2581-4575
International Journal For Recent Developments in Science & Technology
Crossref
A Peer Reviewed Research Journal

ENERGY EFFICIENT LINK-DELAY AWARE ROUTING IN WIRELESS SENSOR NETWORKS

#1SIRIKONDOJU SUNAYANA, #2P.VENKATESHWAR RAO

[1]M.TECH STUDENT, DEPARTMENT OF CSE,SCIENT INSTITUTE OF TECHNOLOGY,IBRAHIMPATNAM, RANGAREDDY,T.S.

[2]ASSISTANT PROFESSOR, DEPARTMENT OF CSE, SCIENT INSTITUTE OF TECHNOLOGY,IBRAHIMPATNAM, RANGAREDDY,T.S.

Abstract:-Wireless Sensor Networks (WSNs) are recently spread widely because of their practical use in different applications and areas; this led to ubiquity wireless sensor networks everywhere. Energy consumption is considered as the biggest challenge to determine the WSNs lifetime, due to the limited power source in the batteries that are integrated into these sensor nodes. This paper proposes a new routing protocol based on BFS algorithm. In this paper, we present brief description and evaluation of different energy aware routing protocols for wireless sensor networks. This can be accomplished by using a range of methods like apply residual energy, placing inactive node in to the sleeping mode, adaptive energy or transmission range which not alone improves the network survivability but also improves wireless sensor network performance.

Keywords: Energy Aware Routing, Network Lifetime, power consumption.

I. INTRODUCTION

Energy efficiency is one of the significant factors for wireless sensor networks. Although energy harvesting from environment is also potential in some applications. But the focus is on sensor nodes with non rechargeable batteries. Due to restricted energy resources and constraint of long operation time, modern communication techniques need to be developed that consider to reduce energy in efficiencies in all networking layers. In wireless communication, communication needs supplementary power than data processing. additional the nodes transmitting more will be battery consumption. So to lessen data redundancy data aggregation techniques are used. There are two categories of data aggregation techniques.

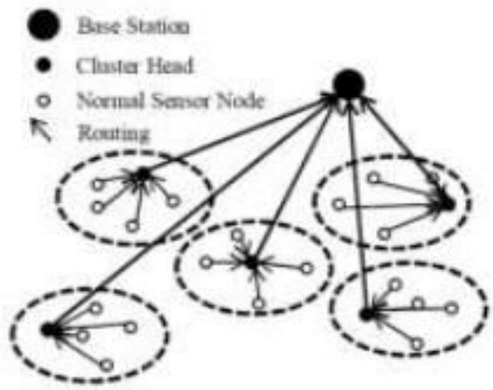

Fig 1: WSN Node Clustering

The first category aggregates the data gathered from different sources and then sends the final data. The second category merges the data from different sources beneath single header and sends it to the sink node. This header packet consolidates and passes it to the base station devoid of any variation to the original data from the sensors. Therefore accuracy is improved

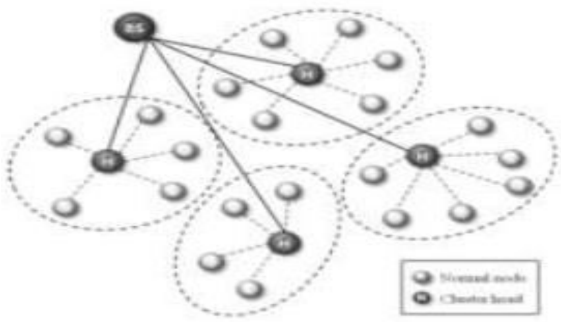

Fig 2: Power Efficient Gathering in Sensor Information Systems

II. RELATED WORK

In recent years, many studies focus on solving the problem of energy saving in WSNs. An energy-efficient adaptive clustering routing algorithm for WSNs was proposed by Jia et al. [2] in order to overcome the drawbacks with the CHs in LEACH [1], such as over-accumulated energy consumption, irrational distribution, none-optimal proportion. Authors provide the improved CH-electing threshold, CH location regulating algorithm and Multi-hop routing algorithm inter-cluster in order to balance the total energy consumption, but also prolong the network lifetime. However, it is not concerned about the network delay. In order to reduce the number of relay nodes between the source node and the BS, Kajikawa et al. [6] proposed a gridbased routing protocol which divides the network area for square cells by using cell rotational technique. Each cell is divided into multiple sub-cells, and assumes one or two sub cells to be active-cells. Then, it demarcates the existing area of active nodes to each active-cell. It reduces the delay of data delivery and the energy consumption. However, its main drawback is that each data source has overhead to exactly compute their location using unique geographical coordinates and proactively build a grid structure. DEAR (Delay-bounded Adaptive Energy-constrained Routing) [7] is multi-path routing protocol. It is interested in many parameters such as reliability, delay and energy consumption. This protocol allows packets are continuously distributed across the network even if the paths are going to crash (turning to other paths). It balances the delay between the different paths by providing a polynomial-time algorithm for solving multi-objective optimization problem. However, energy and network delay efficiency is limited for the complexity of algorithm.

