Modified Cluster Head Election Routing for Energy Efficient Long Life Sensor Network

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Abstract - The energy aware wireless sensor networks are the need of today's wireless generation of information communication. The sensor networks are the specific type of wireless networks. The basic fundamental to reduce the energy consumption of the particular sensor network is to optimize the collection pattern of information from the nodes to base station or server. The conservation of energy is also important due to all the WSN nodes are battery operated. The battery has the limited source of energy and this limitation is also motivation to develop efficient routing technique. In this paper we have proposed modified routing algorithm hybrid energy efficient distributed clustering (HEED) and optimize the pattern of cluster head election probability. The simulation has been done for 3500 rounds and the network live longer more than 3500 rounds and throughput is around $1.152x10^5$.

Keywords - Energy Efficient, Routing, WSN, HEED, Cluster Head, Election Mechanism, Probability, Wireless Networks, MANET.

I. INTRODUCTION

WSNs are widely used to create a smart environment that relies on sensory data from real world. The application of wireless sensor networks provides an enormous wirelessly connected infrastructure facilitating the function of monitoring a physical and environmental conditions, such as temperature, sound, vibration, pressure, humidity, acidity, motion and pollutants. The advent of smart environments relies heavily on sensor network for data acquisition and dissemination whether in building, shipboard, intelligent transportation system, habitat monitoring, healthcare monitoring, home automation, traffic control, or elsewhere. A sensor used in WSNs is a combination of sensing, processing and communication technologies. The basic architecture of smart sensor is shown in Fig. 1 Sensing unit is used to detect the changes of parameters in the network, signal conditioning responsible for smoothing the analog electrical signal before it is converted to digital domain. The resultant digital signal is used as the input to the application algorithm or processing unit and then cached in the memory. The transceiver is used to communicate with other sensors or base station (BS) which may act as an internet gateway in WSN.

Network lifetime is a key characteristic to evaluate a sensor network. The effectiveness of WSNs depends on the functionality of all sensors in the network. If the sensor node is active, it proceeds to perform a duty to sense, communicate and process information (temperature, humidity etc). There are two major factors that affect the network lifetime: how much energy it consumes over time and how much energy is available for the particular node.

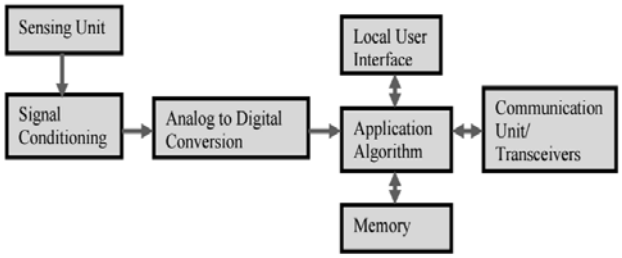

Fig 1: Sensor Architecture

The proposed technique to deal with network lifetime called clustering, which is an important method. Additionally, a good performance WSNs is highly dependent on energy-efficient clustering routing algorithm (Liu, et al., 2010). The development involve a clustering-based hierarchy protocol that optimizes the energy efficiency in WSNs is called Low-Energy Adaptive Clustering Hierarchy (LEACH).

Advantages of wireless sensor networks

Knowing about the advantages of WSNs, it is enough to be conscious of the wide variety of applications where WSNs are present. Typically, WSNs applications involved in some kind of monitoring, tracking, or controlling. Some of the numerous applications and the benefits that WSNs bring are:

i. Environmental Monitoring: watershed management, forest fire prediction or irrigation management. It helps to preserve and maintain the natural resources.
ii. Structural Health and Industrial Monitoring: machinery failure detection. It reduces the maintenance costs and prevents from catastrophic failures.
iii. Civil Structure Monitoring: health monitoring of large civil structures, like bridges or skyscrapers. It prevents from human catastrophes.

iv. Medical Health-care: telemedicine, remote health monitoring. Allows doctors in remote and rural areas to consult with specialists in urban areas, remote handling of medical equipment (tele-surgery), etc.

