

# Improving the Power Efficiency in WSN using Advanced Multi-Hop Protocol



V.Manikandan, M. Sivaram

**Abstract:** This paper uses a hybrid strategy to effectively manage energy consumption by the sensor nodes present in Wireless Sensor network (WSNs). With the dynamic routing protocol, the paper's goal is to increase network lives. The proposed Advanced Multi-Hop (AMH) protocol, routing algorithm incorporates the interaction between multi-hops and direct transmissions. This method also uses the Dijkstra algorithm for routing the data packets in the mobile network between the base station and sensor nodes. This system eliminates the power of other nodes by using a central router. Different results of the proposed method have been checked. The comparison of other existing methods shows that AMH achieves lower network life and better network performance.

**Keywords:** Dijkstra Protocol, Least-Hop Routing, Wireless Sensor Network.

## I. INTRODUCTION

Effective use of wireless network (WSN) sensor nodes to increase energy consumption has been one of the latest trends in current research in recent years [1]. Node routing at the WSN plays an important role in energy consumption. For most scientists, therefore, an energy-efficient routing protocol is seen as a key objective to achieving reduced network resource uses. Two types of traditional techniques can be categorized into direct and multi-hop transmissions. Data is sent from nodes directly to the base station indirect transmission. As the range increases and thus far the nodes consume greater power, transmission costs increase exponentially. This means that the nodes on the network consume greater energy and contributes to unnecessary depletion of the battery. The use of multihop communication eliminates this issue when the nodes operate together through the exchange of packets through intermediate nodes. It splits the range into smaller portions across the whole network. Although the multihop software uniformly distributes the transmission costs between the sensor nodes, the minimum energy consumption is not certain. Therefore, the overall cost of energy for multi-hop transmission is lower than the direct one [2]. In addition, there are several protocol studies aimed at reducing network power usage. Such protocols have also

been modified to boost node residual power [9,11,12]. The length of the network is therefore increased by increasing the energy variation of the node.

In [1-10] these techniques address the methods for maximizing the existence of WSN nodes. Through extended network life, they achieve greater energy efficiency in WSN. The engineering employs the same techniques as in traditional literature, however, in more or less the above methods. The lifespan of the network is much less time consuming than sending the messages. The suggested solution was designed to use a hybrid mechanism to maximize the network's longevity and energy efficiency to overcome these limitations.

The proposed method uses AMH with Dijkstra's path establishment algorithm to achieve improved lives in WSN. This algorithm blends direct transmission with multi-hop transmission for the close nodes and far nodes. The energy consumption in the network is minimized by balancing the nodes in the network. This improves the network life through direct and multi-hop transmission, with reduced network power costs.

## II. PROPOSED METHOD

The approach proposed uses the revised Dijkstra protocol for improving energy efficiency in the multi-hop environment and for network load balancing. The use of the proposed algorithm for the routing of sensor nodes is discussed here. The main objective is to maximize the network's lifespan, i.e. until death, of the sensor nodes. The system used to transfer packets from sensor nodes to base stations is centralized. There are three phases of time for the proposed algorithm: beginning, setting up and constant state stage. The entire operation includes two phases, in the initial phase and in the second phase there are two parts, including the installation and the permanent stages.

### A. Initiation phase

After the sensor nodes deployment, the activation phase begins. In order to auto-identify, the basic station transmits a message to all nodes. In order to authenticate within the network that consists of a control packet, the sensor nodes address the message request. The data packet is said to have position value and initial power value. The base station tends to use the node position to cluster the nodes which are separated according to distance ( $d_i$ ) from the base station nodes. The network structure using the protocol suggested.

The nodes inside the surrounding node if  $d_i < d_{char}$  (distance that uses direct transmission or multi-hop transmission and vice versa). When the distance  $< d_i$ , Multihop transmission is used and, if the distance  $> d_i$ , direct

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transmission takes place. When the distance is less than  $d_i$ . It is entirely dependent on the model factor,

$$d_{char} = \sqrt{\frac{-b + \sqrt{b^2 - 4ac}}{2a}} \quad (1)$$

Where,

$b = -0.5$

$a = \epsilon_{mp}$ ,

$\epsilon_{fs}$ ,  $c = -2E_{elec}$ .