III. PROPOSED METHOD

In wireless sensor network routing protocols classified into three approaches of routing protocols, which are hierarchical-based routing protocol, location-based routing protocol, and flat-based routing protocol. In this paper, the proposed Aware-Routing protocol based on Best First Search algorithm (AR-BFS) will be considered in flat-based approach, because it is more suitable than other routing protocols for the proposed topology and structure, especially for particular applications such as event detection. Data transmission arrives at the base station through multi-hop communication paradigm (the final destination will not be reached directly, the number of sensor nodes could be used to route any sensed data to the base station). AR-BFS will control this transmission in the routing process through applying multivariable heuristic function for each hop in the path. Figure 4 below shows the

2581-4575
International Journal For Recent Developments in Science & Technology
Crossref
A Peer Reviewed Research Journal

difference between Single-Hop and Multi-Hop communication.

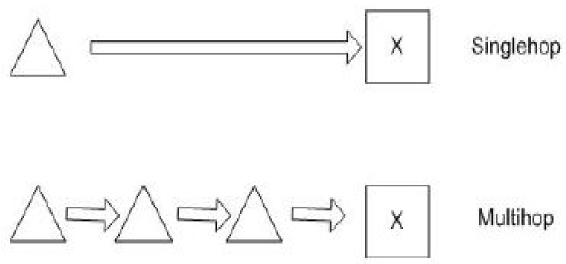

Fig :3 Single and multi hop communication

When a sensor node wants to transmit a message, it selects the next hop from the list of active neighbour nodes using BFS algorithm, choosing a suitable heuristic in BFS is crucial, as bad heuristic will lead to low system performance and system short lifespan.

The proposed heuristic is a multivariable heuristic function (parameters) that will determine the selection process of the sensor node to participate in the path which is composed of three metrics in the WSN, which are

1. The Straight Line Distance (SLD) which is the straight distance from the current node to the base station (sink node), also, SLD is previously known, fixed value, and describes the node value (goodness of the node, when the node far from base station the value will be high and the opposite is true).

2. The amount of energy at each sensor node, this value is updated frequently from the base station, which means that weak nodes will not participate in path to avoid link break, and finally the threshold for the minimum amount of energy that must be available for each sensor node to be included in the path, the threshold is computed by the base station each time it receives a message.

Next Figure 5 shows how each node applies the multivariate heuristic to decide the next node among neighbours, where the node on the right below the threshold and thus ignored.

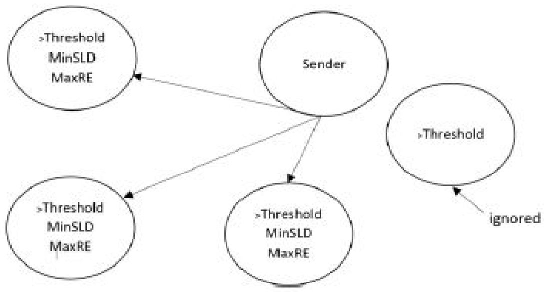

Figure 5. Heuristic example.

Taking all these parameters into account will be the only factor to select next node that will participate in the multi-hop process, the SLD value is fixed, the residual energy for the current node will be added to the message to inform the base station an updated information about the residual energy for this node.

