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Analysis of Sensor Nodes with Distinct Angles using Scalable Network

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Abstract: ***The wireless sensor network (WSN) is a type of wireless ad hoc network that consists of large number of sensors that are effective for gathering data in a variety of environments. It is a network of power restricted nodes with the ability of sensing and communication covering a large region. Unlike its significant advancements in many areas, maximizing the lifetime of the whole network remains a major hindrance. Various protocols and approaches have been into existence to overcome this pitfall. One of the approaches is optimizing the angle by which sensors are placed in the grid formation. In our proposed algorithm we adopt a technique in which the nodes are clustered at four different angles in a scalable network and different parameters like End to End Delay and Throughput are studied at each different angle. The protocol has been simulated in Network Simulator-2 (NS-2).***

Keywords: WSN, LEACH, CH, throughput.

1. Introduction

Wireless communication is where there is no physical connection between the sender and the receiver but instead radio, electromagnetic or acoustic waves are used in place of wires, cables or fiber optics. WSN is a collection of wireless mobile nodes which dynamically forms a network with the use of any existing network infrastructure or centralizes administration. Before this, work has been done by researchers on increasing lifetime and to provide maximum coverage. These all problems are related to the base of WSN i.e. Sensor Deployment. By placing the nodes at a pre-determined optimized location, sensing range can be minimized. Sensing range minimization will lead to increased lifetime as less energy will be consumed during monitoring of targets.[5]

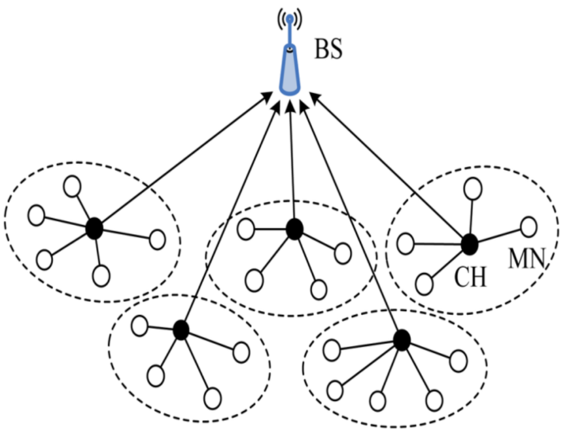

Figure 1: Wireless Sensor Network

LEACH (Low Energy Adaptive Clustering Hierarchy) protocol is the basic and the most important protocol in wireless sensor network which uses clustering based broadcasting technique. Still LEACH needs improvement against the non-uniformity distribution in the selection of cluster head. Further it also needs improvement against single-hop transmission. In this research the LEACH protocol can be enhanced by adding the parameter of angle for partitioning the network[2]. The rectangular network is plotted and the location and residual energy of the nodes are considered for choosing the cluster head effectively. During the research work, the sensor nodes are analysed with distinct angles in a scalable network. In this process network is divided into clusters that vary according to different angles and parameters like end to end delay and throughput is studied at 1000*975 field area.

2. Enhanced Leach

In this research, enhanced LEACH protocol has been proposed in which the angle is optimized for partitioning the network. The cluster head is chosen by using the residual energy and the location of the nodes in the rectangular network. Scheme takes into account the selection of cluster head for extending the life time of network.

In the enhanced LEACH protocol the network is uniformly divided into clusters. Each cluster consists of cluster head and many member nodes. N nodes are randomly distributed in S*S region space. Sink is located far from the monitoring area. By using multi-hop routing the cluster head is chosen effectively. In this scheme operations are performed in respective stages. The stages focus on the finding better solution for lifetime of the wireless sensor networks by choosing the cluster head effectively. In this scheme, operations are performed in three different stages: area portioning, cluster head generation and data transmission.

- **Stage 1: Area partition**
  Firstly the network is partitioned by the sink by applying the optimum angle: k_{angle} that forms different clusters. Then, the k_{angle} is further split into h_{opt} by the following strategy:
  $0 \leq h_{opt} \leq k_{angle}$-1
  here h_{opt} varies from
  0: .1: k_{angle}-1

