left to right and top to bottom. Left to right present the rows (n) and top to bottom present the columns (n). In figure 2 shows the 2×2 grid based network model row is show R and columns show C. [11]
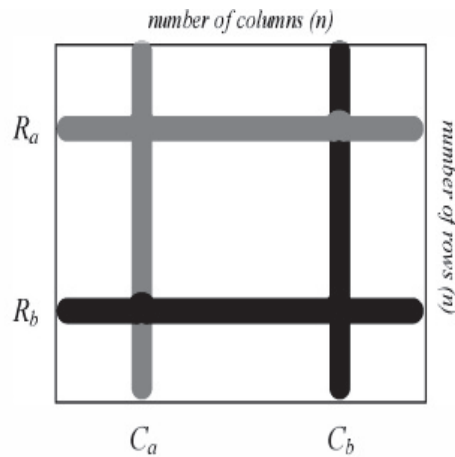

Fig. 2. Example of Grid-Based Quorum

IV. Simulation Setup& scenario

This section provides the information about 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.

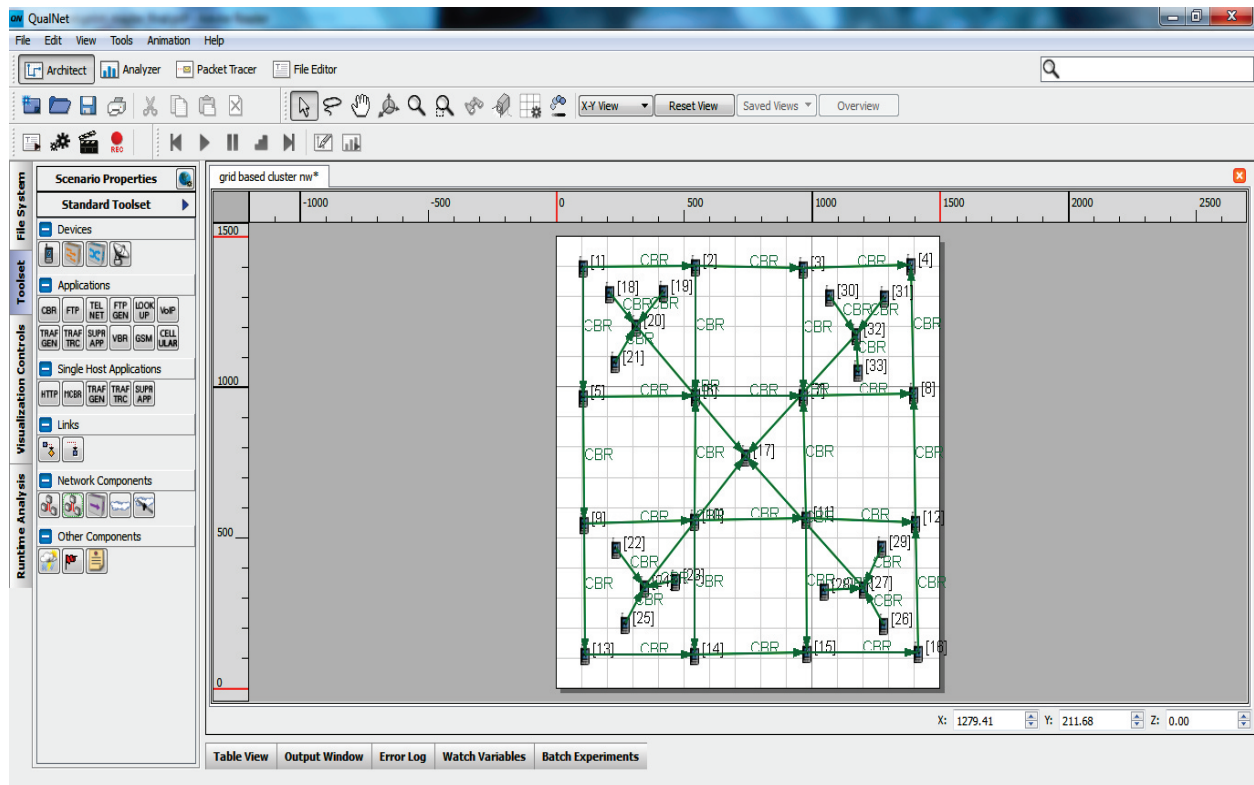### A. Simulation setup

TABLE-1

Simulation parameter for energy based performance analysis of AODV, DSR, DYMO routing protocols

