Estimating Node Density and Achieving Energy Efficient In Wireless Sensor Networks

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Abstract— *In Wireless Sensor Networks, energy consumption is an important issue compared with other parameter. Minimum Energy consumption is achieved by the duty cycle in the network. The concept of a low duty cycle is representing as a periodic wake-up scheme. If the nodes residual energy is higher than the threshold value the node act as a parent node and it creates the leaf node during the transmission finally forwards the packets based on the energy level in the node. If the nodes residual energy is lower than the threshold value the node act as a child node, which is, enter the sleep mode. After finishing the sleep period it will wake up and check the channel if any transmission is there. If packet is to be transmitting or receiving, the nodes forward the packet otherwise again go to the sleep state. In AODV, protocol has the highest energy consumption than the Modified Energy AODV protocol. However, this concept is applicable only in small network. Simulation results show that Modified Energy AODV provides better performance in terms of energy, packet delivery ratio and throughput.*

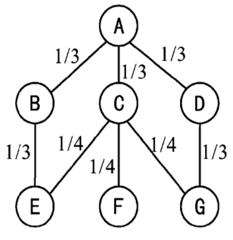
Keywords—— Modified Energy AODV (ME-AODV), periodic wake-up scheme, leaf node, parent node, residual energy.

I. INTRODUCTION

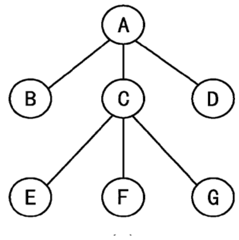
Wireless sensor network (WSN) technology is encouraging and is therefore gaining popularity day by day in a wide area of different applications. The WSN nodes working on battery power which is often deployed in a rough physical environment. To change the batteries is therefore a complex task, as some networks may consist of hundreds to thousands of nodes. Such huge physically distributed networks increase the complication of changing batteries and makes recharging almost unsustainable during operations. This problem has forced node, network and system developers to make changes in the basic WSN architecture to diminish the energy consumption especially of the nodes in order make the network and overall system application more energy efficient. One of the challenging topics in wireless communication techniques to be used for WSN applications is energy efficient. The life time of a sensor node depends on available energy sources and its energy consumption. Further, improve the capacity of batteries is not possible due to the small size requirement of the nodes. Finally, the solution of the problem is to reduce the energy consumption of the sensor nodes. This work aims to identify and quantify energy saving methods in WSN. An important prerequisite to carry out this activity is to expand, a methodology for the evaluation of energy consumption in the individual WSN nodes and in the network as a whole. The aim of this work is to minimize energy consumption of a WSN. In the optimization for minimal energy consumption care should be taken to see that other parameters such as successful transmission of parameters by the network.

II. EXISTING METHODS

In existing networks, they described reliability in networks but they are not considering the energy consumption in the network, which is shown in Fig.2.1(a). In always active wireless sensor, networks with unreliable link have taken unreliable links taking into account when designing energy-efficient data dissemination algorithms. In Fig.2.1(c) shown whereas they bare the objective of minimizing the expected total transmitted (tx) power consumption for guaranteed reliability [1], all of them have pressure on unicast cases and have extended traditional shortest-path algorithms to solve the problem optimally. In Fig.2.1 (b), the network is energy-efficient reliable data dissemination in DC-WSNs with guaranteed performance [2]. The network aims to minimize the expected total tx-power consumption in multicasting or broadcasting under guaranteed reliability [4].



(a)



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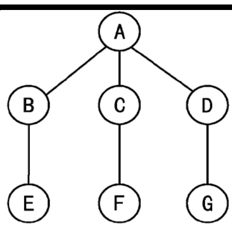

(c)

Fig.2.1: (a) Tree Structure With Link Quality Fig.2.1: (b) Efficient Tree Structure Fig.2.1: (c) Tree Structure

III. PROPOSED METHOD

In the Modified Time reliability power space mechanism [4], initially the structure of network is optimized and performs the optimization individually in the network. If the residual energy of node is lower than threshold level the node act as a child node and it will enter the sleep mode to reduce the overhearing an unnecessary activity. After finishing the sleep period it periodically wake up and listen the network activity, if no packet is to be transmitted or received, the node returns to the sleep state. A whole cycle consist of a sleep period and a listening period is called a sleep/wake-up period and is depicted in Duty cycle is measured as the ratio of the listening period length to the wake-up period length which gives an indicator of how long a node spends in the listening period.

