EMERGENT: JOURNAL OF EDUCATIONAL DISCOVERIES AND LIFELONG LEARNING (EJEDL)
ISSN: 2776-0995 Volume 2, Issue 11, Nov, 2021

RELATING TO NEIGHBORS TO EXTEND WIRELESS SENSOR NETWORKING LIFETIME

Muhammad D. Hassan
Northern Technical University
College of Health and Medica Technology – Kirkuk (CHMTK)
mdhmm75@ntu.edu.iq

Abstract

The LEACH and K-mean clustering techniques were merged in this paper to create a new one. The Energy Efficient Close Nodes Clustering (EECNC) technique was created by focusing on nodes that are close to one other and subject to a threshold value for clustering at the second level (second level). Only one sensor will be used out of all the sensors with the same range that are distributed randomly. Because the same data was used again during detection, the transmitted packet size was minimized, and as a result, energy was conserved.

Keywords: EECNC, K-Mean, Clustering in WSN, WSN, K- Mean

1. Introduction

Scientific, environmental, health care, and military use cases for WSNs are many. A few examples include environmental monitoring, remote patient monitoring, and military defensive systems. Plant and animal habitat monitoring is one example. WSNs are made up of hundreds or thousands of nodes, each of which is capable of performing its own tasks. The nodes of a WSN are tiny and energy-efficient. These nodes may be randomly distributed or scattered across a wide geographic region. Objects or information about the adversary may be sent to other sensors, which then send it to a central location. Sensors are occasionally employed in military applications as well (base station). These networks must thus be widely distributed while still being able to operate in cooperation with other nodes and rectify errors if they occur [1].

In a wireless sensor network, each sensor node has a limited amount of processing power and memory space due to the tiny size of the sensors. A central base station is required to transmit the perceived data from the sensor nodes, which must have a variety of sensing capabilities (cameras, temperature measurements, sound, etc). The deployment of WSNs is often done in a haphazard manner. This means that each node must be well-organized and productive. As a result of the haphazard deployment, the node density of the WSN vary from area to region. As a consequence, in order to interact with their neighbors, each node must use a variable amount of energy. Because of varying intensities and finite energy levels, a network's lifespan is rapidly reduced. At the same time, nodes tossed from above the ground and coming into contact with a hard floor would have partial sensing or malfunction. As a result, making the nodes more robust is essential if we are to keep the amount of network error to a minimal.

The topology of a network is continuously and dynamically changing. It's critical to concentrate on routing techniques and protocols that use the least amount of energy while trying to find a genuine solution to extending WSN lifespan [2].

Weak batteries in wireless sensor networks and the difficulty of charging thousands of sensors at once from a remote source make energy an essential component for the network's long-term survival. Due to sensor nodes' heavy usage, data gathering becomes a laborious task because of the little energy they have available. A good approach to deal with these issues is to cluster the sensor nodes [3].

WSN makes use of two different communication approaches: tree-based and clustering-based. If we use clustering-based communication, we should choose a cluster head from among the nearest network components (nodes). The cluster leader is in charge of coordinating communication between the cluster's members and the rest of the clusters in the organization. In a wireless sensor network, each sensor node has a limited amount of processing power and memory space due to the tiny size of the sensors. Different sensing devices (camera, temperature measurement, sound, etc.) are required on these sensor nodes to monitor the environment and a central base station is required to transmit the detected data [4].

2. WSN Activities Are Being Grouped Together

Using a low-energy adaptive clustering hierarchy technique, Heinzelman et al (LEACH). When using LEACH, you may use methods like randomized data distribution, self-configuration, cluster adaptation, and localized transfer control to save energy. A large number of cycles are used in the LEACH procedure, however it is divided into two stages: the setup phase and the steady state phase. Data is sent during the steady-state phase, not during the setup phase when clusters are created. TDMA or Code Division Multiple Access (CDMA) MAC is used by LEACH to minimize collisions between and within clusters. The amount of sensor types, communication coverage, and geographic location all have a role in cluster formation and how dense the clusters are. The number of cluster heads and the radio signal coverage provided by various algorithms determine the energy consumption incurred throughout the information aggregation process from the sensor node to the receiver. Because arranging sensor nodes into clusters reduces energy usage.