Simulation parameters	
MAC Type	IEEE 802.15.4
Protocols under studies	AODV, DSR, DYMO
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	Generic
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

B. Simulation scenario

In this work Qualnet 5.2 simulator has been used to evaluate the performance of three reactive routing in grid based wireless sensor network. The nodes is deploying in terrain 1500m X 1500m. CBR is used data traffic application. These scenario nodes (1 to 16) made by 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.

Figure3 – Grid based cluster network in WSN

V. Simulation Result &Analysis

This section evaluates the performance of grid based cluster network using three different reactive routing protocols 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, Residual battery capacity (in mAhr).

1. Energy consumed in transmit mode-

In transmit nodes; packets transmitted throughsource nodes to thedestination nodes. Fig4 shows how energy consumed in transmit mode and analysis the performance of each node. In transmit mode AODV routing less energy consumption compare to other routing and DSR is more energy consumed compare to AODV and DYMO routing, node 17 is PAN coordinator so more energy consumed compare to other nodes.
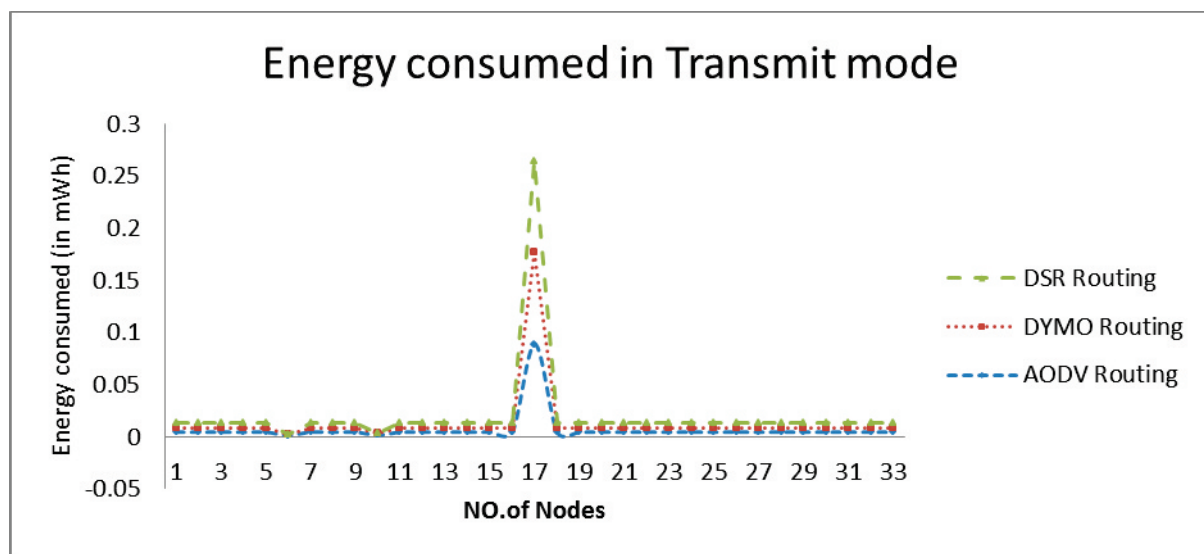