IV. ALGORITHM

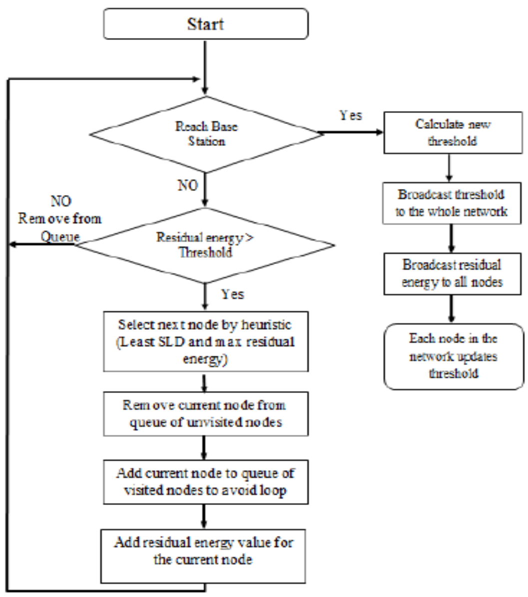

Figure .6.Proposed flow chart

Next is the AR-BFS Algorithm.

Algorithm 2: AR-BFS.

Start

If not (reach destination) then
If (Residual energy > Threshold) then
Select next node: heuristic (Lowest SLD and max residual energy)
Remove current node from queue of unvisited nodes.
Add current node to the queue of visited nodes to avoid
loop
Add residual energy value for the current node
Else (Remove from the queue) and go to line 2
Else
Base station calculate threshold from the received

message

Broadcast threshold to the whole network
Broadcast residual energy to all nodes
Each node in the network updates threshold.

V. RESULTS

To prove the correctness of the proposed protocol, an intensive simulation was conducted using Matlab R2017a which presents an interactive environment for WSN; the comparison included transmission delay, throughput, and packet delivery ratio.The AR-BFS was compared with OLSR and LASeR protocols [5], the simulation environment and parameters used in [5] were adopted to create same conditions and same experiment for the LASeR.

The number of nodes used in the simulation is 100nodes, randomly distributed; all nodes have equal power at the start of the experiment.

Figure7 shows the results for the end to end delay simulation between OLSR, LASeR, and AR-BFS were AR-BFS achieves less delay than the other protocols as it visits only the un-visited nodes after applying the heuristic, which limits the options for the multi hop when selecting next node and thus reduces the delay, while LASeR tries to find a suitable route by discovering multi-paths which need more time to achieve.

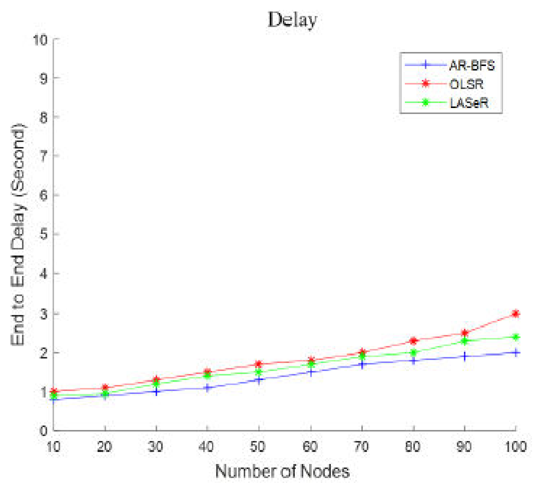

Figure 7. End to end delay.

Figure 8 represents the results of the throughput; were OLSR, LASeR achieves almost the same performance. However, AR-BFS achieves better throughput in the dense network as it has better awareness, and thus better decisions and better performance, it is worth noting that selecting next node in AR-BFS is carefully done and this means that only nodes who can receive and send the message to the next node to reach the destination are selected while the other protocols didn't consider this case.

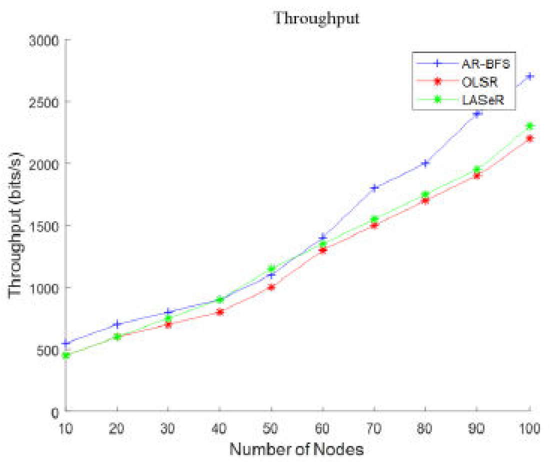

Figure8. Throughput

VI. CONCLUSION

This paper proposed an Aware-Routing protocol based on Best First Search algorithm; this protocol used the multivariable heuristic function in the process of selecting the next hop communication path. AR-BFS computes an optimized route to transmit the packets from any sensor node in the network to the base station (sink node).Since the data are transmitted using an optimal route, the required energy for this transmission will be minimized; thus, the wireless sensor network lifetime is maximized. Also, the reliability of the system and average of packet delivery rate will be increased.