- **Stage 2: Cluster head generation**
  The second stage is the cluster head generation. In the network based on clustering, cluster head is responsible for coordinating the operations among other sensor nodes in the cluster, collecting, fusing the data and then sending it to the sink. Thus, the load on the cluster head is more and consumes more energy[4]. So during the generation of the cluster head, both the position and the residual energy of the node are considered. In the first round, node whose position is close to the sink is chosen as the cluster head. In the following rounds the member nodes can be the cluster heads if it satisfies both of these conditions:
  1) Its location becomes closer to the sink.
  2) The residual energy of the nodes must be greater than the threshold.
  $E_{res}(j) > E_{th\_d}$
  where $E_{res}(j)$ is its residual energy and E_{th_d} is the threshold energy. The threshold energy is set to be the average residual energy of all the alive nodes in the cluster.
- **Stage 3: Data transmission**
  After the above stages, data transmission takes place i.e. nodes send their data during their allocated TDMA (time division multiple access) slot, to the cluster head. Thereafter the cluster head creates and broadcasts its own TDMA schedule which includes time slots for data transmission from member nodes to the cluster head and then from the cluster head to the sink. The cluster head then fuses the data packet received from member nodes and transfers it to the sink.

The protocol is implemented in different scenarios in the simulation field area of 1000*975.

3. Energy Consumption Model

The energy consumed in the network depends upon various factors:

1) Data transmission from the member nodes to the cluster head and then from cluster head to the sink.
2) Data received.
3) Energy consumed in fusing the data by the cluster head. The energy consumption model is taken from [8].

The energy consumption for transmission and receiving the l bit message covering a distance of d meters in the m^{th} power path loss channel respectively are:

$E_{tx\_con}(l,d) = lE_{\_tx} + lE_{\_amp}d^{m}$

$E_{rx\_con}(l) = lE_{\_rx}$

Where $E_{\_tx}$ and $E_{\_rx}$ presents the transmitter and the receiver circuit energy consumed. E_{amp} denotes the effect of antenna, amplifier and carrier frequency with the prescribed bit error rate (BER).

4. Simulation

This section covers the simulation done for EH-LEACH in Network Simulator-2. The parameters taken for the simulation work is presented in Table1.

Table 1: Simulation Parameters

Parameter	Values
Sensor Nodes(N)	50
Simulation Area (S×S)	1000*975
Angle (k_{angle})	20°, 40°, 70°, 90°
Sink Position	(50,175)
Data Packet	2000 bits
Initial Energy	0.5 J
$E_{\_amp}$	100pJ/bit/m2
$E_{\_tx}$	50nJ/bit
$E_{\_rx}$	50nJ/bit
Energy for Data Fusing	5nJ/bit

4.1 Snapshots showing EED and TPUT at 1000*975 field and 20°,40°,70°and 90° angles.

Figure2 and 3 shows the network snapshot for EH-LEACH protocol for 1000*975 field area at different angles. Y axis is in millisecond and X axis consists of simulation time in seconds. The total simulation time taken is 50 seconds.

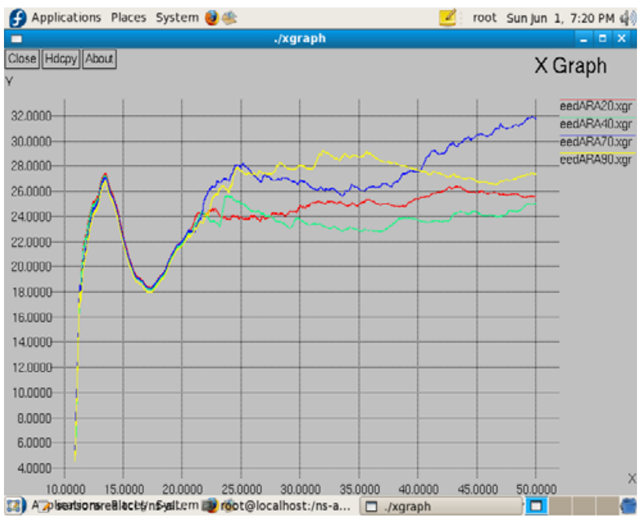

Figure 2: Snapshot showing EED

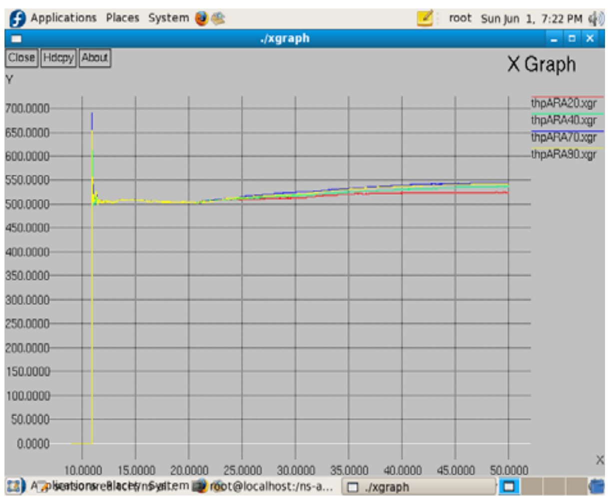

Figure 3: Snapshot showing Throughput

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5. Results

This section depicts the results for enhanced LEACH for different scenarios. The simulation area taken is 1000*975. The clustering angles are also varied from 20°, 40°, 70° and 90°.

