ANALYSIS AND IMPROVED NOVEL ALGORITHEM FOR ENERGY EFFICIENT ROUTING PROTOCOL IN WSNS FOR IMPROVE THE NETWORK LIFETIME AND AVERAGE ENERGY CONSUMED BY CLUSTER HEADS SELECTION

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Abstract

A level-based clustering approach protocol has been proposed. A model based on network power level is being developed. We use mathematical formulas to select cluster heads. For this we have copied a developed model in MATLAB. We are providing the number of cluster and network lifetimes, which is the simulation result of the energy consumption of the provided cluster head. Experimentally it is assumed that the energy consumption for each side CH in EERFHS is lower than that of LEACH. For example, after 400 rounds, LEACH consumed about 84 of the initial energy while EERFHS has about 30. The developed model is simulated in MATLAB. Simulation results of energy consumption of cluster heads, clusters, and network duration are provided. Applying heterogeneous networks will enhance the projected theme to optimize the amount of levels with improvements in network energy consumption and network duration.

Keywords: *LEACH-C, MATLAB, WSN, CH, Energy etc.*

Introduction: There has been level based clustering approach protocol proposed. Model based on network power level is being developed. We use mathematical formulas to select the cluster head. For this we have initiated a developed model in MATLAB. We are providing the number of clusters and network lifetime, which is the simulation result of the energy consumption of the cluster head provided. It has been experimentally that the energy consumption for CHs of every one side in EERFHS is less than compared to LEACH. For example, after the 40 rounds, the LEACH consumed the about 84 of the initial energy while in EERFHS is about 30.

Wireless Detector Network (WSN) is especially characterised by its restricted power provide. Hence, protocols designed for WSNs ought to be energy economical. Cluster based mostly routing helps to boost the network life. Centralized Low-Energy adjustive cluster Hierarchy (LEACH-C) is associate energy economical cluster based mostly routing protocol that has shown improvement over Low Energy Adjustive Cluster Hierarchy (LEACH) protocol. A completely unique LEACH-C (LEACH-CN) protocol is planned during this precise that considers the space between the choosen cluster head (CH) and a member node; and also the distance between the member node and Base Station (BS) to transmit information by a member node to CH or bachelor's degree. The planned approach select variety of CHs on the idea of alive nodes within the network, instead of considering total nodes within the network. Simulation results show that LEACH-CN outperforms to LEACH-C, and improves the network life.

Sensor Networks are able to fulfill several purpose of human life however they even have limitation, one and most vital one is its restricted battery power as a result of detector nodes or smaller in size and in most of the cases battery recharging or renewal isn't attainable thus economical utilization of energy resource is very important, Routing in

WSNs consumes the foremost of sensors nodes energy if we have a tendency to are able to create energy protective routing protocol then we'll be able to conserve the significant quantity of energy which can enhance the Network period.

We have instructed Energy protective economical Routing Protocol with Forward Next Hop choice during within which network is split into clusters associate in there's entomb cluster routing between cluster heads with an optimized minimum distance next hop choice which have taken the options of clump and multi-hop we've got conjointly divided the network in numerous transmission level so node will transmit at minimum attainable energy when adjusting its transmission power at the start of cluster formation section. we've got simulated our model in MATLAB and results compared with LEACH and located it higher in terms of Network period and average energy consumed by Cluster Heads.

It has been conjointly ascertained that the clusters shaped in EERFHS are fewer than LEACH. Finally, it's finished that the EERFHS performs higher than LEACH. The projected theme will be extended to optimize the amount of levels to with efficiency consume the energy of network and improve the network period, to implement heterogeneous Network. we've got simulated our model in MATLAB and result's compared with LEACH and located it higher in terms of Network period and average energy consumed by Cluster Heads. The model developed is simulated in MATLAB. The simulation results of energy consumption of cluster heads, numbers of clusters and network period are provided. Projected theme will be extended to optimize the amount of levels to with efficiency consume the energy of network and improve the network period, to implement heterogeneous Network.