A small duty cycle means that a node is dormant most of the time in order to avoid idle listening and overhearing. However, a balanced duty cycle size must be attaining in order to avoid higher latency and higher transient energy due to start-up costs. If the residual energy of node is higher than threshold level, the node acts as a parent node. It creates the leaf node during the transmission based on the energy level in the node and forwards the packets, which the node has, the highest energy level in the forwarding path. After finishing the data transmission the residual energy level compare the threshold value and start the transmission.

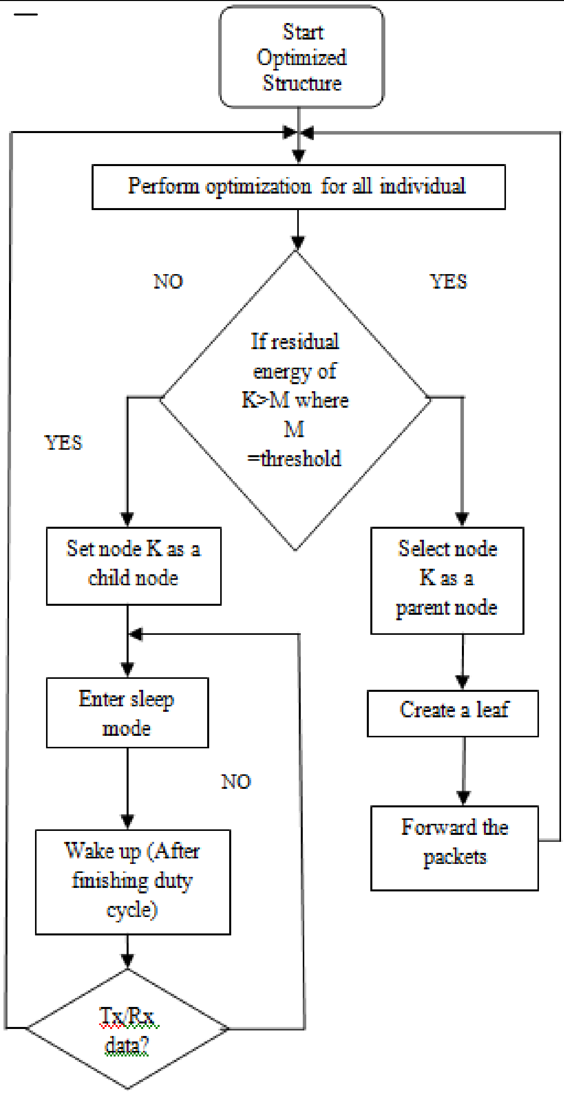

Fig.3.1: Proposed Flow Chart

IV. SIMULATION RESULT AND DISCUSSION

1. Network scenario

Network Simulator (Version 2), widely known as NS2, is simply an event driven simulation tool that has proved useful in studying the aggressive nature of communication networks. Simulation of wired as well as wireless network functions and protocols (e.g., routing algorithms, TCP, UDP) can be done usingNS2. In general, NS2 provides users with a way of specifying such network Protocols and simulating their corresponding behaviors.

The parameter of packet delivery ratio, packet loss, and energy level are calculated by using the network simulator. Due to reduce the delay in the network User datagram protocol (UDP) is using in this scenario. Initially the nodes level is fixed to 6 and gradually increased up to 21 and analyze the performance of the different nodes as well as different protocol like modified AODV. In AODV protocol, the energy level will be decreased. However, in the ME-AODV protocol the energy level is gradually decreased so the performance ratio is better than AODV.