Hybrid Energy-Efficient Distributed Clustering- (HEED) is a distributed clustering technique proposed by Younis et al. [6] that focuses on transmission power. This technique attempts to extend the lifespan of a network by spreading energy usage and ending the clustering process after a certain number of iterations. Minimizing the algorithmic control overrun led to evenly dispersed cluster leaders and modest cluster sizes. Assumptions used by HEED include that nodes differ in their energy usage and that all nodes are of equal significance

PEGASIS is a sensor information system aggregation created by Lindsey et al. [7,8] that focuses on energy efficiency. PEGASIS is a chain-based protocol that improves on the LEACH method. Each node in PEGASIS interacts solely with the other nodes in its local vicinity and instructs it to broadcast to the network's central station. As a result, the amount of energy required to complete each cycle is lower. The Greedy Approach organizes the nodes into a chain (as seen in Figure 1). It's possible to compute and transmit this information to the sensor nodes from the base station. When comparing PEGASIS to LEACH, energy savings occur throughout the process. There are a number of advantages to using local data collection over remote data transmission. For one, the distances between sensor nodes and circuit nodes are much less when using local data collection. A further difference is that in each communication cycle, only one node transmits data to the base station from the client. PEGASIS is effective since it restricts the number of shipments and eliminates dynamic extra burdens.

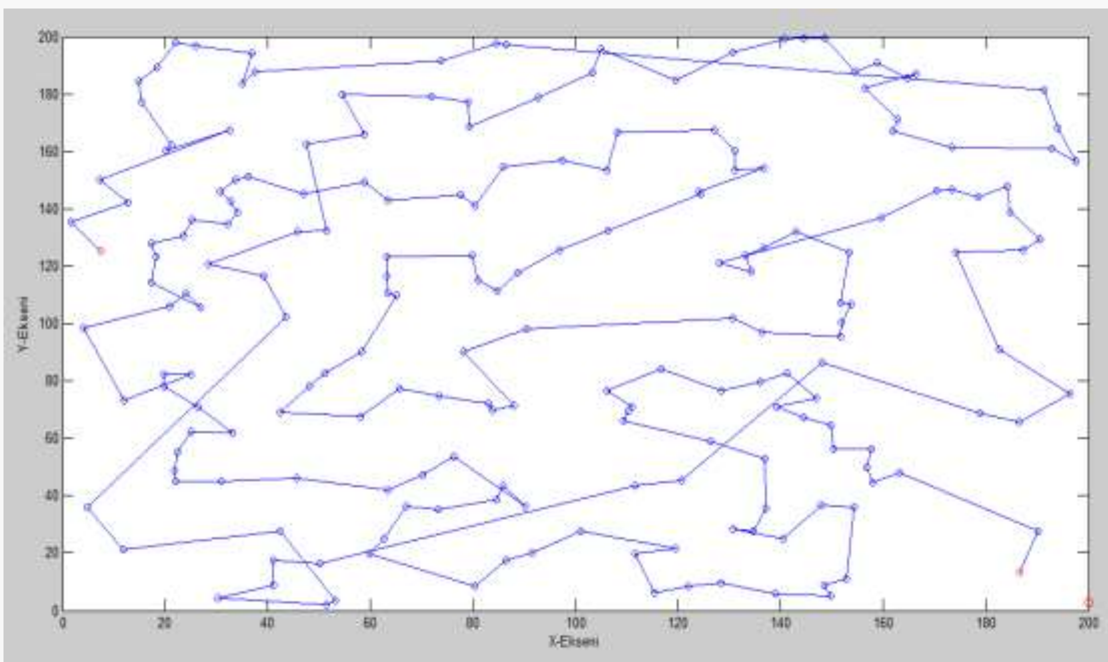

Figure 1. PEGASIS algorithm cluster creation in a simulation software environment

3. Using WSN Cluster Algorithms to Improve Energy Efficient

Creating sensor nodes that can sense and send data is now feasible. Some applications, on the other hand, need the deployment of hundreds or even thousands of sensor nodes, each of which must make efficient use of the limited available energy. Sensor circuit efficiency is critical; there is no question about that. Extending network life necessitates, at that point, establishing a suitable routing method. To begin with, researchers looked at using a direct transmission to bypass any compatibility issues. Therefore, the sensor node picks up information about its surroundings and sends it right up to the base station. In spite of providing data protection, the technique outlined consumes an excessive amount of energy. Nodes that are far away from the base station tend to expire prematurely because of the energy spent on transmission rather than sensing. As a result, they quit the field [10].