II. PROPOSED METHODOLOGY

The wireless sensor network a subset of mobile ad-hoc network has lot of challenges to reduce the energy consumption of sensor nodes or wireless nodes to live longer in network and keep communicating with the network. Here we have to work out main areas by which a node can live longer and i.e. either make batteries (source of energy) equipped with nodes having larger in size or the material having larger charges saving capability but this approach having limited capabilities because the larger battery size make sensor node more bulk which is not feasible in any case, and to finding out the material has larger charge storing capability is also tough task to do. Instead doing above things another method is to make transfer of information on network more efficient. For this many routing protocols has been given as we discussed in the previous sections.

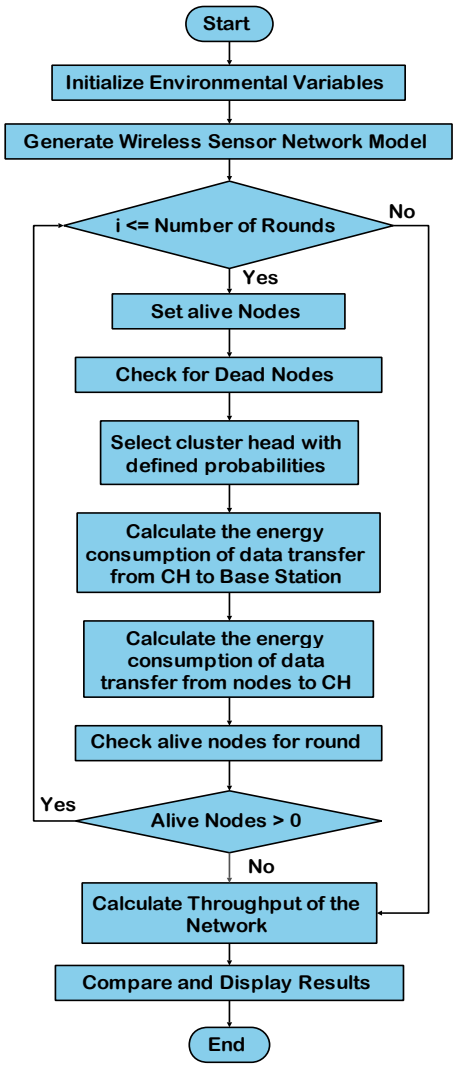

Fig. 3.1 Flow Chart of the Proposed Methodology

III. SIMULATION OUTCOMES

Wireless Sensor Network(WSN) is having lots of research areas to work on and here we have chosen routing protocol to make network life span more than the previous work. The simulation performed on hybrid energy efficient distributed clustering (HEED) which is based on reducing the data aggregation energy. The simulated results are in terms of number of alive nodes and numbers of dead nodes versus number of transmission rounds and packets sent to base station and packets sent to cluster curves.

In existing work life span of the network with Enhanced MODLEACH is calculated up to 3500 transmission rounds. If the network sustain for more number of rounds means life span of the network is going better. In proposed approach the life span of the network reaches more than 3500 rounds in 400x400 network, which is greater than the previous work.