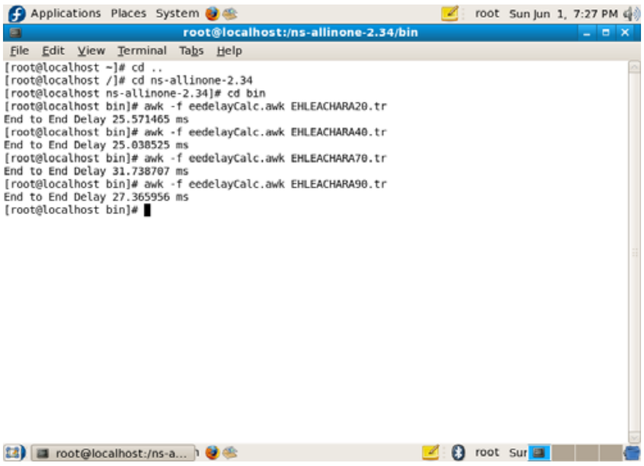

Figure4: Snapshots for EED deploying nodes at 1000*975 area

Figure4 shows a common window showing values obtained for end to end delay at four different angles i.e. 20°, 40°,70° and 90°.

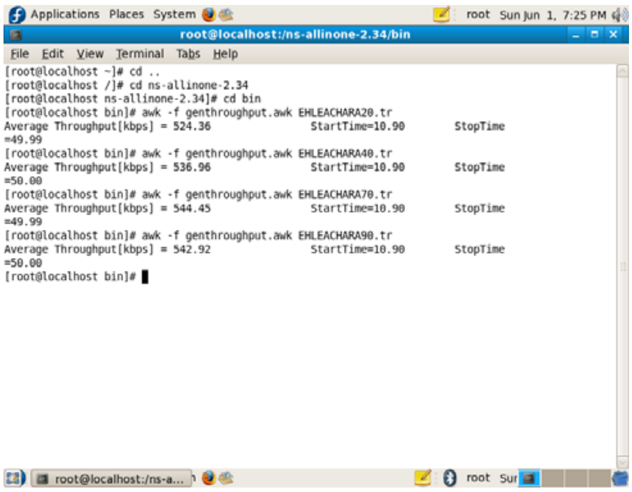

Figure5: Snapshots for TPUT deploying nodes at 1000*975

Figure5 shows a common window showing values obtained for throughput at four different angles i.e. 20°, 40°,70° and 90°.

Table 2: End to end delay and throughput with four different angles

SCHEME	AVG EED	AVG TPUT
Angle 20	25.57	524.36
Angle 40	25.03	536.96
Angle 70	31.73	544.45
Angle 90	27.36	542.92

Table2 shows the end to end delay and throughput for enhanced LEACH at four different angles i.e. The tabulated values have been obtained from figures 4 and 5. It is shown that at 70° angle the end to end delay and throughput is maximum whereas at an angle of 40° the EED obtained is minimum. Therefore by placing the nodes at this clustering angle will ensure less energy consumption.

