Nat. Volatiles & Essent. Oils, 2021; 8(6): 3674-3684

NVEO
Natural Volatiles & Essential Oils

# Wireless Sensor Networks - Adaptive Clustering Mechanism For Nodes In Rich Availability Reduce The Communication Overhead In Clutser Heads

**BODLA KISHOR[1] , Dr. BIRRU DEVENDER[2] , Dr. S. K. YADAV[3]**

[1]Research Scholar, Shri Jagdishprasad Jhabarmal Tibrewala University, Jhunjhunu.

[2]Associate Professor, Dept. CSE Holy Mary Institute of Technology & Science, Telangana.

[3]Research supervisor, Shri Jagdishprasad Jhabarmal Tibrewala University, Jhunjhunu.

**Abstract:**

The field that is wireless sensor networks (WSNs) is among the fastest growing and rapidly developing areas of research in the world of science. It has resulted in the creation of low-cost, low-power, and multi-functional sensor nodes. But, the issue that sensors run out of energy rapidly is a problem and a variety of energy-efficient methods of routing have been developed to resolve this issue and preserve the long-term viability for the system. This is why the routing protocols in a wireless sensor networks focus on the efficiency of energy conservation. The majority of recent papers have demonstrated a wide array of techniques that are specifically designed to minimize the energy use for sensor network. This paper presents a hierarchical routing technique that proves energy efficiency. The technique we employ selects the cluster heads with the highest remaining energy per round of transmission. It also takes into consideration, which is the closest distance from the station from cluster heads. Simulation results demonstrate that hierarchical routing techniques with different levels of hierarchy extends the lifespan of the network when compared to other clustering strategies and the energy residual average value after a certain number of simulation rounds grows significantly.

**Keywords:** Network Lifetime; Clustering; Hierarchical Routing; Wireless Sensor Network., re-clustering; Energy Efficiency;

## 1. INTRODUCTION:

Many electromechanical devices, such as relays equipped with sensing units come with communication and computing capabilities, which are incorporated as part of Wireless Sensor Networks (WSN). Sensing units are an electro-mechanical device that typically gathers three primary parameters, including the collection of information from the surrounding environment as well as processing the data to share the information with neighbouring devices. The neighbouring devices could be sink or sensor nodes. A Sink is a specific node which collects the data or data from sensing nodes in the network . It can take them in and then send the data to a data concentration center.

Typically, sensor nodes transmit their data to the closest sink node. If the volume of data that needs to be transferred is decreased, the power usage of networks is decreased. In WSN architecture it is essential to think about the topology of the network as well as power consumption, fault tolerance and data rate in order to cut down on energy consumption and enhancing the utilization of bandwidth. Sink repositioning involves an active node that can move around in order to gather information from sensors.

Multiple sinks can be used to collect environmental data with no delay, and without causing buffer overflow. This chapter proposes a multi sink relocation solution to improve network life and power optimization through shifting the sink nodes to the most optimal locations using an ingenuous concept. All data from sensor networks are directed to only one sink, the gateway in the model. and any hops near the sink get significantly involved in forwarding packets and, consequently, the energy resource depletes very quickly.

**II METHODOLOGIES:**

**HYBRID OPTIMIZATION METHODS**

The PSO has many advantages, including greater convergence, higher performance in solving optimization and minimized diversity of population and rapid convergence towards the local optimal. The TS is a technique of powerful stochastic optimization which could theoretically aggregate in an asymptotical fashion towards the resolution of the global optimal. The integration of the TS with the PSO to create local development processes allows an algorithm to sustain an array of diverse populations without mistakenly guiding the local optimal. This is because the TS has a higher energy usage average compared to PSO. The combination of both could make it easier to avoid a trade-off between the two. Simple PSO combined with a generalized TS is used in a hybrid method