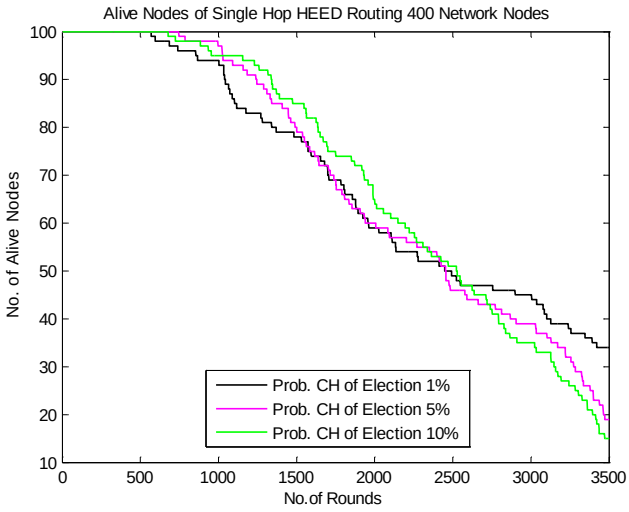

Fig. 4.1 Network Life Time (Alive Nodes vs Rounds) of Proposed Methodology

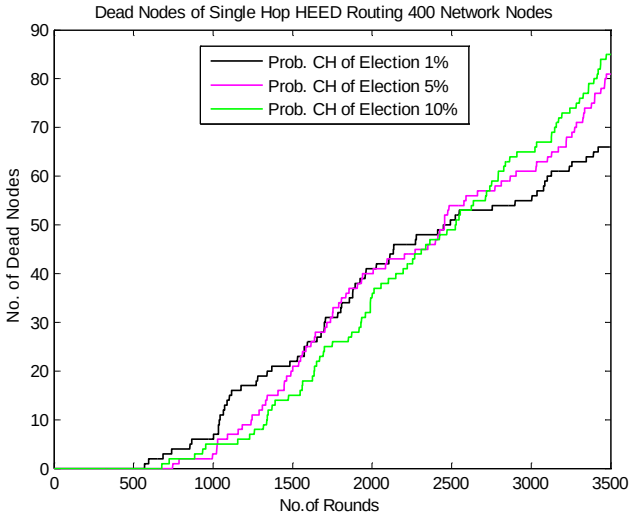

Fig. 4.2 Network Life Time (Dead Nodes vs Rounds) of Proposed Methodology

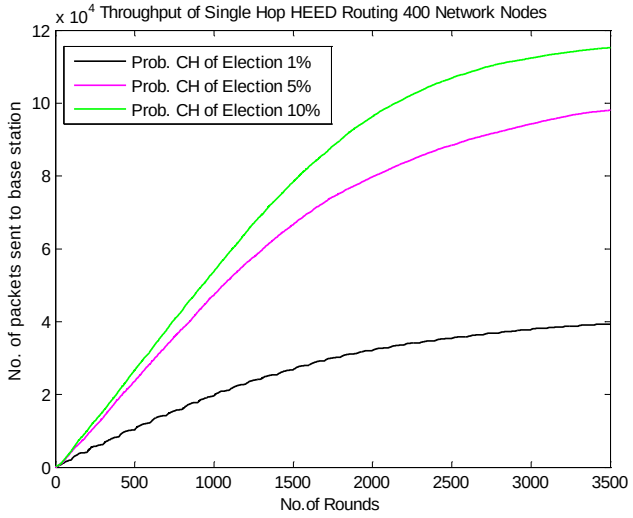

Fig. 4.3 Packets Sent to Base Station of Proposed Methodology

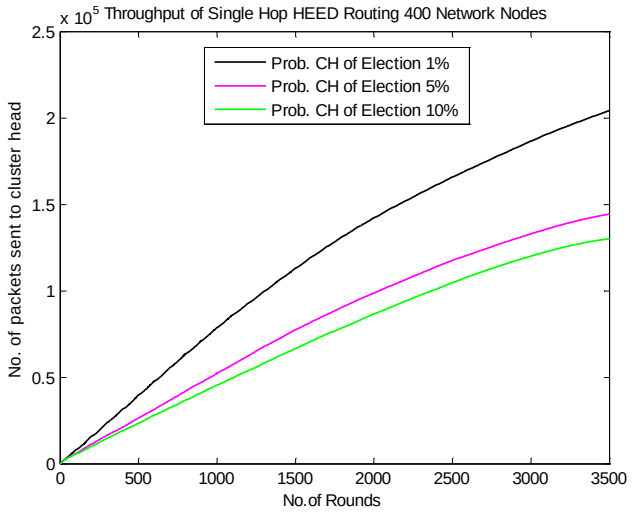

Fig. 4.4 Packets Sent to Cluster Head of Proposed Methodology

IV. CONCLUSION AND FUTURE SCOPE

The wireless sensor network (WSN) is need to be sustain longer to stay with the network, and from the proposed methodology and its simulation results analyzed that with the lower election probability of cluster head in the hybrid energy efficient distributed clustering (HEED) routing will have longer network lifetime which is higher than the existing methodologies. During simulation of proposed methodology number of dead nodes versus transmission rounds are calculated and the same for alive nodes and throughput i.e. packets send to base station also calculated for different probabilities and found longer network lifetime (the sensor nodes survived to more number of transmission rounds) with better throughput. With the analysis of other network parameters like network area, initial energy etc. researcher will make out something more robust routing protocols which have lower energy consumption and higher network lifetime.

