International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 2 Issue 10, October - 2013

Behavior of Cluster Based Wireless Sensor Network at Different Packet Sizes

Vivek Parashar
Amity School of Engineering & Technology(AUMP)
Gwalior, India

Geetam S. Tomar
Director, MIR Lab
Gwalior, India

Ashish Doorwar
Amity School of Engineering & Technology(AUMP)
Gwalior, India

Abstract

wireless sensor network (WSNs) are now a days of great importance ,as the deployment of human at extreme places is not possible all the times, WSNs are usually having very limited energy resources therefore in order to get the optimum use of them we must be aware of the right packet size to avoid retransmission due to packet collision or expiry of TTL or bandwidth limitation in this paper we are going to show the network performance at different packet sizes in cluster based network for optimum performance .

Keywords-Wireless sensor network,Power consumption poware aware routing protocols,powere aware MAC protocols.

1. Introduction.

Wireless sensor network (WSN) consists of tiny devices called sensor nodes usually deployed in Ad-hoc manner sensor node is equipped with central processing unit, battery, memory, sensor and radio transceiver .WSN's can be used for variety of purposes it may be general or where the deployment of human is either not possible or the cost of deployment is quite high like homes, workplaces, supermarkets, plantations, oceans, streets, and highways, war fields, habitat monitoring, vehicles tracking, monitoring environment changes, medical diagnostic and many more. [1][2][3] In a WSN, the sink node also called coordinator or PAN coordinator receives data from different sensors nodes places for sensing phenomenon in , algorithms for efficient data gathering, improving quality of service to avoid retransmission of packets, designing hybrid protocols for multi cluster communication improving fault tolerance without effecting the size of a node Fig 2 redrawn from [6]shows the general working architecture of sensor network. Showing large number of sensor nodes deployed in target area sending data to sink node in multi-hope manner which is being sent to internet or server for further processing.

ad-hoc manner. A sink node may also send queries, program updates, or control packets to sensor nodes. Sensor nodes detect events in the sensor field, perform local data processing and then transmit data to the base-station. In sensor node Transceiver is a major energy consumer component as communication is one of the most energy expensive tasks; in comparison to data processing. Fig.1 shows general sensor node hardware architecture, since sensor network are having limiter energy hence efforts has been made to increase lifetime of a node by designing energy efficient protocols

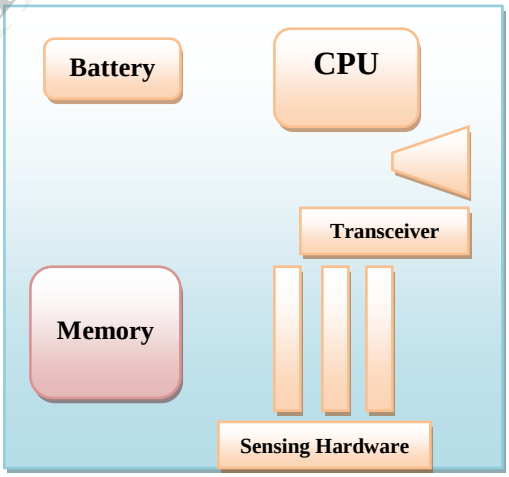

Fig. 1 General sensor node architecture [4] [5] [12]

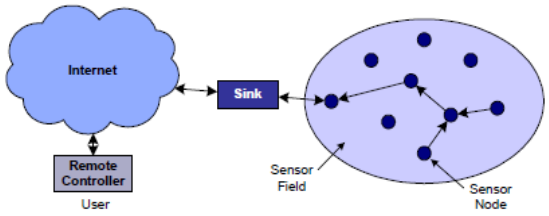

Figure2. General sensor network architecture

In this paper we have shown the performance of cluster based wireless sensor network at various packet sizes using Qualnet 5.0.2 network simulator all the nodes taken are stationary in nature. Rest of this paper consists of 5 more section, in section 2 we will discuss about various routing techniques, in section 3 we will discuss about simulation platform and the scenario created by us and in section 4 we will discuss result and conclusion is given in section 5.