$\epsilon_{fs}$  is the free space loss coefficient,

$\epsilon_{mp}$  is the multipath loss coefficient,

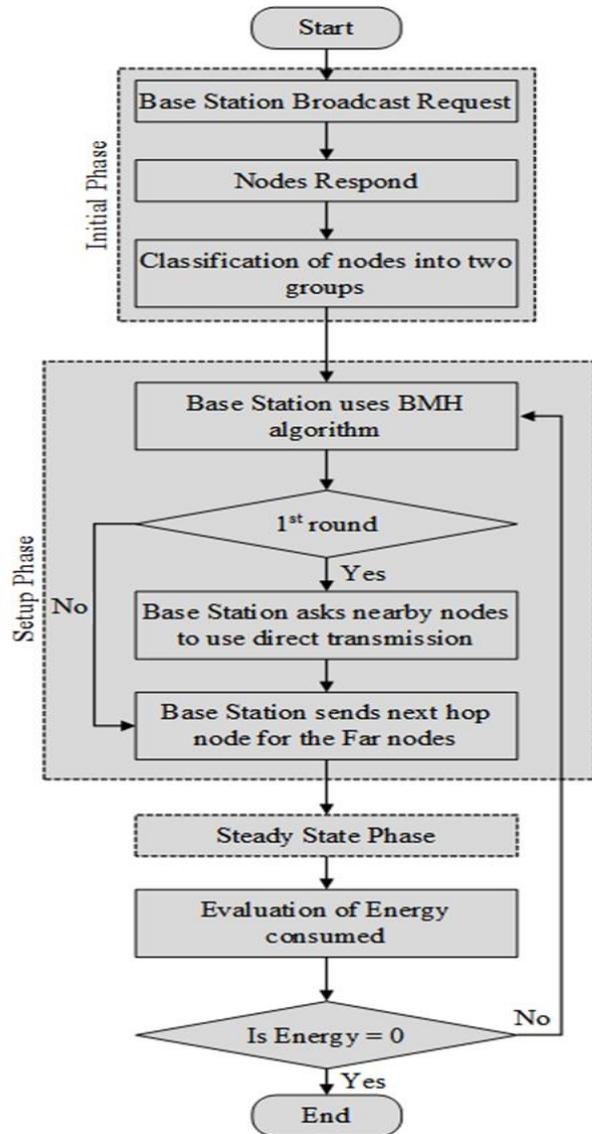
$E_{elec}$  is the consumed energy per bit.

## B. Setup phase

The best paths for sensor data transmission to the base station is allocated during this process. The weight matrix here is constructed by means of the power level and the information about the location on the network nodes. This is used by the base station to determine the optimal route to its base station from each sensor node using the Dijkstra algorithm. When the node paths are identified, the base station will notify all nodes of the paths. With the hop-node nearby, the sensor nodes construct and update the routing table. Far nodes for the next rounds are also added to the routing table. The direct transmission, however, is used by close-knots and therefore the routing table specification is not specified here. This well eliminates energy consumption costs when setting up and modifying the routing table for adjacent nodes.

## C. Steady-state phase

The nodes connected to the energy levels can be moved to the following hop nodes. The data packets travel through the nodes that are intermediate between the source and destination before they finally reach the base station. The data about the energy is collected after the packets are received by the base station. The energy data is therefore modified in the weight matrix. All of the network nodes are mirrored, and this is shown in Figures 1 and 2 as a flowchart.



**Fig. 1. Flowchart of the Proposed Protocol**

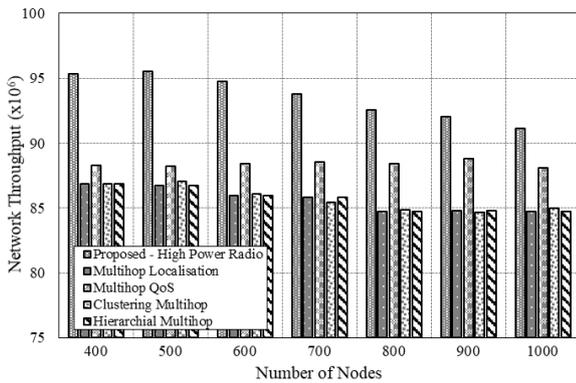
## III. EVALUATION AND DISCUSSIONS

A battery unit is used for testing the proposed method using the sensor nodes on the simulator. The nodes are flexible and are periodically awoken by the message of each cluster head. In a 1000 x 1000 m<sup>2</sup> field, the analysis uses 24 nodes. The sink node is located from the origin nodes at the nearest location. Table.1 contains the simulation parameters.

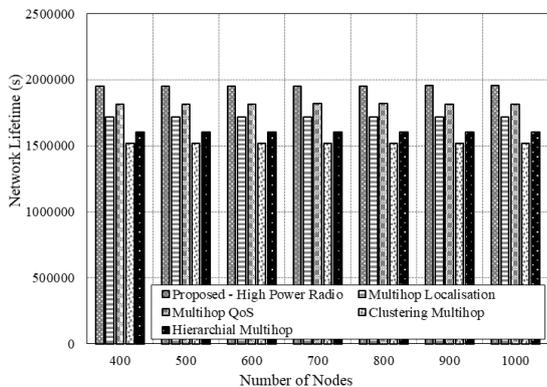
High-energy nodes send a control message and this advertised nodes excepts reply from other sensor nodes and also the other nodes available in the network responds to the control message. The high power knots from the surrounding nodes are the cluster heads for the high power knots. Therefore the node will be allocated an Id and the destination node will thus be set for packet transmission. The path is specified by the proposed algorithm and it is used for simulation purposes.