Literature Review

Elhabyan, R.; Shi, W.; St-Hilaire, M. (2018) LEACH uses the random rotational approach to select cluster head in such a way that energy depletion is uniform in the network and participation of nodes in the election of cluster heads is in round robin fashion.

S. Chelbi, M. Abdouli, M. Kaddes, C. Duvallet (2016) In Cluster based routing protocols wsn network is divided into clusters. Then cluster head are formed in each cluster. The role of the cluster head is to collect the data from the other nodes present in the cluster and the transmit it to the Sink. Because of this the routing overhead of the node in the cluster is reduced. Some of the cluster based routing protocols are discussed in upcoming sections.

Santar Pal Singh, Subhash Chander Sharma (2017) Every node in direct communication is considered to be in the range of communication to BS and they have the knowledge, which one is the base station. If nodes don't have any idea about base station then BS announces itself by broadcasting a message .

Turki Ali Alghamdi (2020) This paper proposes a new hybrid algorithm that hybridizes the concept of the Dragon Fly and Firefly Algorithm algorithms, called updates instead of Firefly. Finally, the proposed work is performed by comparing it with other traditional models in terms of the number of surviving nodes, network energy, delay and risk probability.

Objective

1. The most important purpose in this thesis is that we have followed our model in MATLAB and its result has been compared to that of the LEACH and we have found it to be a lifetime of the network and we have found the cluster heads better and the cluster heads are more.
2. To improve, the average energy conditions consumed by us have been found to be better. A modified LEACH-C (LEACH-CN) protocol is proposed in this dissertation that considers the distance between the selected cluster head (CH) and a member node; and the distance between the member node and Base Station (BS) to transmit data by a member node to CH or BS.
3. The projected approach selects quantity of CHs on the basis of alive nodes in the network, to a certain extent than considering total nodes in the network. Simulation results show that LEACH-CN outperforms to LEACH-C, and improves the network lifetime. The clustering algorithms are implemented with the goal of concurrently minimizing the intra-cluster distance along with optimizing the custom of network power.
4. Here we test roughly the existing algorithms and we also analyze the results and show the duration of living nodes in supremacy, energy consumption, packet distribution ratio, and system throughput compared to the previous ones. And the simulation result shows that the proposed algorithm improves other existing algorithms.

Research Methodology

Energy-efficient routing with cluster head selection in WSN

The entire protocol is divided into two phases

1. Setup step
2. Inter-cluster routing

Used Energy Model for proposed scheme

The energy model mentioned in [1,2] is being used from here for conversational power dissipation. The transmission energy is rated to transmit 1-bit facts for distance D is calculated as:

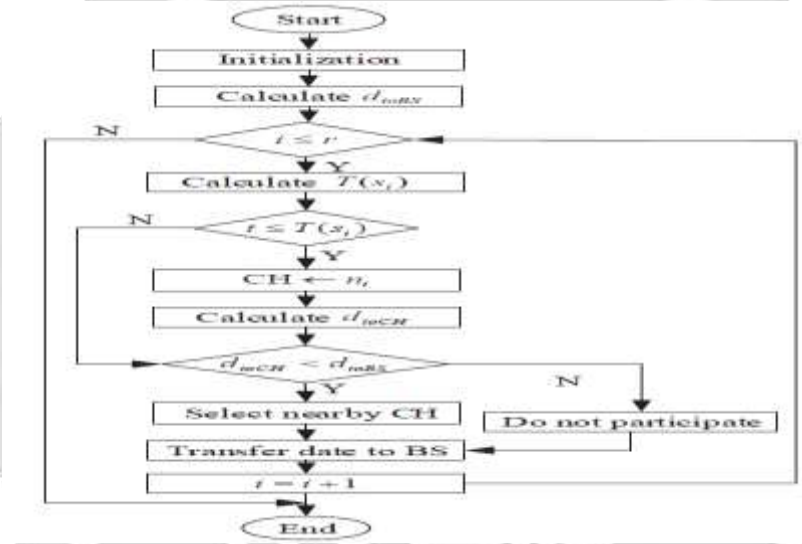
$$E_t(L, D) = \begin{cases} LE_{elec} + L\epsilon_{fs}d^2, D < D_0 \\ LE_{elec} + L\epsilon_{fs}d^4, D \geq D_0 \end{cases}$$