2. Routing Protocols.

Routing is a mechanism of sending data from one place to another by means of some medium in WSN we are sending our data through multi-hope wireless links ,all the devices taken are connected in an ad-hoc manner and all devices behaves as router means they all are processing and forwarding data to other nodes[13] [14], most of the nodes in sensor are stationary in nature but due to depletion of battery in nodes the routing configuration changes hence the dynamic routing algorithms are required to meet out the requirements.

Routing protocols are broadly divided into three categories proactive, reactive and hybrid , proactive routing protocols[16] maintains routing tables at each node before starting of transmission but in case of large network it is very difficult to maintain and update route because of small size of memory and fever processing capabilities and also to update the routing tables more number of communications are required which will deplete the battery soon few proactive routing protocols are DSDV, STAR, LANMAR,OLSR, FSR, HSR. While working of reactive routing protocols can be divided into two major parts route discovery and route maintenance. In these protocols first the route is being discovered which is called route discovery and which is performed at the time of network setup while route maintenance is performed in case of any topological change few reactive routing protocols are AODV,DSR,DYMO,TORA,SSA,CBRP. Hybrid routing protocols are the combination of both proactive and reactive routing protocols these protocols take care of the nodes around us forming small zones proactively and then gradually finds the route from source to destination by using route discovery this will also increases scalability .

In our paper we are going to use Ad hoc on Demand Distance Vector (AODV)[16] routing protocol) as it name suggested it is a reactive routing protocol and establishes route whenever required it can work in both unicast and multicast manner . In this protocol source node sends Route Request messages (RREQ) to all its neighbors they check that whether the packet is meant for them if not they forwarded that packet to their neighbors and mark this in there temporary route file, this process keep on going until unless source is found, when source receives RREQ packet it creates Route Reply messages (RREP) and check its temporary routing table and sends back the packet from the same path he received the RREQ message the advantage of using this protocol is that no central administrative system is required to handle routing ,it also reduces the overhead of control packet and in case of any change in physical structure of network it adopts quickly but it do have a disadvantage of having high latency due to route discovery.

3. Network Simulation.

In this section we will analyze our cluster based network under different packet sizes. In this paper we have taken cluster based WSN .There are many advantages of taking cluster based network [8] [9] in clustered network flooding[10] is not performed in whole network only nodes within a cluster interacts with cluster head which further communicate data in a network this saves energy of nodes who remains busy in flooding another advantage is not all the nodes need to perform aggregation of data only cluster heads can perform this another advantage is in case of performance degradation of node or failure it won't affect the whole network but only the cluster in which it is present.

3.1 Scenario.

In this paper we are using QualNet 5.0.2 discrete event simulator in our model it can be used for both wired and wireless simulation .we are using 500X500 meter terrain with 15 static nodes arranged in two clusters seven node each including one cluster head sensor node placed in field can behaves as normal devices which can sense event around them, coordinators and PAN coordinators which can further classified into Reduced Functional Device (RFD) and Full Functional Device(FFD) devices are made RFD and coordinators and PAN coordinators are made FFD ,in our simulation coordinators can be used for collecting data from wireless nodes placed in field while PAN coordinator is behaving as base station and collects data from coordinators ,here in our simulation we are taking packets of different sizes and will check various network parameters here we are using Constant Bit Rate(CBR) as traffic generator it means the traffic generated will have a constant flow rate with constant size packets and even time interval. The height of antenna is varying from 0.5 to 1.5 figure 3 shows scenario and simulation parameters are the shown in table1.