**Table- I: Simulation Parameters**

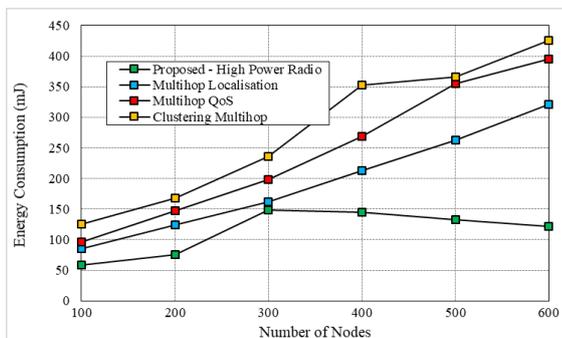
Parameter	Value
Size of the cluster	1000 × 10000 m <sup>2</sup>
Propagation limit	-100 dB
Propagation Space	Free Space
Protocol Type	802.11
Data rate	2.4 Mbps
Packet size	5000 bits
Traffic Type	CBR
Message size	1000 bits



**Fig. 2. Network Throughput**



**Fig. 3. Network Lifetime**



**Fig. 4. Energy Consumption**

With the aid of direct communication taking place with the sensor nodes that are near to each other and multimedia communication taking place with far nodes, the proposed

method reduces the capacity of transmission.

The study by conventional methods of the proposed routing system is shown in Figures 2, 3 and 4. Figure 2 shows the network throughput between the proposed method and the standard one. Figure 3 shows the lifetime and the Figure 4 shows that energy consumption has well declined compared to conventional technology using the proposed process. Direct and multi-hop transmission is used for this purpose. The life of the Network was therefore significantly increased by using this hybrid mode between the original and dead times of each node. Therefore, it is useful to route the route through which the proposed algorithm is more efficient than other traditional algorithms in terms of the network through which the frequency of transmission of the proposed algorithm is shown in Figure 4, respectively.

**IV. CONCLUSION**

In this post, the Dijkstra algorithm uses a hybrid direct and multihop dynamic system to effectively route packets. The method uses three steps to minimize electricity consumption in the network by close or far knots. The main concern here is reliability to achieve improved network life. The algorithm proposed selects the path between source and destination nodes in an optimal way with Dijkstra. The results of the simulation show that the network's efficiency is enhanced to a greater extent with AMH protocol. Therefore, testing of the proposed system in intercluster interaction in WSNs will extend the job.

**REFERENCES**

1. Wang, J., Niu, Y., Cho, J., & Lee, S. (2007, December), "Analysis of energy consumption in direct transmission and multi-hop transmission for wireless sensor networks," in *Signal-Image Technologies and Internet-Based System, 2007. SITIS'07. Third International IEEE Conference*, (pp. 275-280). IEEE.
2. Anbukaruppusamy, S., K. Batri, and Erode Gobi. "Explicit Congestion Control With Buffer Management For Multihop Adhoc Networks." *Life Science Journal* 10.2 (2013).
3. Nagayama, T., Ushita, M., & Fujino, Y. (2011), "Suspension bridge vibration measurement using multihop wireless sensor networks," *Procedia Engineering*, 14, 761-768.
4. Wang, J., Cho, J., & Lee, S. (2008, April), "Experimental study of energy consumption in direct transmission and multi-hop transmission for wireless sensor networks," in *Networking, Sensing and Control, 2008. ICNSC 2008. IEEE International Conference on IEEE*, (pp. 1179-1184).
5. Batri, K. "S. Anbu karuppusamy,"Improving TCP Performance in Ad-Hoc Networks". European Journal of Scientific Research 65.2 (2011); 237-245.
6. Shah, S., & Beferull-Lozano, B. (2013), "Joint sensor selection and multihop routing for distributed estimation in ad-hoc wireless sensor networks," *IEEE Transactions on Signal Processing*, 61(24), 6355-6370.
7. Elappila, M., Chinara, S., & Parhi, D. R. (2018), "Survivable path routing in WSN for IoT applications," *Pervasive and Mobile Computing*, 43, 49-63.
8. Selvi, M., Logambigai, R., Ganapathy, S., Ramesh, L. S., Nehemiah, H. K., & Arputharaj, K. (2016, August), "Fuzzy temporal approach for energy efficient routing in WSN," in *Proceedings of the international conference on informatics and analytics*, (p. 117). ACM.
9. Singh, A., Rathkanthiwar, S., & Kakde, S. (2016, April), "Energy efficient routing of WSN using particle swarm optimization and V-LEACH protocol," in *2016 International Conference on Communication and Signal Processing (ICCSP)*, (pp. 2078-2082).



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10. Shah, N. F., Gautam, S., & Gosain, D. (2016, August), "EERA: Energy efficient reliable routing algorithm for WSN," in *2016 1st India International Conference on Information Processing (IICIP)*, (pp. 1-5).
11. Sun, Z., Zhang, Z., Xiao, C., & Qu, G. (2018), "DS evidence theory based trust ant colony routing in WSN," *China Communications*, 15(3), 27-41.
12. Karuppusamy, S. Anbu, and K. Batri. "Improving the performance of TCP in Ad hoc networks based on signal strength and buffering system." *Journal of Applied Sciences Research* 8.5 (2012): 2554-2563.