Long-distance communications should make use of the lowest transmission power method, which is more efficient. Instead of using direct transmission, this method makes advantage of multi-hop transmission. Data is sent from the nodes that are far away from the base station, in particular, to the adjacent nodes and the base station itself, in order to provide energy distribution and prolong the network lifespan [11]. Clustering, on the other hand, is a tried-and-true technique for cutting routing energy costs. When nodes are dispersed, they self-organize and choose a node to act as the cluster's central node. During the time when other nodes are doing sensing, the cluster head's job is to aggregate and transmit the data collected from them to the base station. As a result, the division of labor reduces energy waste while also extending the life of a network. Many clustering-based researches have been carried out in the last few years. No matter the cluster head selection process you choose, your goal of conserving energy will always be the same [13].

Clustering methods like LEACH, PEGASIS, TEEN, APTEEN, and HEED are often utilized. The LEACH method is divided into three stages: signal propagation (position specification), cluster creation, and sensing.

4. EECNC: Problem Identification and Solution Implementation

As a result of a random deployment and communication distance that is the same, different sensor nodes will not sense and generate the same data. Sensor nodes are well-known for having many properties at once (e.g. heat sensation, sound, image, etc.). Sensor nodes in difficult-to-reach places like volcanoes and battlefields, such as the crater rims, tend to cluster together. The distance between two points may vary depending on the application. For example, the distance between cameras that detect movement and sensors that gather temperature data should be varied in order to avoid confusion. Using a cluster of sensor nodes is an efficient approach to deal with these issues. As a result, the user has complete control over the process of determining the closeness of various apps. It is hoped that by using a single sensor for a given region, it would be possible to avoid sending duplicate data and so save energy. As can be seen in Figure 2, the sensing area indentations have accumulated, resulting in energy loss.

EMERGENT: JOURNAL OF EDUCATIONAL DISCOVERIES AND LIFELONG LEARNING (EJEDL)
ISSN: 2776-0995 Volume 2, Issue 11, Nov, 2021

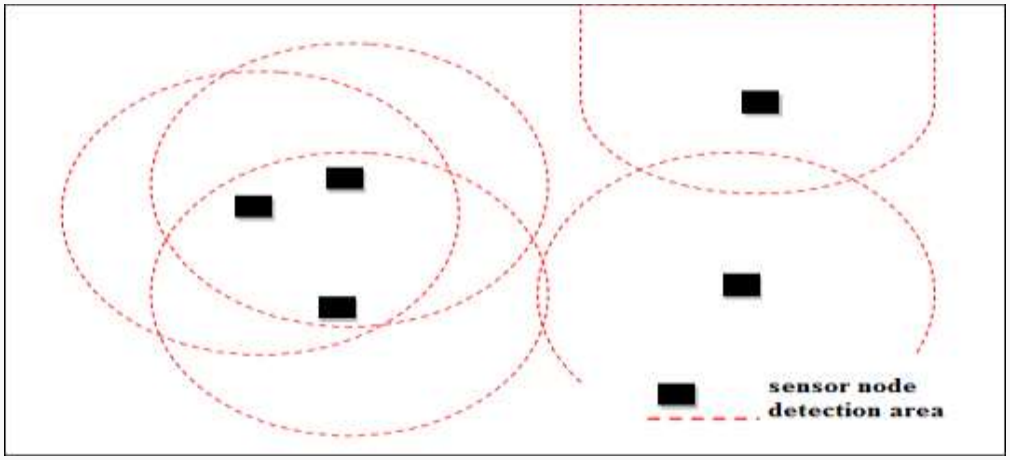

Figure 2. Unpredictable placement of nodes results in communication overlap between them.