Maximizing the lifespan of sensor networks through scheduled operations are the most efficient way to create WSNs which are efficient in energy use. The research also proposed an innovative hybrid method which combines both the Genetic Algorithm (GA) with the Schedule Transition Operations, called the STHGA. To address this issue various approaches have been suggested and the STHGA will implement an forward-encoding method for chromosomes in the population. The uniqueness of this scheme is the fact that it has a maximal gene count for all chromosomes which are raised with the implementation and the quality of it correlated to the actual amount of cover sets. Through the application of limitations on the chromosomes, forward encoding schemes will be able to reflect the structural features of the different schedules that are possible within the sensors, which provide some guidelines

In order to meet the specifications of the encoding there are genetic and the operation of schedule transition within the STHGA that work together to change the cover set that was not complete to one that is complete. There are several applications used to measure a particular number of targets and the entire area, the term used to describe area-coverage, and also to assess the effectiveness of the STHGA. The results show that the algorithm is successful and outperformed other strategies, including speed of optimization as well as the quality of the final solution.

**MOBILITY MODELS**

It focuses on how fundamental heterogeneity that is present in mobile devices' contacts influences the efficiency of the epidemic routing algorithms. They developed two new models for mobility and the efficiency of the algorithm for epidemic routing using these models is studied. The models for mobility take advantage of the diversity in contact rates between nodes. The two models that are used for mobility include Individually Heterogeneous Network Model (IHNM) and Spatially Heterogeneous Network Model (SHNM).

IHNM creates heterogeneity by providing diverse contact rates for different pair of nodes in various groups. SHNM permits heterogeneity in every cluster of spatial space where mobile nodes are located. how transmission performance for the epidemic routing protocols in the two heterogeneous models is different from the current uniform mobility model. In opportunistic networks mobile nodes can communicate with one another even without a route between them. Furthermore, nodes lack information about the topology of the network. They are constructed dynamically whenever messages are routed between the source and destination make use of flooding for message transfer. When two nodes meet them, they swap all the strange messages they can and, in this way, the messages will eventually be distributed across the entire network.

**OPTIMIZED CLUSTERING SCHEME FOR ENHANCED LIFETIME**

Routing is among the most important fields of Wireless sensors. When WSNs are considered as a class, they possess two fundamental characteristics self-organization and energy efficiency. If the network is able to meet these two attributes, then it is considered to be efficient. The primary activities of the network have being carried out on the basis of these traits. They also decide the networks longevity. There are a variety of protocols that have been suggested to address this issue, but the majority do not work when utilized in large networks.

Energy consumption is the main factor to be taken into consideration in the context of a sensor network. In this technique, a combined system of clustering and gradient-based routing was employed. Multi-hopping technique is applied in this plan in which the data isn't transmitted straight from the head of cluster directly to the BS. This kind of routing aids to improve the performance of the cluster, by cutting down on energy consumption. Initially , a "Cost field" is being created in which every member Node knows the cost of linking for the source. Within a certain time frame, the CH selection is made in various rounds. The CHs collect data from adjacent nodes, and then they combine the data to send it directly to BS. Each sensor sends data to its own central cluster node.

In this protocol, a homogenous sensor network will be considered. These nodes are tasked with primary tasks, which include collecting data, sensing, and forwarding them to the cluster head. The CH transmits data to the BS. A first pattern of network gradient is created so that every node is aware of the location of the Sink and the price of connecting with the sink. After the initial gradient is established, the cluster heads will be chosen. Contrary to other clustering strategies, this method employs an energy-aware clustering technique in which the batteries' residual energy is used to determine the CH. When the clusters have formed, the members of the cluster forward the information into CH. CH while the CH then sends an analysis of the data received and then sends the data back to BS.

## III. PROPOSED MODELS

### Cluster Head Selection

The choice of CH within a the particular cluster is based on a diverse range of parameters like proximity to the node, residual energy, and Link Quality Factor (LQF). In general, the amount of energy consumed by the node is dependent on ransmission, data collection and reception. The node taking part in network activities should have adequate energy. This energy is known as residual energy. Another requirement for a node to qualify as CH is the fact that it must possess more residual energy than the other nodes. A fuzzy-based approach employs these three parameters to select the most convenient set of nodes for bondsing member nodes that have the suitable CH.