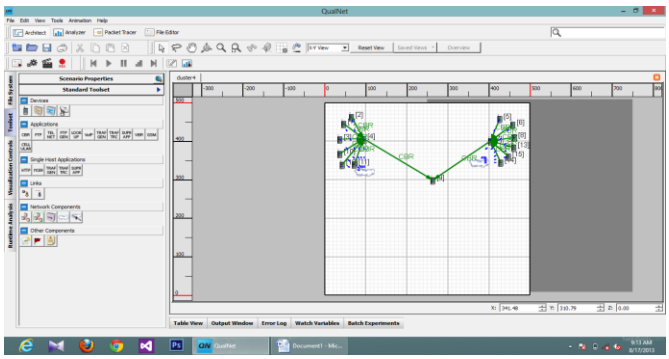

Fig.3 XY Axis view of scenario

Table 1. Simulation parameters

Parameter	Value set
Terrain	500X500
Number of nodes	15
Height of antenna	.5 to 1.5
Mobility model	None
Node deployment	Random
Node type	MicaZ
Initial battery capacity	200 mAhr
Traffic Model	CBR
Simulation time	300 Sec.
Noise	10 dB
Routing protocol	AODV
MAC protocol	MAC802.15.4
Network protocol	IPv4
Packet size in bytes	40,53,60,70
Battery model	Linear
Battery charge monitoring interval	1 Sec.
Chanel frequency	2.4 Ghz
Number of CBR	12
Number of channels	1
Antenna Model	Omni-directional

3.2 Performance Parameters

In our paper we are taking five parameters for measuring the performance of our cluster based network

A. Number of data Packet sent: This is the total number of packet sent by each node at MAC layer.

B. Number of data packet received: This is the total number of packet received by each node at MAC layer.

C. Number of packets dropped: This is the total number of packet dropped by each node at MAC layer.

D. Residual battery capacity: This will show the amount of battery consumed by each node in mAhr.

E. Throughput: Throughput means the number of output per unit time which is measured at physical layer in bits/s.

4. Simulation Results

In our paper we have used QualNet 5.0.2 a product of Scalable Network Technology [11] as a simulation tool, it can be used for planning, testing, training, and it can imitate the real communication scenario .The scenario we have created is shown in fig.3 and fig.4 above where fig.3 is a two dimensional view over XY axis of a scenario and fig. 4 is simulation during running state, on the basis of above given parameters and scenario we got results shown from fig.5 to fig.9