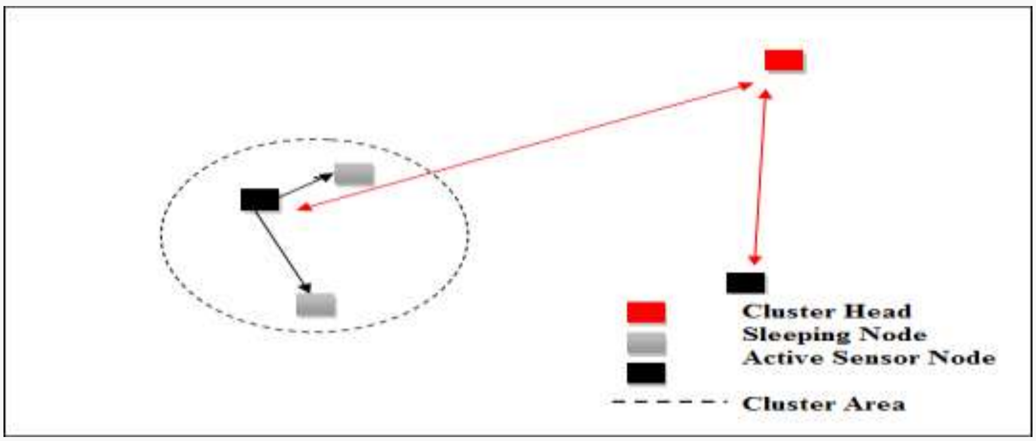

Figure 3. Those nodes in the second stage cluster maintain their distance from each other at a safe distance.

This goal may be achieved with the help of cluster structure design. The LEACH cluster structure is the subject of this investigation. As a result, in the first step, the cluster was created by nodes inside it, but in the second stage, nodes depending on their proximity arrange themselves to form a new cluster.

When comparing a second stage cluster to a regular cluster, the main difference is that only the cluster head actively works, doing the detecting and transmitting tasks as well. Many more nodes have gone to sleep. After reaching a particular threshold, the cluster head sends a command to all other nodes in the cluster to become active, and then it goes into cluster head sleep mode itself. A communication range diagram is shown in Figure 3.

The goal of this research is to increase energy efficiency while also extending the life of wireless sensor networks by utilizing a random distribution of nodes. The suggested research uses a threshold value to prohibit nearby nodes from functioning at the same time. There are two phases to clustering. The K-Mean method is used to turn randomly dispersed nodes into clusters in the initial step. As a result, data transmission between nodes and the base uses less energy. After creating a neighborhood table in the first step, a cluster head was found by establishing communication amongst the nodes that were in the neighborhood. The cluster head will begin active sensing and put the rest of the nodes to sleep. As soon as the current node runs out of energy, another node will take over as the cluster head and order the cluster to go into sleep mode. So the network's lifespan may be extended while also allowing for the specification of various sensing regions depending on the sensing requirements of the system.

5. Proposal for Research

The following are the actions that need be followed to complete the task recommended by this research:

1. It's time to distribute the WSN nodes and get things going.
2. Assess the value using a topology diagram.
3. pick the clumps of cluster heads
4. Sending data packets between nodes to establish communication.
5. Finding the outcomes of the EECNC technique (such as network life, dead nodes, etc.).
6. Calculating the outcomes of several alternative strategies (HEED, PEGASIS, TEEN, APTEEN, and LEACH).
7. Compare the outcomes of several techniques and gauge which one performs better.

5.1 Assumptions

The simulation is based on the assumption that WSN nodes are randomly dispersed and wireless networks have the following properties:

1. Have your data ready to go at all times.
2. There is only room for one base station at the network's heart.
3. If a node's remaining power cannot transmit packets to the cluster head, it is deemed dead.
4. There is no consideration given to signal degradation or interference.
5. The amount of communication-related energy lost varies with distance.

5.2 The outcome of the simulation

Compared to other parts of the simulation, distributing and comparing WSNs is difficult due to the large number of factors to be taken into account. Based on established techniques, various clusters are formed, and the life cycle is calculated.

6. Proposal for Research

1) The following are the actions that need be followed to complete the task recommended by this research:
2) It's time to distribute the WSN nodes and get things going.

3) Assess the value using a topology diagram.
4) pick the clumps of cluster heads
5) Sending data packets between nodes to establish communication.
6) Finding the outcomes of the EECNC technique (such as network life, dead nodes, etc.).
7) Calculating the outcomes of several alternative strategies (HEED, PEGASIS, TEEN, APTEEN, and LEACH).
8) Compare the outcomes of several techniques and gauge which one performs better.