The energy required to receive the same message would be:

ER(L) = LEelec

E_{elec} is the energy consumed to drive the receiver or transmitter amplifier and $\epsilon_{fs}\,d^2$ or $\epsilon_{fs}\,d^4$ is the amplifier energy, depending on the allowable data error rate. In the equation, we can see that achieving the data requires a lot of energy. Thus the number of transmission and receiving must be minimized to maximize energy use.

Figure 1.1: flowchart for proposed Model



Proposed Algorithm

The algorithm for the given scheme can be shown briefly.

Step 1: Get the number of given nodes

Step 2: Will check for given energy level and drain rate

Step 3: Will check for formation of cluster based on given energy level and drain rate

Step 4: Select the cluster head and given more energy and drain rate

Step 5: Implement network coding by implementing EXOR operation between packets to avoid unnecessary data transmission

Step 6: Select the master node from the cluster

Step 7: Reduce the number of data transmission and then do network coding on the master node

Step 8: Packet decoding will be done at the sink node

Step 9: The sink node will check the ID of the native packets one by one.

Result Analysis

The performance of the proposed model is being evaluated by simulation. For simulation, we have used MATLAB and tested the performance of our protocol with LEACH.

The following parameters are kept in mind for performance evaluation:

1 Network Lifetime.

2 Energy consumption of CH.

3 Number of rounds per cluster.

Simulation parameter

The network size is assumed to be 200 m X 200 m and the number of nodes is 200 which are randomly positioned in the sensor area. The base station is located at (80170).
The parameters of our simulation are as follows:

Table 1.1: Simulation parameters

Parameter	Values
simulation Area	200*200
initial Energy	0.2J
Base station	200*200
Transmitter/Receiver Electronics	100 nJ /bit
Efs	200pJ
Ems	0.0026pJ
EDA	10pJ
Number of nodes	200
Data packet size	8000bits
Control packet size	200bits
Number of rounds	400

Lifetime of Network

The time period until the node dies before the start of the simulation is defined as the network life time. The network lifetime results are described in Figure 1.2. It has been concluded that the proposed algorithm improves the lifetime of nodes. With our approach the first nodes survive in the network longer than the LEACH. The result between the number of living and T rounds is shown by Figure 1.2. Results obtained by measuring the time until the first node dies. The node dies for 500 rounds. The first dead node appeared in round 97 for EERFHS, 82 rounds for LEACH, and the last dead node appeared in 446 rounds for EERFHS and in 362 rounds for LEACH. It is observed that EERFHS is much better than the LEACH protocol over the life span of the network.