REFERENCES

[1] Arabi, Z., HERF: A hybrid energy efficient routing using a fuzzy method in Wireless Sensor Networks, *Intelligent and Advanced Systems (ICIAS), 2010 International Conference on* , vol., no., pp.1,6, 15-17 June 2010.

[2] W. R. Heinzelman, A. Chandrakasan, and H. Balakrishnan, Energyefficient communication protocol for wireless microsensor networks, Proceedings of the IEEE Hawaii International Conference on System Sciences, pp. 1–10, Maui, HI, USA, January 2000.

[3] Ahmad, A.; Latif, K.; Javaid, N.; Khan, A.; Qasim, U., "Density controlled divide-and-rule scheme for energy efficient routing in Wireless Sensor Networks," in Electrical and Computer Engineering (CCECE), 2014 26th Annual IEEE Canadian Conference on , vol., no., pp.1-4, 5-8 May 2014.

[4] Katiyar, V., Chand, N., Gautam, G.C., Kumar, A., Improvement in LEACH protocol for large-scale wireless sensor networks, *Emerging Trends in Electrical and Computer Technology (ICETECT), 2011 International Conference on* , vol., no., pp.1070,1075, 23-24 March 2011.

[5] Chand, K.K., Bharati, P.V., Ramanjaneyulu, B.S., Optimized Energy Efficient Routing Protocol for life-time improvement in Wireless Sensor Networks, *Advances in Engineering, Science and Management (ICAESM), 2012 International Conference on* , vol., no., pp.345,349, 30-31 March 2012.

[6] Bista, R., Yong-ki Kim, Jae-Woo Chang, A New Approach for Energy-Balanced Data Aggregation in Wireless Sensor Networks, *Computer and Information Technology, 2009. CIT '09. Ninth IEEE International Conference on* , vol.2, no., pp.9,15, 11-14 Oct. 2009.

[7] Lindsey, S. Raghavendra, C. and Sivalingam, K, M. Data gathering in Sensor Networks using the energy delay metric, IEEE transactions on parallel and distributed systems, Vol. 13, No. 9, pp 924-935, 2002.

[8] W. Heinzelman, A. Chandrakasan, H. Balakrishnan, An application specific protocol architecture for wireless microsensor networks, IEEE Trans. Wireless communication, vol.1, no.4, pp 660-670, Oct. 2002.

[9] S. Lindsey and C. S. Raghavendra, PEGASIS: power efficient gathering in sensor information systems, Proceedings of the IEEE Aerospace Conference, Big Sky, MT, USA, pp 1125-1130, March 2002.

[10] A. Manjeshwar and D. P. Agrawal, APTEEN: a hybrid protocol for efficient routing and comprehensive information retrieval in wireless sensor networks, Proceedings of the 2nd International Workshop on Parallel and Distributed Computing Issues in Wireless Networks and Mobile Computing, Ft. Lauderdale, FL, USA, April 2002.

[11] A. Manjeshwar and D. P. Agrawal, TEEN: a protocol for enhanced efficiency in wireless sensor networks, Proceedings of the 1st International Workshop on Parallel and Distributed Computing Issues in Wireless Networks and Mobile Computing, San Francisco, USA, April 2001.

[12] Yanwei Wu, Xiang-yang Li, Mo Li, Wei Lou, Energy-Efficient Wake-Up Scheduling for Data Collection and Aggregation, *Parallel and Distributed Systems, IEEE Transactions on* , vol.21, no.2, pp.275,287, Feb. 2010.

[13] Tyagi S, Kumar N. A systematic review on clustering and routing techniques based upon LEACH protocol for wireless sensor networks, Journal of Network and Computer Applications, Elsevier, Vol. 36, issue 2, 2013, pp 623-645.

[14] S.Mohanty and S.K.Patra, ―A novel Bio-inspired Clustering algorithm for Wireless Sensor Networks,‖ *accepted in 3rd International Conference on Intelligent and Advanced Systems*, Kuala Lumpur, Malaysia *(ICIAS 2010).*

[15] D. J. Cook and S.K. Das, Smart Environments: Technologies,Protocols, and Applications, John Wiley, New York, 2004.