5.3 Assumptions

1) The simulation is based on the assumption that WSN nodes are randomly dispersed and wireless networks have the following properties:
2) Have your data ready to go at all times.
3) There is only room for one base station at the network's heart.
4) If a node's remaining power cannot transmit packets to the cluster head, it is deemed dead.
5) There is no consideration given to signal degradation or interference.
6) The amount of communication-related energy lost varies with distance.

5.4 The outcome of the simulation

Compared to other parts of the simulation, distributing and comparing WSNs is difficult due to the large number of factors to be taken into account. Based on established techniques, various clusters are formed, and the life cycle is calculated.

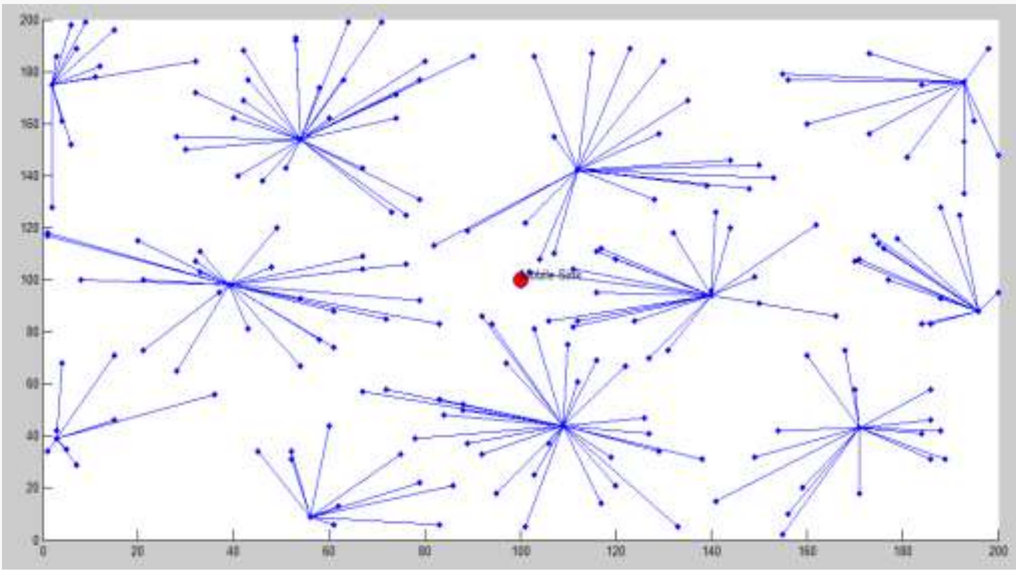

Figure 4. 50-meter-radius cluster designating the cluster's location

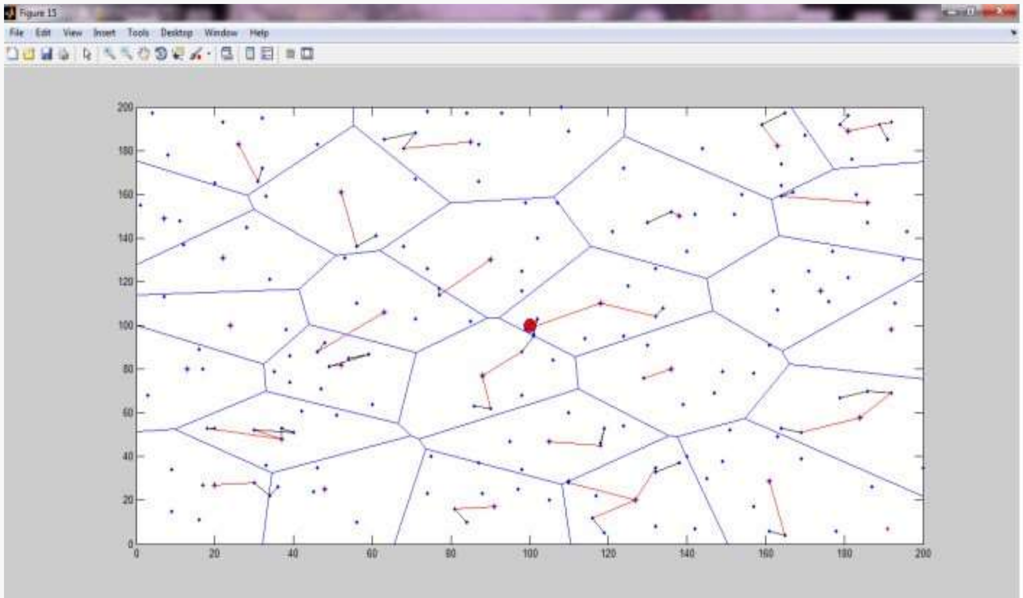

Figure 5. An example of two stages of clustering

Only the second stage cluster heads and the nodes selected by proximity are operating when the application first begins. Figure 5 shows active nodes as red arrows, while sleeping nodes as black arrows. The second stage cluster (the nodes linked to each other with a black line create the cluster) behaves as a single node, as seen in Figure 5. In this case, the active node is connected to the cluster head, and the red line shows that this is happening.

To see how well the EECNC technique compared to others, the program's performance was examined first. After the number of nodes is input, the program will wait for the distance between the nodes to be calculated before forming a cluster. The measurement of distance will make it easier to determine the number of clusters and to build a dynamic cluster from those clusters. Proximity is needed for the formation of the second stage clustering. There will be a certain number of nodes in each cluster based on their proximity to each other. Each cluster has one, two, or more nodes, but only one node is active at a time in each cluster. The choice of the operational node is determined by the available energy. The active node will be determined by its energy level. The program checks if the active node's energy level has reached criticality at the conclusion of each loop. The old cluster head will go into sleep mode when the energy level drops too low and another node in the cluster will become active from sleep mode. Dead nodes are identified and added to the counter for performance evaluation by the application. At the conclusion of each of four stages, the number of dead nodes and the amount of energy lost are calculated (25, 50, 75, and 100 steps).