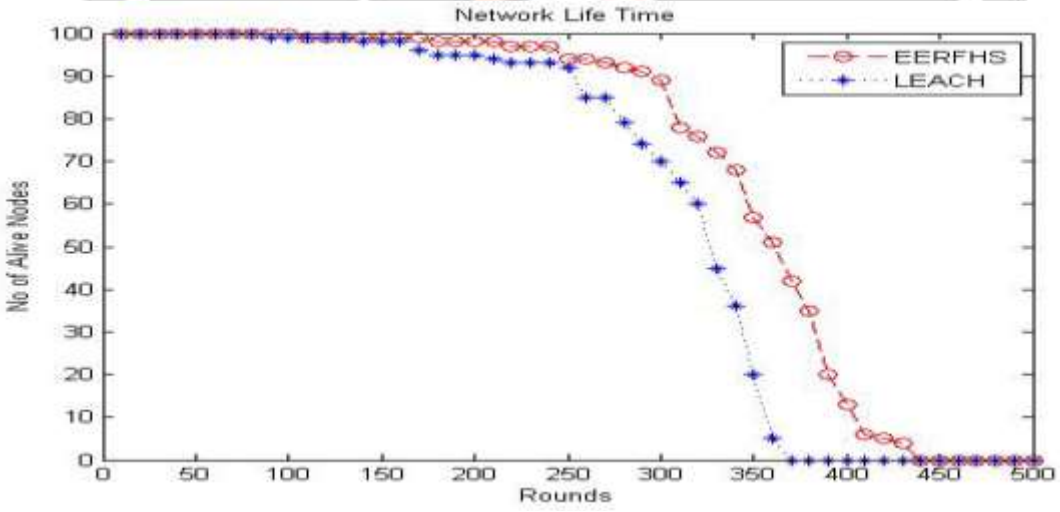


Figure 1.2: Lifetime of Network

Energy consumption of CH

Fig. 1.3 Results for the energy consumed by CHs for 30 rounds in the EERFHS and LEACH protocols. The energy consumption for CHS for each round in EERFHS is much lower than in Lech. This is because in LEACH, CHs send their data in a sigle -hop fashion to BS.Therefore; Energy consumption is high. In EERHS, CHS sends data collected to BS via multihop communication. So a significant amount of energy is left. For example, after 20 rounds, LEACH consumed about 42 initial energies, while about 15 in EERFHS.

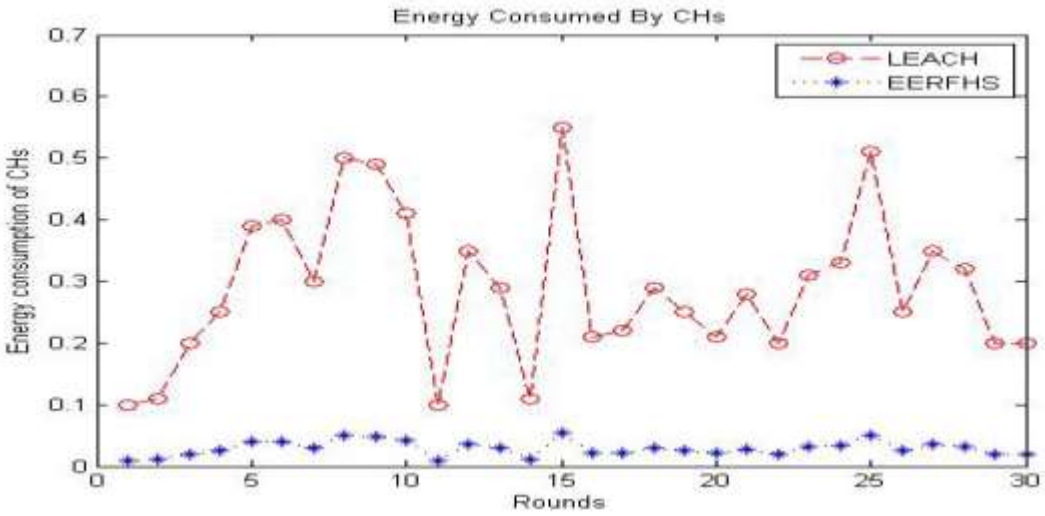


Figure 1.4: Energy Consumption of CHs

Number of clusters per round

Figure 1.5 In EERFHS and LEACH shows the cluster distribution for 30 rounds. It shows that the clusters formed in EERFHS are much lower than in LEER.