Table I. Simulation Parameters

Simulation area	1000m x 1000m
Channel type	Two ray ground
MAC type	IEEE 802.11
Antenna model	Omni-directional
Mobility	None
Node pause time	1 sec
Simulation time	250 sec
Traffic model	UDP
Application	CBR
Initial energy	100 Joules
Routing protocols	AODV and ME-AODV
Number no nodes	50

Initially 100 joules energy level is set in node, which is starts, the transmission. Omni directional antenna is used for radiation. The proposed system has MAC type of IEEE802.11 and it will be using the application of military environment, agriculture environment only. Because of the constraint, the proposed system has the limited advantages. By increasing the node level, it gives the poor performance in the network so it will applicable only for limited number of nodes. AODV protocol will suitable for any network but it has the energy constraint this is the major issues so ME-AODV will propose for this applications.

2. Output scenario

The nodes are randomly placed and start to perform the optimization for all individual nodes. Initially the path is selected by the node have highest energy. In fig.1 scenario the node 5 has highest energy level compared with other node, so node 5 starts the transmission. The energy level will check and select the next forwarding path that is node 19.Futher proceeding that the forwarding path is selected and transmit the data. The packets will be forwarded up to the node level 50. If the node level is increased, the performance of energy level will reduce. Both AODV and ME-AODV protocol will be simulated.

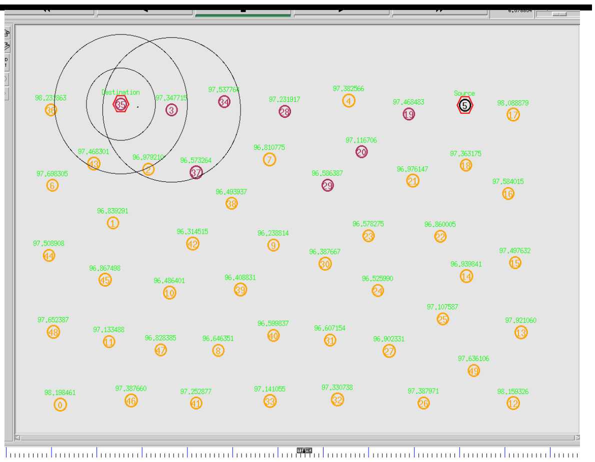

Fig.1: Packet Transmission For 50 Nodes

3. Energy level comparison in AODV and ME-AODV

Energy level output is compared with AODV, ME-AODV and existing method (EX-METHOD) In ME-AODV has the minimum energy consumption during transmission. AODV protocol each node participates in route discovery and route maintenance so that the energy level of the node is reduced more is shown in Fig.2. ME-AODV has better energy conservation than AODV and existing method.

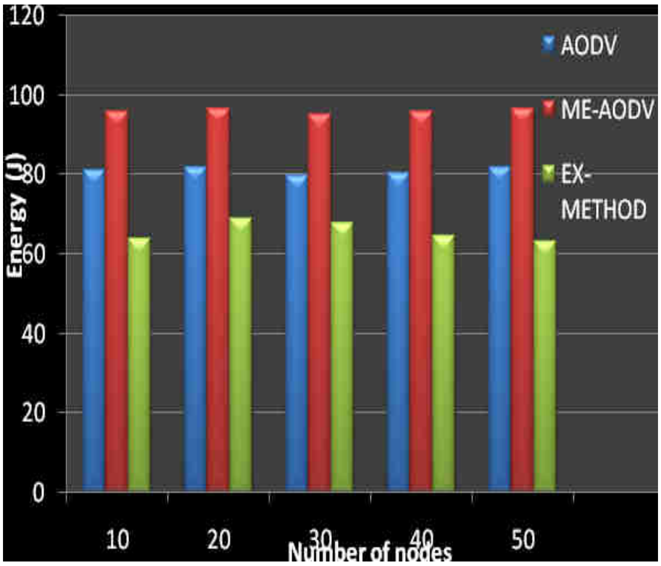

Fig.2: Energy Level Output For 50 Nodes

ME-AODV considers the energy factor and node lifetime on the path for finding the optimal path between source and destination pairs. Each node does not participate in route discovery and data forwarding process if residual energy is less than threshold value of energy also the proposed method of ME-AODV is compared to the existing method is shown in Fig 2. Due to this, ME-AODV has better performance. However, in AODV protocol each node participates in route discovery and route maintenance so that the energy level of the node is reduced more.