Fig4- energy consumed in transmit mode

2. Energy consumed in received mode-

In receiver mode, when packets is received in destination nodes. Fig5- shows the performance how energy consumed in received mode. In receive mode AODV is less energy consumed and DSR is more energy consumed compare to other nodes.
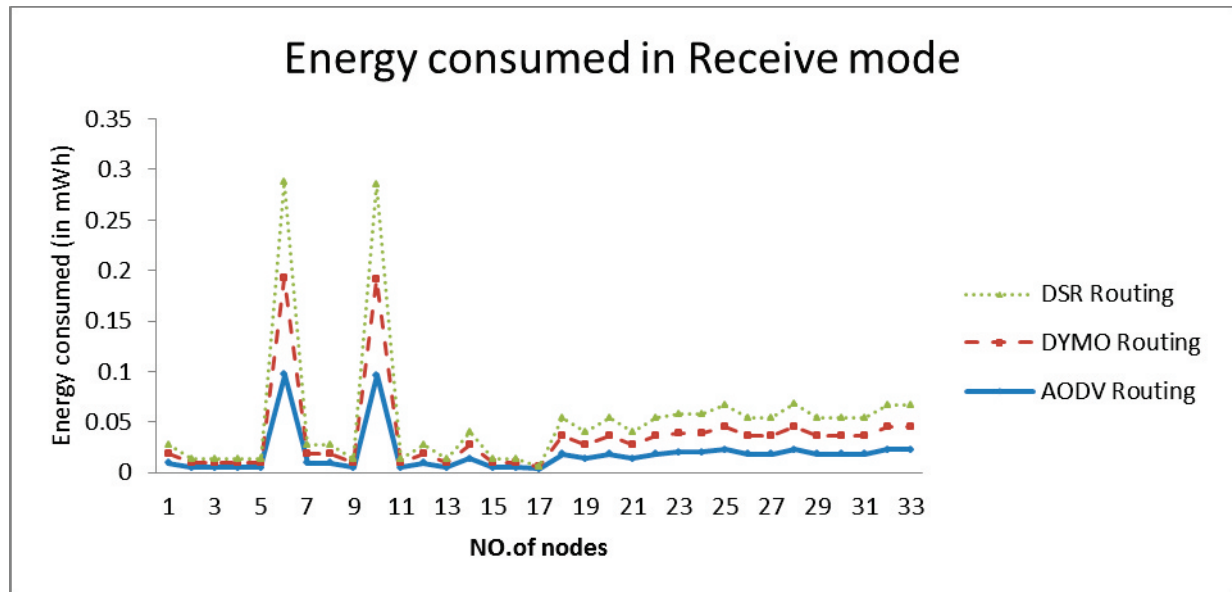
Fig5:- energy consumed in receive mode