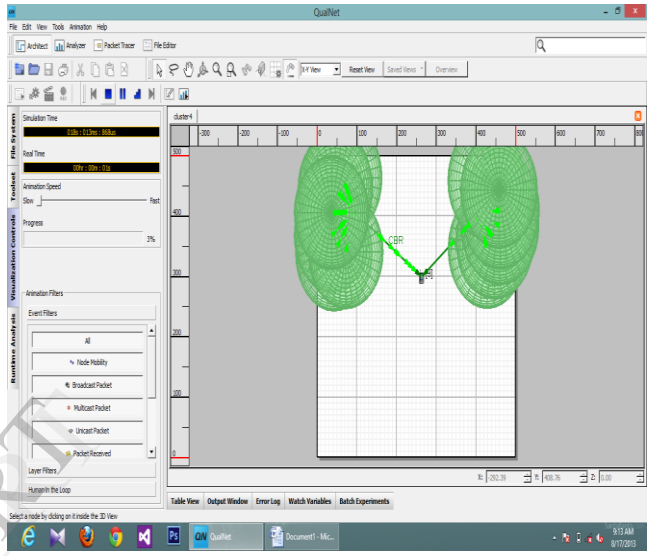

Fig.4 Simulation in running state

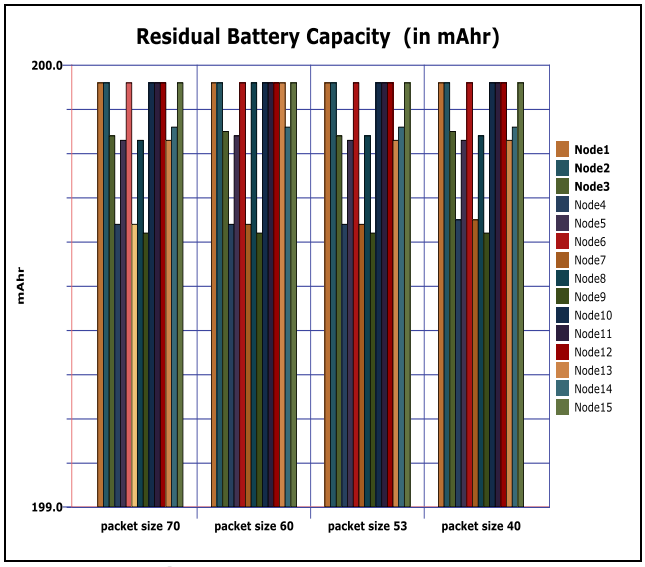

Fig. 5 Residual battery capacity

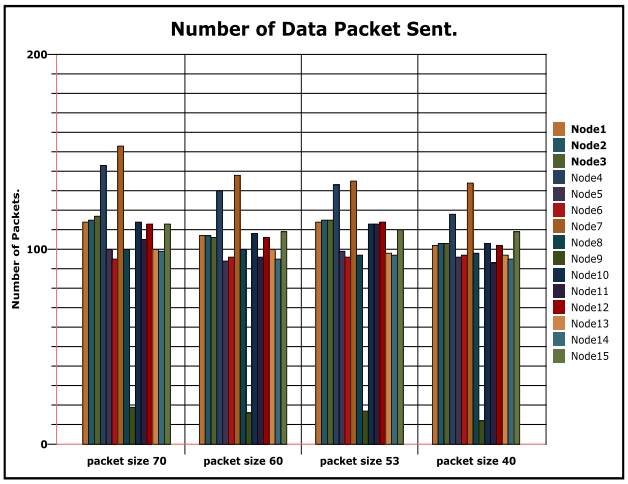

Fig.6 Data packet sent

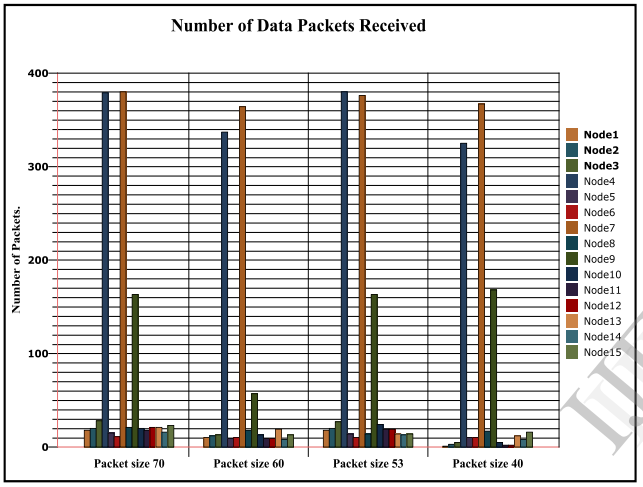

Fig.7 Data packets received

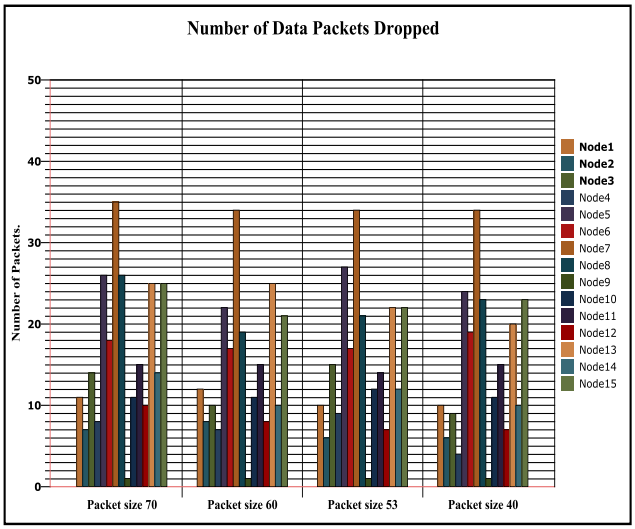

Fig.8 Data packets dropped

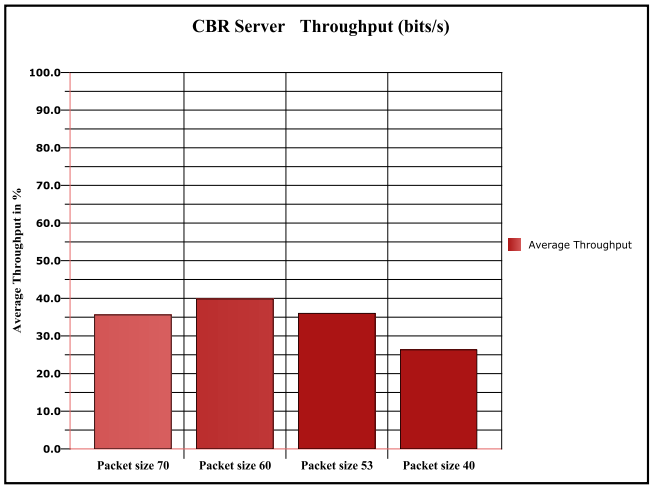

Fig.9 Average throughput.