**Backup node selection using GSA optimization**

Input: Number of nodes, number of iterations

Output: Backup node

1. The Agents must be loaded i.e. an m-number of nodes.
2. Find the fitness function of each agent.
3. Substitute G (t) Best (t) and the worst (t).
4. Examine the force total.
5. Find the inertial mass and acceleration.
6. Modify speed and position.
7. This process continues until the best solution is reached. The most effective solution is choosing of the back-up nodes i.e. the agent with the largest mass.

**Algorithm for Fault Detection**

Input the following information: number of CHs Input: number of CHs

Output: fault detection

1. Backup node checks the CH and determines if it's alive or not.
2. Every so often, BN sends alive message (AL_Mes) to the CH.
3. In the event that the BN receives a reply message from CH and decides that CH exists. If not, CH is declared to be indeficient and the BN is responsible for the work of CH.
4. Similar to that, the members of the same the cluster will be monitored by the CH. CH.
5. Every CH within a cluster gets information from members of the cluster frequently.
6. If CH fails to receive information within a specified time the member that is responsible is considered to have failed and will be deleted from the routing table.

**The flowchart that is used for the hybrid algorithm proposed:**

Step 1 Step 1: Initialization of the optimization problem as well as algorithm parameters.

Step 2 The memory is initialized in harmony.

Step 3. New Harmony improvisation.

Step 4: Assess the glowworms' health function.

Step 5: Harmony memory update.

Step 6: Review glowworms' lumiferin value, movement, and range of decision.

Step 7: If end requirements are met, continue to the conclusion of algorithm.

Otherwise , follow step 3.

An independent normal variable error model can be employed to implement Least Expected Distance (LED) routing method. Two points are measured distance with the help of a the distance formula. The distance between sensor node S as well as sensor node T is determined using the formula:

$$d_{st} = \sqrt{(x_s - x_t)^2 + (y_s - y_t)^2}$$

where xs, xt, both ys and yt represent the origin of the coordinates for x and y of nodes s and. The distance estimated between sensor node S as well as sensor node can be calculated as:

$$d_{st}^{\sim} = \sqrt{(x_s' - x_t')^2 + (y_s' - y_t')^2}$$

$$E(d_{st}^{\sim}) = \sigma_{st}\sqrt{\frac{\pi}{2}}L_{\frac{1}{2}}\left(-\frac{d_{st}^2}{2\sigma_{st}^2}\right)$$

$$Var(d_{st}^{\sim}) = 2\sigma_{st}^2 + d_{st}^2 - \left(\pi\frac{\sigma^2}{2}\right)L_{\frac{1}{2}}\left(-\frac{d_{st}^2}{2\sigma_{st}^2}\right)$$

$$d_{sK} = \sqrt[\alpha]{\frac{c}{(\beta(1-2^{1-\alpha}))}}$$

$$d_{sK} = \sqrt{(x_s - x_K)^2 + (y_s - y_K)^2}$$

$$x_K = x_s \pm \frac{d_{sK}}{\sqrt{1+m^2}}$$

$$y_K = y_s \pm \frac{d_{sK}}{\sqrt{1+m^2}}$$

The strength-ideal function K can be placed on the line connecting the node that is currently transmitting and the node that is destination L. The line's slope m is determined using (ys-yL) = m(xs-xL) where the ys, xs are locations of the sensors s, and the yL and xL coordinates are the location of the node L. The slope is the same for all variables comprised of K, which means that the coordinates xK as well as the sensor's yK coordinates are calculated for K are calculated using the these equations:

PSEUDOCODE FOR LEAST EXPECTED DISTANCE (LED) TECHNIQUE

```
Procedure least_expect(a,b)
t←a
do
s←t
if Dest_id < α√(c / (β(1−2^(1−α))))
then choose node z
otherwise
Let t be neighbour of s that minimizes Y_t(D) = E[D_tK]
Send packet to t
until j =z (destination z reached).
End Procedure least_expect
```

While LED routing was concentrated at finding the forwarding point which is efficient in energy usage however, it was found that the Packet Delivery Ratio (PDR) was not high enough. When a node is selected through the LED method instead of altering the transmission range of the sender to the precise distance between the sender's location and the chosen node, the range of transmission is extended by a of rext. For an error area, if the range of transmission is high and the probability of failure to transmit is diminished.