4. PDR comparison in AODV and ME-AODV

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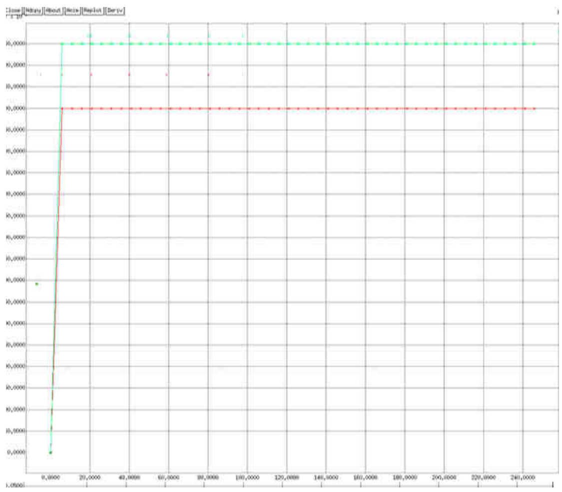

Simulation time(s)

Fig.3: PDR Output For 50 Nodes

Packet delivery ratio of AODV and ME-AODV is compared. More number of packets is delivered in particular pause time. Whole simulation time the AODV has the gradual response similar that ME-AODV is increasing due to RREQ and RREP packets are transmitted during the simulation time .ME- AODV has the highest PDR value. ME-AODV has highest packet delivery ratio than AODV protocol is shown in Fig.4, due to this ME-AODV has the RREQ, RREP and routing table of the nodes. ME-AODV protocol periodically updates the routing tables in the network. Some modification will occur in the RREQ and RREP packets

5. Throughput comparison in AODV and ME-AODV

On comparing the throughput of ME-AODV has the highest packet delivery in second than AODV. Throughput is nothing but number of bits received per second. It will be higher in ME-AODV than the AODV shown in Fig.5. The first two bits of reserved field in RREQ packet are used to access Ep and Tp and two new fields are added into RREQ and RREP packet to access energy factor and node life time. In AODV protocol does not updates the routing protocol periodically so that the throughput is less compared with ME-AODV protocol.

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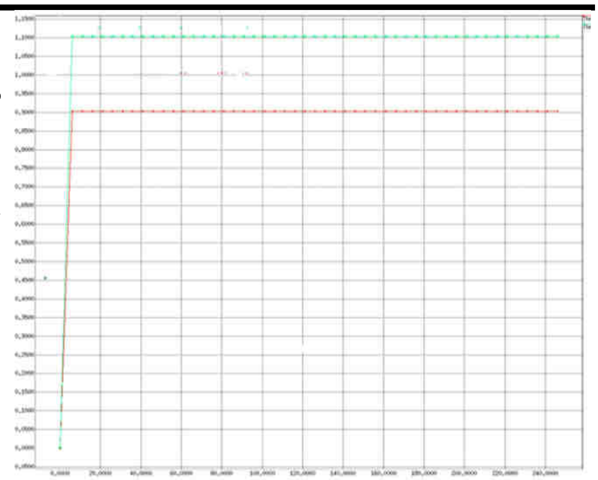

Simulation time(s)

Fig. 4:Throughput Output For 50 Nodes

V. CONCLUSION

The proposed system aims to provide the route, which has a higher energy factor from the source to the destination. Wireless Sensor Network can suffer routing break problem during packet transmission due to power expiration in the network. Energy efficiency and the reliability of packet transmission can be improved by choosing an optimal path, which has efficient energy resource. Modified Energy AODV achieves a better performance of energy conservation, packet delivery ratio and throughput than the AODV protocol. However, Modified Energy AODV is simulating with node 50 and it does not work well in larger network. In future to add, the clustering technique while the network density is too large.