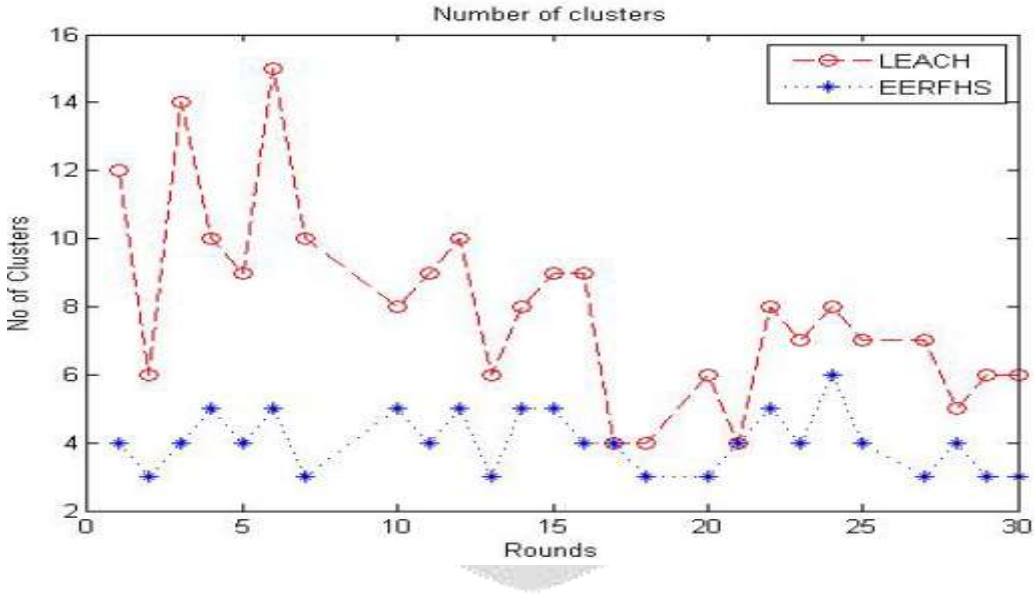


Figure 1.5: Number of Clusters per Round

Number of Alive Nodes per Round

Figure 1.6 shows the number of surviving nodes per squatter for the NDCA and LEACH-ICE algorithms. The figure is clear that the proposed NDCA algorithm achieves better performance than the LEACH-ICE algorithm. The proposed algorithm extended the network life-time by more than 400 rounds compared to LEACH-ICE, which is about 16%. This improvement is due to energy conservation during the clusters setup phase, while LEACH-ICE treats all nodes without discrimination according to the data load of one node, but takes into account the data load of the NDCA nodes; therefore, there is a longer duration of network lifetime than LEACH-ICE.

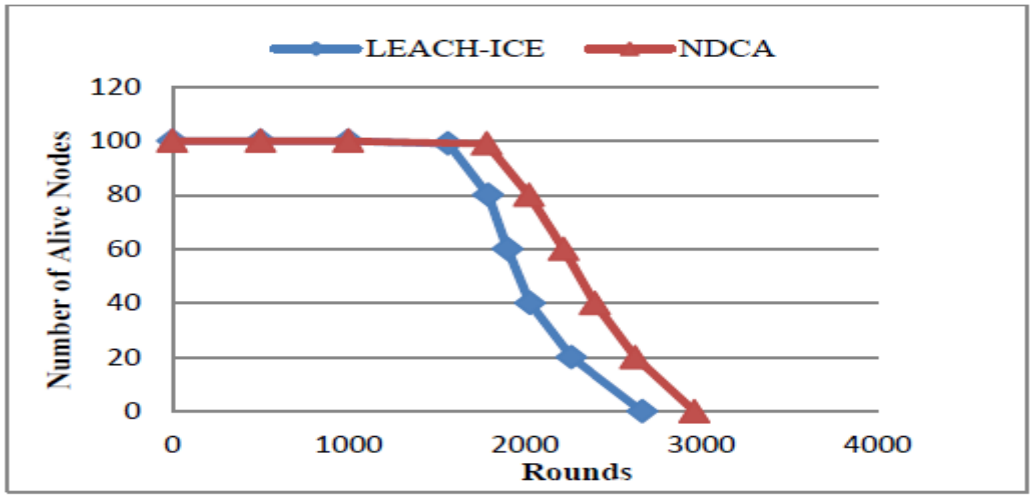


Figure 1.6: Number of Alive Nodes per Round

Average Energy Consumption

Figure 1.7 shows the energy consumption for both the NDCA and LEACH-ICE algorithms. In order to compare the proposed NDCA with the LEACH-ICE algorithm, ten rounds are randomly extracted along the round range. This figure is clear that the NDCA algorithm saves 29% more energy than the LEACH-ICE algorithm. This energy conservation is due to the criterion for CH selection that selects a node that has the minimum number of packets to be selected as CH. Unlike LEACH-ICE which it is based on random distribution of CHs and selection criteria.