Using EECNC, PEGASIS, HEED, TEEN, and LEACH as an example, Table1 shows the common parameters for each technique. Following is an example of parameter assignment.

EMERGENT: JOURNAL OF EDUCATIONAL DISCOVERIES AND LIFELONG LEARNING (EJEDL)
ISSN: 2776-0995 Volume 2, Issue 11, Nov, 2021

Table1. A set of values that were utilized for 100 rounds of testing

Parameters	Value
The total number of sensors	200 count
Area in which a number of places are grouped	25 m
Proximity	5m
Area	200 X 200 m²
Coordination of the station's infrastructure	100 X 100 m²
Bit transmission and reception energy consumption	500 nJ/bit
Iteration	100
Distributed generation and supply of energy	10*0.000000000001 J
Transferring power	50*0.000000000001 J
The power of reception	50*0.000000000001 J
Data gathering requires a lot of energy.	5*0.000000000001 J

When comparing the two, EECNC and PEGASIS come out on top as the best performers. Using the LEACH algorithm in its original form results in substantial energy waste. Despite the fact that the algorithm application seems to be helpful on the surface, it turns out to be ineffective when looking at costs.An attempt was made to enhance the EECN's performance by comparing it to other algorithms with fewer nodes and more energy levels. This was done in line with the parameters given in Table 2 and the Results for the energy level displayed in Figure 6.
Finally, simulations with a random distribution of 200 nodes using the same methods revealed that EECNC had the best performance. EECNC's network life is predicted to be longer than other algorithms', despite having fewer nodes. Figure 7 displays the simulation's output in Table 3, along with the parameters and outcomes.

Table 2. The comparative parameters used in the next stage

Parameters	Value
The total number of sensors	100 count
Area in which a number of places are grouped	35 m
Proximity	7m
Area	100 X 100 m²
Coordination of the station's infrastructure	50 X 50
Bit transmission and reception energy consumption	50 nJ/bit
Iteration	12000 iterations
Distributed generation and supply of energy	10*0.000000000001 J
Transferring power	50*0.000000000001 J
The power of reception	50*0.000000000001 J
Data gathering requires a lot of energy.	5*0.000000000001 J