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REFERENCES

[1] K. Han, L. Xiang, J. Luo, and Y. Liu, "MEGCOM: Minimum-energy group communication in multi-hop wireless networks," IEEE Trans. Veh. Technol., 2014

[2] K. Han, Y. Liu, and J. Luo, "Duty-cycle-aware minimum-energy multicasting in wireless sensor networks," IEEE/ACM Trans. Netw., vol.21, no. 3, pp. 910–923, Jun. 2013

[3] X. Y. Li, Y. Wang, H. Chen, X. Chu, Y. Wu, and Y. Qi, "Reliable and energy-efficient routing for static wireless ad hoc networks with unreliable links," IEEE Trans. Parallel Distrib. Syst., vol. 20, no. 10,pp. 1408–1421, Oct. 2009

[4] K. Han, L. Xiang, J. Luo, M. Xiao, and L. Huang, "Energy-efficient reliable data dissemination in duty-cycled wireless sensor networks,"in Proc. ACM MobiHoc, 2013, pp. 287–292.

[5] A. S. Ahluwalia and E. Modiano, "On the complexity and distributed construction of energy-

efficient broadcast trees in wireless ad hoc networks,"IEEE Trans. Wireless Commun., vol. 4, no. 5, pp. 2136–2147, Sep. 2005

[6] Filipe Sousa, Rui Campos, and Manuel Ricardo, "Energy-efficient wireless multimedia sensor networks using FM as a control channel," IEEE symposium on computers and communication(ISCC),June 2014

[7] Amrita Ruperee, Shikha Nema and Sanjay Pawar, "Achieving Energy Efficiency and Increasing Network Life in Wireless Sensor Network," IEEE International on Advance Computing Conference(IACC), Feb 2014

[8] Chu-Fu Wang, Jau-Der Shih, Bo-Han Pan, and Tin-Yu Wu "A Network Lifetime Enhancement Method for Sink Relocation and Its Analysis in Wireless Sensor Networks" IEEE Sensors Journal, Vol. 14, No. 6, June 2014

[9] S. Kulkarni and L. Wang, "Energy-efficient multihop reprogramming for sensor networks," Trans. Sensor Netw., vol. 5, no. 2, pp. 1–40, 2009.

[10] K. Han, L. Xiang, J. Luo, and Y. Liu, "Minimum-energy connected coverage in wireless sensor networks with omni-directional and directional features," in Proc. ACM MobiHoc, 2012, pp. 85 94.

[11] I. Caragiannis, C. Kaklamanis, and P. Kanellopoulos, "Energy-efficient wireless network design," Theory Comput. Syst., vol. 39, no. 5, pp. 593–617, 2006.

[12] S. Banerjee and A. Misra, "Minimum energy paths for reliable communication in multi-hop wireless networks," in Proc. ACM MobiHoc, 2002, pp. 146–

[13] Chang & Tassiulas, (2004) Maximum Lifetime Routing in Wireless Sensor Networks, IEEE/ACM Transactions on Networking", Vol. 12, issue 4.

[14] Ritesh Madan and Sanjay Lall,"Distributed Algorithms for Maximum Lifetime Routing in Wireless Sensor Networks", IEEE Transactions on wireless communications, 2006.5(8).pp.2185-2186.

[15] Ok, Lee, Mitra & Kumara, (2009) Distributed Energy Balanced Routing for Wireless Sensor Networks, Computer & Industrial Engineering, vol. 57, issue 1, P.P. 125-135.

[16] Ritesh Madan and Sanjay Lall. "Distributed Algorithms for Maximum Lifetime Routing in Wireless Sensor Networks." IEEE Transactions on Wireless Communications, 2006.5(8).pp2187-2193