### IV. Experimental Setup

Simulation has been done in MATLAB R2013a. Nodes are randomly distributed over a network area of 50 X 50 m

Table 1 Average number of hops using LED

| LEAST EXPECTED DISTANCE ROUTING TECHNIQUE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| NUMBER OF SENSOR | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 |
| AVERAGE NUMBER OF HOPS | 1.50 | 1.25 | 1.40 | 1.50 | 1.60 | 1.28 | 1.62 | 1.12 |

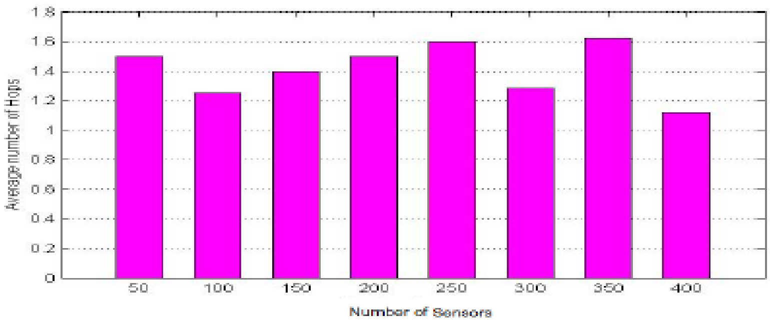


Figure 2 Number of sensors vs. Average number of Hops

Table 2 provides the data on the ratio of packet delivery for sensors with a range of numbers between 50 and 400. It is clear that the rate of delivery for sensors with 50 nodes has been calculated at 15% while for 300 350, 400 and 300 sensor nodes the delivery percentage is thirteen percent. The graph plots the ratio of Packet Delivery and various number of sensors by using the Least Expected Distance Technique is shown on Figure 5.2.

Table 2 Packet Delivery Ratio for variable number of sensors using Least Expected Distance Technique

| **LEAST EXPECTED DISTANCE ROUTING TECHNIQUE** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| NUMBER OF SENSOR | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 |
| PACKET DELIVERY RATIO % | 50 | 12 | 10 | 8 | 19 | 13 | 13 | 13 |

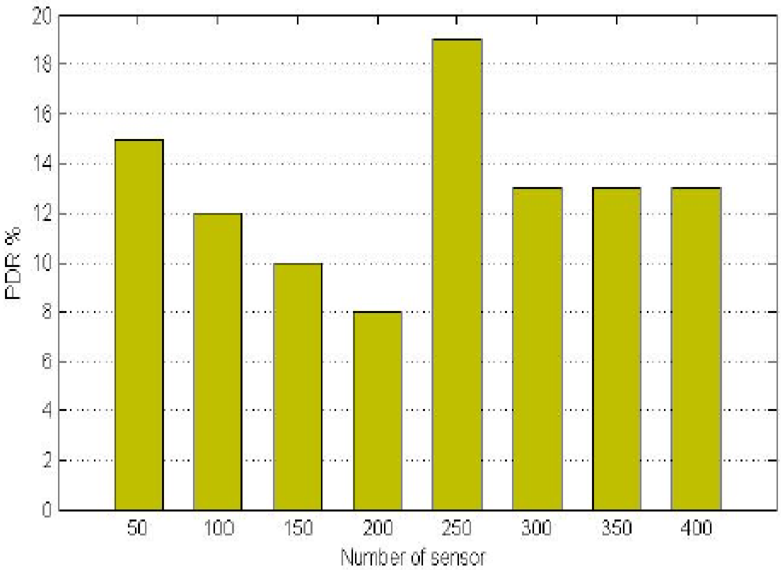


Figure 3 PDR vs. Average number of Hops using Least Expected Distance

The energy consumption of sensors with variable values ranging from 50-400 is shown by Table 5.3. The details on the energy consumption of LED Technique for variable sensor nodes can be seen on Figure 5.3. From the graph, it is evident that the it consumes energy for nodes with 50 sensors. 0.87 Joules. The energy is gradually increased until 1.78 Joules.