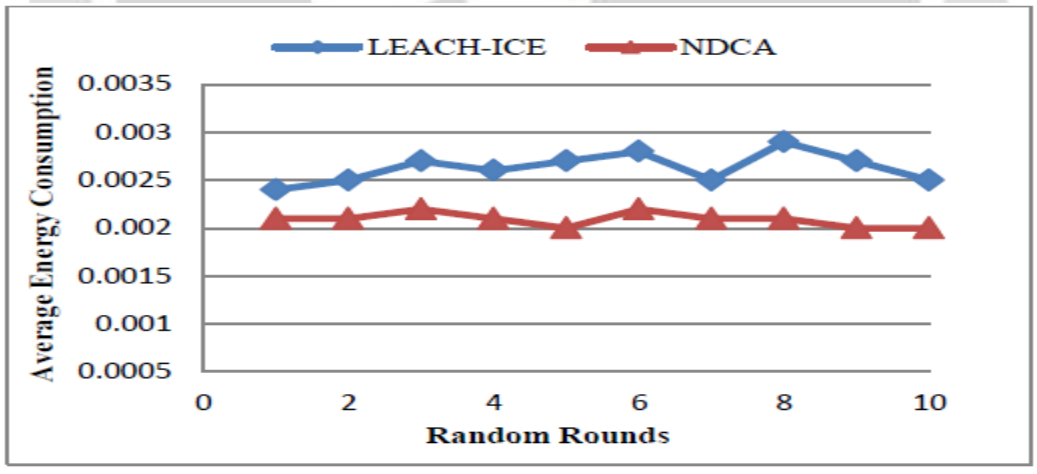


Figure 1.7: Average Energy Consumption

Number of Packets Delivered to Base Station

Figure 1.8 shows the number of packets delivered to BS for the NDCA and LEACH-ICE algorithms. Figure 1.8 shows that the packet received by the NDCA algorithm at the base station is much larger than that received by the LEACH-ICE algorithm. In this term, the proposed NDCA algorithm results in an improvement of up to 30% in the LEACH-ICE algorithm. Improved network cluster head distribution and efficient cluster head selection criteria are the two main reasons for increasing data packets in the NDCA algorithm.