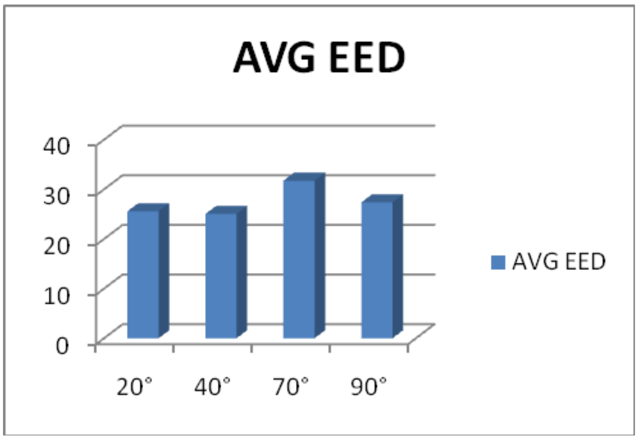

Figure 6: Graph for average EED

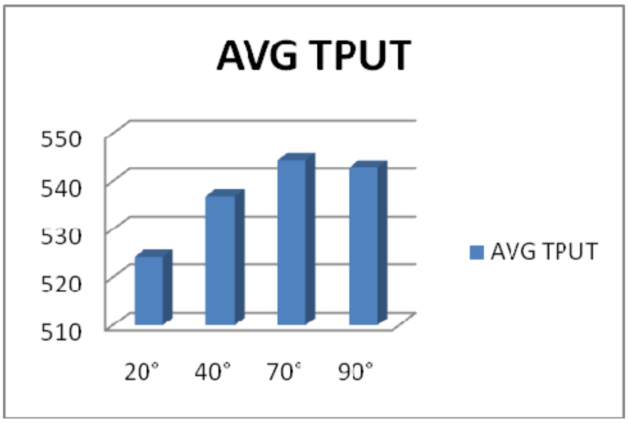

Figure 7: Graph for Average Throughput

Figure6 and figure7 shows the graph for variation of the angles with field area 1000*975. The simulation results shows that by placing the nodes at a clustering angle of 70° will give the maximum throughput thus ensuring less energy consumption.

6. Conclusion

In the proposed method we implemented EH-LEACH in which the rectangular network was partitioned by applying the optimum angle to have uniform cluster head distribution. It was analyzed that by placing the nodes at different angles in a particular field area gives different end to end delay and throughput at each angle. The maximum throughput obtained is at 70°. The proposed routing protocol analysis and the number of packets received at the sink at different angles thus ensuring less energy consumption.

6.1 Future Scope

Research can be carried out to study

a) The performance of the protocol under other network scenario by varying
   - The angles other than 20°, 40°, 70° and 90°.
   - By changing the topology shape from rectangular to square, circular or any other random shapes.
   - By varying the field area.

b) Security issues can be incorporated in wireless networks.

c) Issues like load balancing can be incorporated.

References

[1] Heinzelman W, Chandrakasan A, Balakrisham H. "Energy-efficient communication protocol for wireless microsensor networks."In Proceeding of the 33rd Annual Huawaii International Conference on System Sciences. IEEE Computer Society, 2000:3005-3014.

[2] T. D. Raty, "Survey on contemporary remote surveillance systems for public safety", IEEE Trans. Syst., Man, Cybern., Part C, vol. 40, no. 5, pp. 493–515, Sep. 2010.

[3] Mainwaring, D. Culler, J. Polastre, R. Szewczyk, and J.Aderson, "Wireless sensor networks for habitat monitoring". In Proc. ACM International Workshop on Wireless Sensor Networks and Applications, (2002),

[4] Murad A. Rassam, Anazida Zainal, Mohd Aizaini Maarof, "An adaptive and efficient dimension reduction model for multivariate wireless sensor networks applications", Journal of Applied Soft Computing, Vol 13 issue 4, April 2013, pp. 1978-1996.

[5] Wendi Rabiner Heinzelman, Anantha Chandrakasan, and Hari Balakrishnan, "Energy-Efficient Communication Protocol for Wireless Microsensor Networks" Copyright 2000 IEEE. Published in the Proceedings of the Hawaii International Conference on System Sciences, January 4-7, 2000, Maui, Hawaii

[6] W.B. Heinzelman, A. P. Chandrakasan, and H. Balakrishnan, "AnApplication-Specific Protocol Architecture for Wireless Microsensor Networks", IEEE Transactions on Wireless Communications, vol. 1,Oct, 2002, pp. 660-670, doi:10.1109/TWC.2002.804190.

[7] F. M. Omer, D. A. Basit, and S. G. Asadullah, "Multi-hop Routing with Low Energy Adaptive Clustering Hierarchy," Proc. International Conference. Sensor Technologies and Applications (SENSORCOMM 10), IEEE Press, July, 2010, pp. 262-268.

[8] Yongming Qin, Qiuling Tang, Ye Liang, Xiuyu Yue, Xian Li, "An Energy-Efficient Cooperative MIMO Scheme for Wireless Sensor Networks", The 14th IEEE International Conference on Computational Science and Engineering,2011 [10] A. Rahmanian, H. Omranpour, M. Akbari, Raahemifar, "A Novel Genetic Algorithm in LEACH-C Routing Protocol for Sensor Networks," Canadian Conference on Electrical and Computer Engineering (CCECE), Niagara Falls, Canada, pp. 001096 – 001100, May 2011