Simulation results show that the AR-BFS achieves better performance than OLSR and LASeR protocols. In the future work, another artificial intelligence algorithms will be tested like: A* or Knapsack to test the system performance.

REFERENCES

[1] Agarkar P. and Kodole A., "A Survey of Routing Protocols in Mobile Ad Hoc Networks," Multidisciplinary Journal of Research in Engineering And Technology, vol. 2, no. 1, pp. 336-341, 2015.

[2] Attea B. and Khalil E., "A New Evolutionary Based Routing Protocol for Clustered Heterogeneous Wireless Sensor Networks," Applied Soft Computing, vol. 12, no. 7, pp. 1950-1957, 2012.

[3] Biswas K.., Muthukkumarasamy V., Sithirasenan E., and Singh K., "An Energy Aware Heuristic-Based Routing Protocol in Wireless Sensor Networks," in Proceedings of the 17th International Conference on Computer and Information Technology, Dhaka, pp. 53-58, 2014.

[4] Contreras W. and Ziavras S., "Wireless Sensor Network-Based Infrastructure Damage Detection Constrained by Energy Consumption," in Proceedings of the IEEE 7th Annual Ubiquitous Computing, Electronics and Mobile Communication Conference, New York, pp. 1-7, 2016.

[5] Hayes T. and Ali F., "Location Aware Sensor Routing Protocol for Mobile Wireless Sensor Networks," IET Wireless Sensor Systems, vol. 6, no. 2, pp. 49-57, 2016.

[6] Huang X. and Fang Y., "Multiconstrained QoS Multipath Routing in Wireless Sensor Networks," Wireless Networks, vol. 14, no. 4, pp. 465-478, 2008.

[7] Hussein A. and Samara G., "Coordinator Location Effects in AODV Routing Protocol in ZigBee Mesh Network," International Journal of Computer Application, vol. 127, no. 8, pp. 975-8887, 2015.

[8] Kiani F., Amiri E., Zamani M., Khodadadi T., and Abdul Manaf A., “Efficient Intelligent Energy Routing Protocol in Wireless Sensor Networks,” International Journal Distributed Sensor Networks, vol. 11, no. 3, 2015.

[9] Kiani F., “AR-RBFS: Aware-Routing Protocol Based on Recursive Best-First Search Algorithm for Wireless Sensor Networks,” Journal of Sensors, vol. 2016, pp. 1-10, 2016.

[10] Kumar A., Ovsthus K., and Kristensen L., “An Industrial Perspective on Wireless Sensor Networks-A Survey of Requirements, Protocols, and Challenges,” IEEE Communications Surveys and Tutorials, vol. 16, no. 3, pp. 1391-1412, 2014.

[11] Lin H. and Uster H., “Exact and Heuristic Algorithms for Data-Gathering Cluster-Based Wireless Sensor Network Design Problem,” IEEE/ACM Transactions on Networking, vol. 22, no. 3, pp. 903-916, 2014.

[12] Luo J., Hu J., Wu D., and Li R., “Opportunistic Routing Algorithm for Relay Node Selection in Wireless Sensor Networks,” IEEE Transactions on Industrial Informatics, vol. 11, no. 1, pp. 112-121, 2015.

[13] Maheen N., “Efficient, Least Cost, Energy-Aware (ELCEA) Quality of Service Protocol in Wireless Sensor Networks,” International Journal of Science and Research, vol. 3, no. 6, pp. 442-448, 2014.

[14] Majumdar S., Pattanaik M., and Alamelu J., “Energy Efficient Wireless Sensor Network For Polyhouse Monitoring,” European Journal of Advances in Engineering and Technology, vol. 2, no. 6, pp. 77-82, 2015.

AUTHOR'S PROFILE:

[1]. **N. SOUJENYA,** Pursuing *M.Tech in CSE* **at** Scient Institute Of Technology, Ibrahimpatnam, Rangareddy, T.S.

[2]. Mr.P.Venkateshwar Rao, He pursued his B.Tech in MTCET from JNT University Hyderabad, M.Tech Computer Science and Engineering from JNT University Hyderabad, He is currently working as Asst Prof in the Department of CSE at **Scient Institute of Technology Ibrahimpatnam**. He has 3 years of Academic experience. He Attended Many Workshops in different areas.