EMERGENT: JOURNAL OF EDUCATIONAL DISCOVERIES AND LIFELONG LEARNING (EJEDL)
ISSN: 2776-0995 Volume 2, Issue 11, Nov, 2021

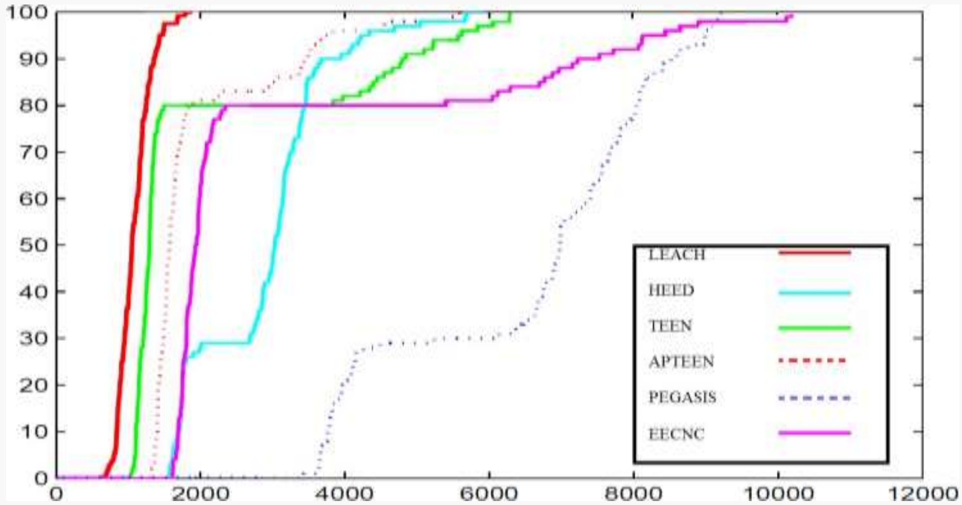

Figure 6. A comparison of the energy output of several techniques is made.

6 Recommendations and Concluding Statements

By prohibiting sensor nodes from multiple sensing and controlling communication range for various applications, this research aims to save energy in wireless sensor networks. Extension or reduction of communication range (for example, the range of the nodes thrown into a forest should be longer than the range for sensing moving objects) to collect data more efficiently, to prevent sensor nodes from sensing the same objects or conditions are all important considerations for reducing energy loss.

This research found that using the clustering architectural approach in wireless sensor networks resulted in better energy efficiency than using sensor nodes that are randomly dispersed. A threshold value is used in the experiment to prevent sensor nodes placed close together from functioning at the same time. In order to do simulations, software MATLAB is used.

Table 3. The parameters used in the procedures for 200 nodes are listed below.

Parameters	Value
The total number of sensors	200 count
Area	200 X 200 m²
Coordination of the station's infrastructure	100 X 100
Bit transmission and reception energy consumption	50 nJ/bit
A packet's bit count	4000 bit
Distributed generation and supply of energy	10*0.000000000001 J
Transferring power	50*0.000000000001 J
The power of reception	50*0.000000000001 J
Data gathering requires a lot of energy.	5*0.000000000001 J