3. *Energy consumed in idle mode-*

In idle mode, where nodes is always ready for transmit or received packet. Fig:-6 shows the performance of idle mode how energy consumed, the DSR routing is more energy consumed in idle mode and AODV is less energy consumed.
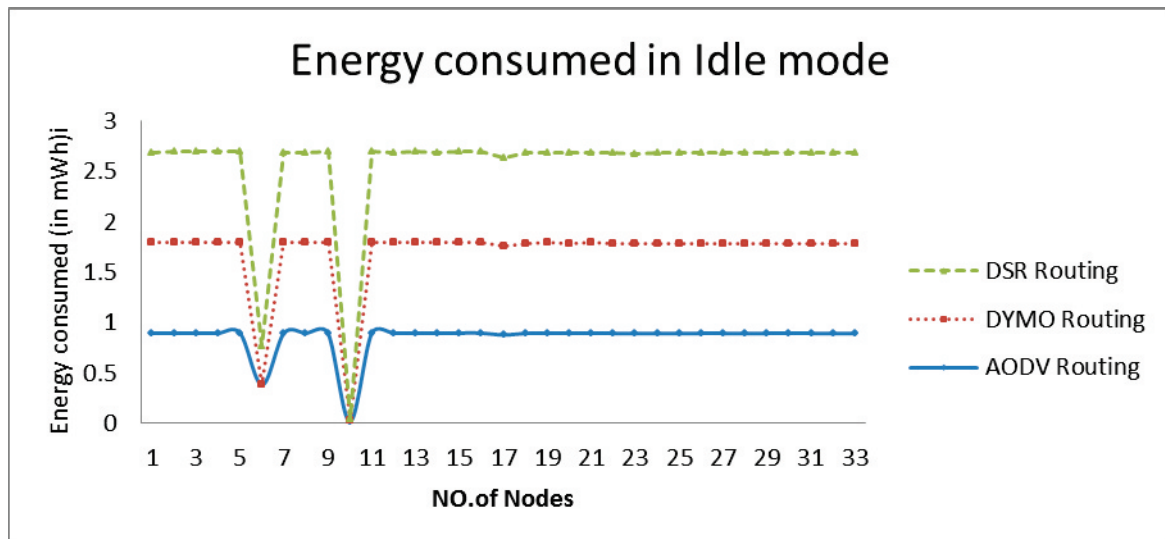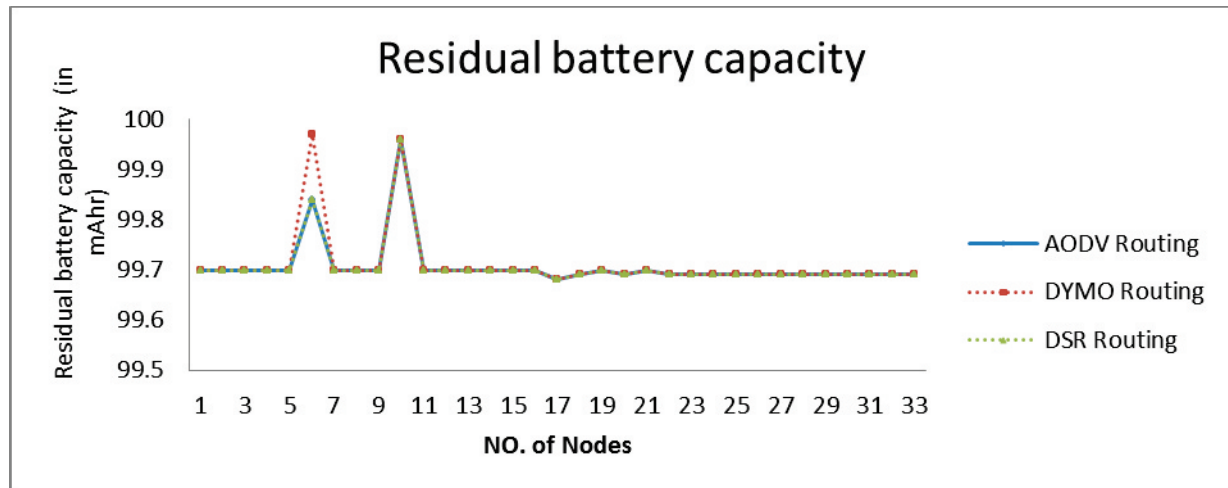

Fig6 :- energy consumed in idle mode

4. Residual battery capacity –

Residual battery is the remaining battery after a simulation. Fig:-7 show the residual battery capacity. All three routing are approximately same performance.

Fig7 :- Residual battery capacity

VI. Conclusion

Grid communication plays an important role in data exchange for any objects. Grid based approach is large scale coverage area network which improve the efficiency and reduced cost. Energy saving is important factor for sensor networks, because sensor has limited energy storage. This paper compare the three different reactive routing using same scenario of grid based sensor network and analysis the performances of three routing with the help of simulator. From the above data it has been analysed that AODV routing performance is better than tothe DSR and DYMO in transmit, receiver, idle and residual battery capacity modes. AODV is less energy consumed compare to theother two routing and DSR routing is consumed the more energy compare to AODV and DYMO in grid based sensor network.According to this scenario analysis AODV routing performance is better than other routing.

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