Table 3 Energy Consumption

| LEAST EXPECTED DISTANCE ROUTING TECHNIQUE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| NUMBER OF SENSOR | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 |
| ENERGY CONSUMPTION x 10-3 | 0.87 | 1.30 | 1.76 | 1.38 | 1.71 | 1.74 | 1.68 | 1.70 |

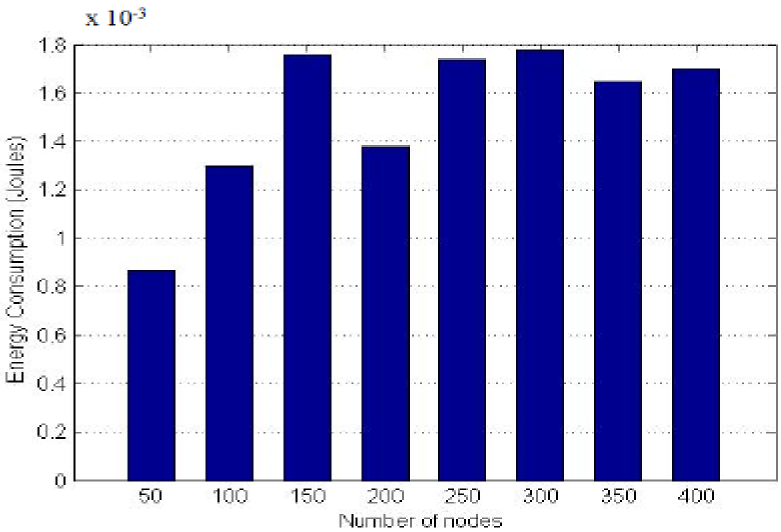


Figure 4 Energy Consumption vs. Number of nodes

Table 4 provides information on the delivery ratio of packets for variables Standard Deviation values from 6 to 10. It is possible to conclude that the ratio of delivery is decreased and increased when the standard deviation is increased. The graph plots and the Standard Deviation and the Packet Delivery Ratio of the Least Expected Distance Routing. The technique is described by the figure 4.

**PSEUDOCODE FOR ENERGY CONDITIONED MEAN SQUARE ERROR TECHNIQUE:**

Procedure ECMSE (Source, Destn)
i := Source
do
if Destn is a neighbor of i
then send packet to Destn;

else
calculate optimal position M;
for j := 1 to W (W is the number of neighbors of i)
calculate
if (t minimizes ) and (j ensures
then send packet to j;
j := i;
end
until j = Destn;
End Procedure ECMSE

The purpose of the accuse is to ensure to ensure that the affiliations that are provided are truly working but not as a solid direction to imagine the possibility of them working effectively in the unimaginably distant future. The basic structure of the system is to execute the visual comprehension and manual elimination of misrepresentations. This system can cause problems as human intrigue causes to make mistakes, it comes at a costs a lot and isn't massive. In the meantime forward-balanced denounce monitoring confirmation structure for WSN is utilized. By self-finding inside points, WSN will be able to detect imperfections in its parts. With store request two or three obsessions are used to screen the direction of an inside point. Finally, in the fit zone the introduction of scolds takes place with an accreditation tree, where an alleged pecking request is presented for the obvious check of failing centre focus interest. Hierarchical detection is the fault detection process is done with a detection tree, where the hierarchy is established to identify failing nodes. In a hierarchical detection, the detection process is moved to a stronger device, such as the sink. The flow of fault detection with CHs and BNs can be seen as Figure 5.2 the algorithm table.