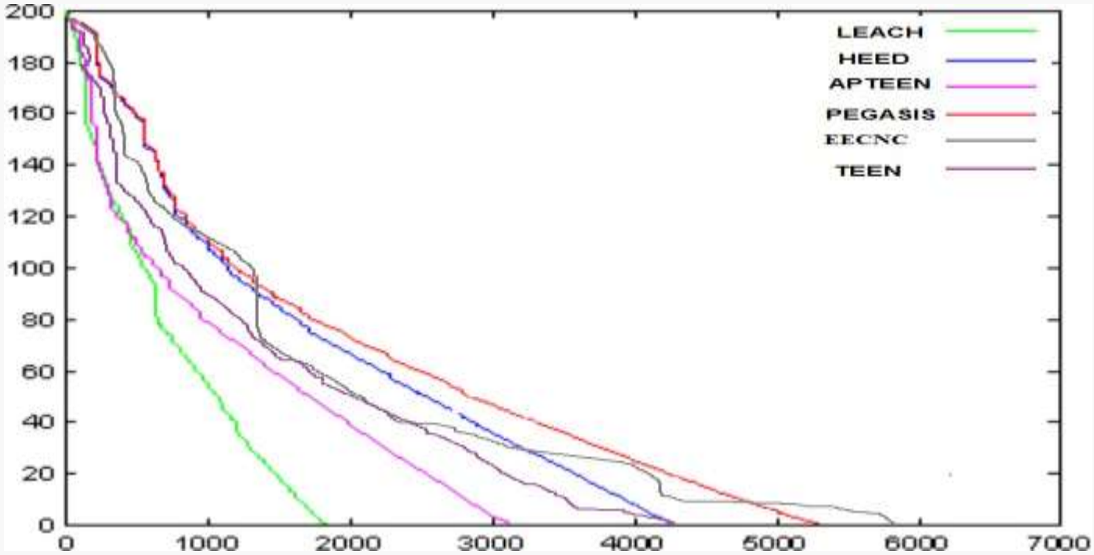

Figure 7. Results of comparisons between techniques based on the energy levels of 200 nodes

The goal of this research is to increase energy efficiency while also extending the life of wireless sensor networks by utilizing random node distribution and K-Mean clustering design. The researcher's goal in this study is to use K-mean clustering architecture to increase the energy efficiency of a wireless sensor network with randomly dispersed sensor nodes. A threshold value will be used in the proposed research to prohibit sensor nodes located near to one another from functioning at the same time. There are two phases to clustering.

The K-Mean method is used to turn randomly dispersed nodes into clusters in the initial step. As a result, data transmission between nodes and the base uses less energy.

A cluster head is selected in the second stage, which uses the neighborhood table generated in the first sage and communication between nodes that are near together. Nodes in the cluster go into sleep mode when the cluster head is engaged. After a period of time, the active node will run out of energy and, as a cluster head, will order another node to take its place before entering sleep mode. By doing this, the network's lifespan will be extended and various sensing regions may be defined according to varied sensing requirements.

Studies show that simulated techniques save more energy and prolong network life than conventional clustering methods. Many studies have attempted to save energy in the WSN sector simply through clustering, regardless of the variations between the many applications that use the network.

In addition to the results, the following suggestions for further research are made:

Most research on the energy saving potential of wireless sensor networks use routing algorithms to gather and transmit data to the central station. In contrast to other forms of energy conservation, however, this one is seldom investigated.

The goal of this research is to make the network last longer. This study's results may be expanded and improved by putting greater emphasis on customer service quality.

REFRENCES

1) Al Nuaimi, M., Shuaib, K., Al Nuaimi, K. (2014). Clustering in WSN Using Node Ranking with Hybrid Nodes Duty-Cycle and Energy Threshold. IEEE 13th International Symposium on Network Computing and Applications, Cambridge, MA. (21-23 August)
2) Nithyakalyani, S., Gopinath, B. (2015). Analysis of Node Clustering Algorithms on Data Aggregation in Wireless Sensor Network. Journal of Scientific & Industrial
3) Yuhui, J., Junping, H. (2008). A Time- based Cluster - Head Selection Algorithm for LEACH. IEEE Symposium on Computers and Communications, Marrakech. (6-9 Haziran)
4) Lindsey, S., Raghavendra, C. S. (2002). PEGASIS: Power-Efficient Gathering in Sensor Information Systems. IEEE Aerospace Conference Proceedings. 3(3)1125 - 1130.
5) Mahmood, Z., Nasret, A., Awed, A., Design of New Multiband Slot Antennas for Wi-Fi Devices, (2019) International Journal on Communications Antenna and Propagation (IRECAP), 9 (5), pp. 334-342.
6) Z. S. Mahmood, A. N. N. Coran and A. Y. Aewayd, "The Impact of Relay Node Deployment In Vehicle Ad Hoc Network: Reachability Enhancement Approach," 2019 Global Conference for Advancement in Technology (GCAT), 2019, pp. 1-3, doi: 10.1109/GCAT47503.2019.8978445.
7) Mahmood, Z. S., Coran, A. N. N., & Kamal, A. E. (2018). Dynamic approach for spectrum sharing in cognitive radio. International Journal of Engineering & Technology, 7(4), 5408-5411.
8) Nasret, A., & Mahmood, Z. (2019). Optimization and integration of rfid navigation system by using different location algorithms. International Review of Electrical Engineering (IREE), 14(4).
9) Mahmood, Z. S., Nasret, A. N., & Mahmood, O. T. (2021, October). Separately excited DC motor speed using ANN neural network. In AIP Conference Proceedings (Vol. 2404, No. 1, p. 080012). AIP Publishing LLC.