5. Conclusion

In this paper we have shown performance of WSN at various parameters in fig 5 we have shown a residual battery capacity which is almost similar for all packet sizes except for few nodes which is having high residual capacity at packet size 60 in fig.7 we have shown that data packet received are higher at size 40,in fig.8 it is shown that the data packet dropped is higher at packet size 70 and in fig.8 we have shown throughput which is highest at packet size 60,hence it is clear that the overall performance of network is improved at packet size 60.

References.

[1] C. Schurghers, V. Raghunathan, S. Park, and M. Srivastava.Energy- Aware Wireless Microsensor Networks. IEEE Signal Proc Mag. 40–50, 2002.

[2] I.F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, .A Survey on Sensor Networks,. IEEE Communications Magazine, pp. 102-114,August 2002.

[3] K. Akkaya, M. Younis, "Energy-aware to mobile gateway in wireless sensor networks", Proc. of the IEEE Globecom 2004 Workshops, pp. 16–21, Dallas, United States, November 29–December 3, 2004

[4] Wireless Integrated Network Sensors, University of California,LosAngeles.Available: http://www.janet.ucla.edu/WINS

[5] J.M. Kahn, R.H. Katz, and K.S.J. Pister, "Next century challenges: Mobile networking for smart dust," in *Proc. Mobicom*, pp. 483-492, 1999.

[6] Giuseppe Anastasi , Marco Conti , Mario Di Francesco,Andrea Passarella "Energy conservation in wireless sensor networks: A survey" Internationa Journal on Ad Hoc Networks ,Elsevier,Volume 7, Issue 3, Pages 473-650 ,May 2009

[7] Das,Samir R.,Perkins,Charles E.,Royer,Elizebeth M., "The Ad-hoc On Demand Distance Vector Routing Protocol(AODV) for Ad Hoc Networks" Internet Draft, draft-ietf-manet-aodv-06.txt,July 2000.

[8] C. Hao and S. Megerian, "Cluster sizing and head selection for efficient data aggregation and routing in sensor networks",In Proceedings of the IEEE on Wireless Communications and Networking, vol. 4, pp. 2318–2323, April 2006.
[9] Tang Qi and Qiao Bing , "An energy-efficient protocol architecture with multiple clustering for Wireless Sensor Networks" , Intelligent Computing and Integrated Systems (ICISS), International Conference ,Oct. 2010.
[10] W. R. Heinzelman, J. Kulik and H. Balakrishnan, "Adaptive Protocols for Information Dissemination in Wireless Sensor Networks", In Proceedings of. 5th ACM/IEEE International Conference on Mobile Computing, MOBICOM, Washington, USA,1999,
[11] Scalable Network Technologies, "Qualnet simulator", SoftwarePackage, 2003. http:// www.scalable-networks.com.
[12] Krishna M. Sivalingam "Tutorial: Wireless Sensor Networks", University of Maryland, Baltimore County (UMBC) Baltimore, MD 21250, November 2005.
[13] Guihai Chen , Chengfa Li ,Mao Ye · JieWu, "An unequal cluster-based routing protocol in wireless sensor networks", Internationa Journal on wireless Networks ,Springer, Volume 15, Issue 2, pp 193-207, February 2009.
[14] A. Pantazis, A. Nikolidakis, D. Vergados"Energy-efficient routing protocols in wireless sensor networks for health communication systems" in Proceedings of the 2nd International Conference on PErvasive Technologies Related to Assistive Environments,2009.
[15] C Mbarushimana, A Shahrabi "Comparative Study of Reactive and Proactive Routing Protocols Performance in Mobile Ad Hoc Networks",Advanced Information Networking and Applications Workshops, AINAW '07. 21st International Conference (Volume:2), Pages 679 - 684 ,May 2007.
[16] Ian D. Chakeres, Elizabeth M. Belding-Royer" AODV Routing Protocol Implementation Design" Proceedings of the 24th International Conference on Distributed Computing Systems Workshops-W7 EC (ICDCSW'04) - Volume 7, Pages 698-703,2004.