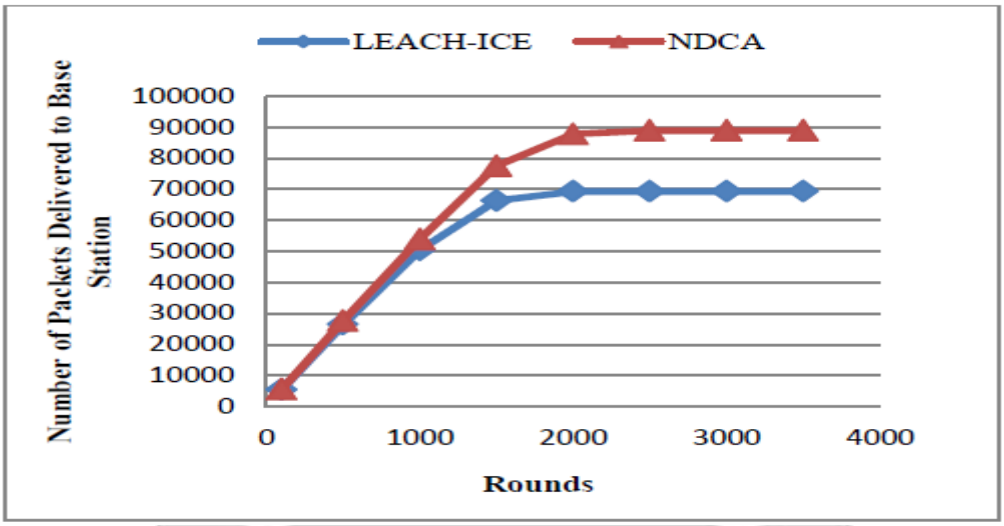


Figure 1.8: Number of Packets Delivered to Base Station

Conclusion and Future Work

In this paper, a level-based clustering approach protocol is proposed. A network model based on power levels is being developed. Mathematical formulas have been provided for choosing cluster heads. The developed model is simulated in MATLAB. Simulation results of the energy consumption of cluster heads, clusters, and network lifetimes are provided. It is observed that the energy consumption for CHs for each round in EERFHS is lower than that for LEACH. For example, after 20 rounds, LEACH consumed about 42 initial energy, while EERFHS is about 15.. It has also been observed that the cluster formed in EERFHS is lower than LEACH. Finally, it is concluded that EERFHS outperforms LEACH. This algorithm selects the node with the minimum data packet to send as CH and the residual energy of the new CH must be higher than the predefined threshold level. In addition, the proposed algorithm divided the network into zones (clusters). A simulation program was created for both the NDCA algorithm and the LEACH-ICE algorithm to evaluate their performance and make comparisons between them. Two different scenarios are used to evaluate the proposed NDCA algorithm. It is concluded from the results, that the proposed NDCA algorithm outperforms the LEACH-ICE algorithm over all performance matrices.

In future research, the proposed scheme can be extended to optimize the number of levels to consume the energy of the network efficiently and to improve the lifestyle of the network to implement heterogeneous lifetimes. There are several important topics such as: introducing clustering technology for wireless sensor networks on cloud computing. It is important to add an intelligent method to secure communication in this filed.

References:

[1]. Turki Ali Alghamdi, Energy efficient protocol in wireless sensor network: optimized cluster head selection model, 16 March 2020, Telecommunication Systems volume 74, pages331–345(2020).

[2]. Moorthi, M., & Thiagarajan, R. (2020). Energy consumption and network connectivity based on Novel-LEACH-POS protocol networks. Computer Communications,149, 90–98.

[3]. Elhabyan, R.; Shi, W.; St-Hilaire, M. A Pareto optimization-based approach to clustering and routing in Wireless Sensor Networks. J. Netw. Comput. Appl.2018, 114, 57–69.

[4]. S. Chelbi, M. Abdouli, M. Kaddes, C. Duvallet, R., Bouaziz, "An unequal cluster based routing protocol based on data controlling for wireless sensor network", International Journal of Electrical and Computer Engineering, Vol. 6, No. 5, pp. 2403-2414, 2016

[5]. Santar Pal Singh, Subhash Chander Sharma "A Novel Energy Efficient Clustering Algorithm for Wireless Sensor Networks" Engineering, Technology & Applied Science Research Vol. 7, No. 4, 2017, 1775-1780, www.etasr.com

[6]. Senouci, M. R., & Mellouk, A. (2019). A robust uncertainty-aware cluster-based deployment approach for WSNs: Coverage, connectivity, and lifespan. Journal of Network and Computer Applications,146, 102414.
[7]. Krishnan, M., Yun, S., & Jung, Y. M. (2019). Enhanced clustering and ACO-based multiple mobile sinks for efficiency improvement of wireless sensor networks. Computer Networks,160, 33–40.
[8]. Radhika, S., & Rangarajan, P. (2019). On improving the lifespan of wireless sensor networks with fuzzy based clustering and machine learning based data reduction. Applied Soft Computing,89, 105610.
[9]. Zhao, B., Ren, Y., Gao, D., Xu, L., & Zhang, Y. (2019). Energy utilization efficiency evaluation model of refining unit based on Contourlet neural network optimized by improved grey optimization algorithm. Energy,185, 1032–1044.
[10]. Vieira, R. G., Cunha, A. M., Ruiz, L. B., & Camargo, A. P. (2018). On the design of a long range WSN for precision irrigation. IEEE Sensors Journal,18(2), 773–780.
[11]. Hintsch, T., & Irnich, S. (2018). Large multiple neighborhood search for the clustered vehicle-routing problem. European Journal of Operational Research,270(1), 118–131.