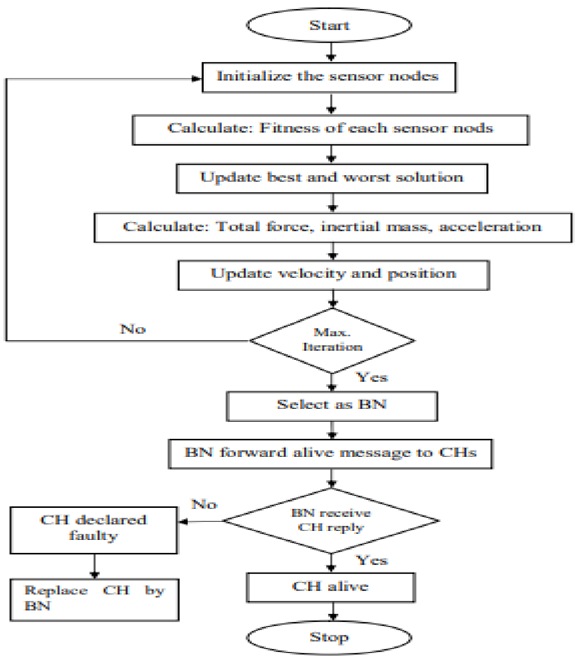


Figure 5 Detailed work flow of GSA-FT protocol

Input Number of CHs Input: number of CHs
Output: fault detection

1. Backup node is monitoring the CH and determines if it's alive or not.
2. Each time, BN sends alive message (AL_Mes) to the CH.
3. In the event that the BN receives a reply message from CH and decides that CH remains alive. If not, CH is declared to be unfit and the BN takes care of the function of CH.
4. In the same way, members of a cluster are tracked by their respective CH.
5. Every CH within a cluster receives information from members of the cluster regularly.
6. If CH does not receive information at a time that is pre-determined and the member that is responsible is deemed to be in error and removed of the table for routing.

There are two primary methods of maintaining a cluster which are energy monitoring and reconstruction. The residual energy of each node is measured and when until it is below the threshold, then cluster reconstruction is begun. When cluster reconstruction is initiated when it is determined that the cluster head's (CH) remaining energy falls less than some level, it'll choose the child with the highest residual energy. However in the event that the energy residual of the delivery node is lower than the threshold and the CH will select to switch the destination on the basis of its cost of the route. The second phase that is called path switching, is to switch the path to another sink when it is primary. When a path that is the primary is in use for a prolonged duration the energy consumption of these sensors as well as the route will diminish faster as other sensors and some nodes could be unable to use energy, rendering the path inaccessible. When switching paths, energy consumption can be spread more evenly. The size and shape of each cluster are governed by certain guidelines so that each CH is able to transmit data to sinks over a time that does not overflow with the other, and the time intervals are never interrupted.

## V. CONCLUSION

WSN is a crucial component in many areas of application. Deploying and the redeploying sensors is a necessity in a the real-time massive networks. There is a balance between the need and the necessity of redundancy levels within the network. A fuzzy-based approach is implemented to the proposed solution in order to reduce the redundancy , and to redistribute the sensors based on the need. There are a variety of network parameters that directly or indirectly affect the consequent redundant impact. In this regard, the elements like connectivity coverage, distance, and the overall density that determine the level of redundancy are included. A fuzzy-based decision-making system allows the system to be fine-tuned to identify redundant sensors and to make best choices, either with or off or by pushing. Simulation results indicate that the fuzzy-based system performs better in terms that it has residual energy as well as coverage, and throughput. The work to come in the future will be focused on fault tolerance system. It is about how an inactive sensor could be utilized to replace any failed nodes within the network by changing the topology of the network with minimum modifications.

## REFERENCES

1. Gharaei, N.; Bakar, K.A.; Hashim, S.Z.; Pourasl, A.H. Inter-and intra-cluster movement of mobile sink algorithms for cluster-based networks to enhance the network lifetime. Ad Hoc Netw. 2019, 85, 60–70. [CrossRef]

2. Yu, Z.; Guan, Y. A dynamic en-route filtering scheme for data reporting in wireless sensor networks. IIEEE/ACM Trans. Netw.2009, 18, 150–163.

3. Yang, H.; Lu, S. Commutative cipher based en-route filtering in wireless sensor networks. In Proceedings of the IEEE 60thVehicular Technology Conference, Los Angeles, CA, USA, 26–29 September 2004; Volume 2, pp. 1223–1227.

4. Ye, F.; Luo, H.; Lu, S.; Zhang, L. Statistical en-route filtering of injected false data in sensor networks. IEEE J. Sel. Areas Commun.2005, 23, 839–850.

5. Zhu, S.; Setia, S.; Jajodia, S.; Ning, P. Interleaved hop-by-hop authentication against false data injection attacks in sensor networks.ACM Trans. Sens. Netw. 2007, 23, 839–850. [Cross Ref]

6. Lu, R.; Lin, X.; Zhu, H.; Liang, X.; Shen, X. BECAN: A bandwidth-efficient cooperative authentication scheme for filtering injected false data in wireless sensor networks. IEEE Trans. Parallel Distrib. Syst. 2012, 23, 32–43.

7. Karp, B.; Kung, H.-T. GPSR: Greedy perimeter stateless routing for wireless networks. In Proceedings of the 6th Annual International Conference on Mobile Computing and Networking—MobiCom'06, Boston, MA, USA, 6–10 August 2000; pp. 243–254.

8. Pantazis, N.A.; Nikolidakis, S.A.; Vergados, D.D. Energy-Efficient Routing Protocols in Wireless Sensor Networks: A Surveys. IEEE Commun. Surv. Tutor. 2013, 15, 551–591. [Cross Ref]

9. Wang, J.; Yin, Y.; Kim, J.U.; Lee, S.; Lai, C.F. A mobile-sink based energy-efficient clustering algorithm for wireless sensor networks. In Proceedings of the 2012 IEEE 12th International Conference on Computer and Information Technology, Chengdu, China, 27–29October 2012; pp. 678–683.

10. Shahzad, M.K.; Nguyen, D.T.; Zalyubovskiy, V.; Choo, H. LNDIR: A lightweight non-increasing delivery-latency interval-basedrouting for duty-cycled sensor networks. Int. J. Distrib. Sens. Netw. 2018, 14, 1550147718767605. [Cross Ref]

11. Banerjee, J.; Mitra, S.K.; Naskar, M.K. Comparative study of radio models for data gathering in wireless sensor network. Int. J.Comput. Appl. 2011, 27, 49–57. [Cross Ref]

12. K Mahesh (2019) "AMAZON CLOUD SERVICES BASED ON SERVICE LEVEL AGREEMENT AND QUALITY OF SERVICE", volume 11, issue 11, pp. 1604-1613. DOI 10.34218/IJARET.11.11.2020.149

13. Lyshevski, S.E. Nano-In addition, Micro-Electromechanical Systems: Fundamentals of Nano-In Addition, Microengineering; CRC Press: Boca Raton, FL, USA, 2018.

14. Azzabi, T.; Farhat, H.; Sahli, N. A survey on wireless sensor networks security issues and military specificitie. In Proceedings of the 2017 International Conference on Advanced Systems and Electric Technologies (IC_ASET), Hammamet, Tunisia, 14–17January 2017; Volume 1, pp. 66–72.

15. Kumar, A.; Pais, A.R. En-route filtering techniques in wireless sensor networks: A survey. Wirel. Pers. Commun. 2017, 96, 697–739.[Cross Ref]

16. Prasadu Peddi (2021), "Deeper Image Segmentation using Lloyd's Algorithm", ZKG INTERNATIONAL, vol 5, issue 2, pp: 1-7.