Minimizing Energy Conservation of Sensor Nodes Using Leach Protocol In Wireless Sensor Networks

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Abstract- *Cluster-based hierarchical routing protocols are critical for lowering wireless sensor network energy consumption (WSNs). As an application-specific protocol architecture for WSNs, a low-energy adaptive clustering hierarchy (LEACH) has been proposed. The LEACH protocol, on the other hand, can increase the network's energy consumption if it does not take into account the distribution of cluster heads (CHs) on a rotation basis. In this paper, we propose a novel modified routing protocol to increase the energy efficiency of the WSN. The newly proposed enhanced energy-efficient LEACH (IEE-LEACH) protocol takes into account residual node energy as well as network average energy.*

Keywords- Network lifetime; wireless sensor networks; routing protocol; energy efficiency

I. INTRODUCTION

WSNs are self-configured, infrastructure-free wireless networks that track physical or environmental conditions such as temperature, sound, vibration, strain, motion, or pollutants and cooperatively transmit their data across the network to a central location or sink where the data can be observed and analysed. A sink, also known as a base station, serves as a connection between users and the network. By inserting queries and collecting results from the sink, one can retrieve necessary information from the network. A wireless sensor network usually consists of hundreds of thousands of sensor nodes. Using radio signals, the sensor nodes can communicate with one another.

We know that SNs use more energy during contact than during computation, Other protocols, on the other hand, use multi-hop communication, which causes unnecessary transmission overhead at nodes close to the BS, resulting in energy leaks in the sensor. Many clustering techniques have been developed to solve the energy hole issue and extend the network lifetime.

WSN guidelines have been suggested explicitly. The hierarchy of low-energy adaptive clustering.In terms of energy savings, (LEACH) is the most effective hierarchical routing protocol. Routing protocols that have been in use for a long time.The entire network is divided into many segments in this protocol.

In this paper, we propose a novel improved energy-efficient LEACH (IEE-LEACH) routing protocol to address the disadvantages of traditional methods and extend the lifespan of WSNs even further.The threshold setting in the proposed protocol incorporates four parameters, including the initial energy of nodes, node residual energy, total energy of the network, and network average energy The node closest to the BS than the CH does not participate in the proposed IEE-LEACH protocol into a cluster As a result, the protocol is able to balance the energy load and reduce energy consumption. Furthermore, the proposed IEE-LEACH protocol contrasts single hop and multi-hop energy consumption..

A Wireless Sensor Network (WSN) is made up of various hardware components for sensing and computation that work together to detect and track environmental changes in areas such as plains, forests, and oceans. The resources, processing, and communication capabilities of WSN devices are limited..

II. LITERATURE SURVEY

LEACH: An Energy Efficient Routing Protocol for Wireless Sensor Networks Using Omnet++ Using the Omnet++ simulator, Deepak M. Birajdar and Sharwari S. Solapure demonstrated the comprehensive operation of the LEACH protocol. Set-up and steady-state phases are the two phases in which LEACH operates. LEACH rotates cluster-head nodes on a regular basis, ensuring that every node has a chance to be cluster head, and distributes energy consumption among nodes in the network, lowering power consumption and increasing network lifetime. LEACH is superior to traditional methods such as SPIN, GAF, TEEN, and APTEEN, among others..

Improving the Lifetime of Wireless Sensor Networks by Mitigating Correlated Data with the LEACH Protocol-

Rajat Kandpal and Rajesh Singh suggested IL- LEACH as a new improved version of LEACH (Improved Lifetime Low Energy Adaptive Clustering Hierarchy). Sensor nodes in the area collect correlated data, which is then sent to the cluster head. By turning groups of nodes into virtual correlated clusters (VCC) and allowing only one node to send data, IL-LEACH aims to mitigate correlated data transmissions. The grouping is performed using a threshold sensing coverage (TSC) and Euclidean distance measurement. In comparison to existing sensor networks, IL- LEACH increases the lifespan of sensor networks by an average of 30.006 percent.

H-LEACH: Wireless Sensor Networks Hybrid-Low Energy Adaptive Clustering Hierarchy Abdul Razaque and his colleagues suggested a novel strategy. H-LEACH (Hybrid Low Energy Adaptive Clustering Hierarchy) is a method for solving energy-related problems while choosing a channel head. When selecting a channel head using the threshold condition, H-LEACH considers the node's residual and maximum energy for each round. When the proposed threshold and energy conditions are considered, the proposed algorithm is used to find the life time of the nodes in terms of rounds in this paper. Nodes with less energy than the (Etr) minimum energy needed for transmitting and receiving signals are developed..

OE-LEACH:AnEnergy Efficient LEACH Algorithm for Wireless Sensor Networks- Parul and Sapna Gambhir suggested a new strategy. The OE-LEACH (Optimized Energy Efficient LEACH) project aims to reduce energy consumption in WSNs in order to increase time delay, network reliability, and network lifetime. In certain cases, sensor nodes do not have data to send on a daily basis because they are event oriented. As a result, data is only accessible when they detect an incident. As a result, the sensor nodes do not have to listen to the channel all of the time. The amount of energy spent on idle listening is greater than the amount of energy wasted on transmitting and receiving. This approach makes use of the slots that belong to the node.total extracted features, seven most characteristic features are used for comparison and ranking these features is very simple and fundamental in the process of identifying a normal and a diabetic fundus image.

LEACH-T is a three-layer LEACH clustering protocol- LEACH-T is a new strategy suggested by Mustafa A. Al Sibahee and his team (Leach Three Layers). As the distance between the sink node and the cluster heads (CHs) grows, so does the power consumption. Distance is introduced as a major problem in LEACH as a result of this flaw. A LEACH-based protocol with three layers is proposed in this paper. Per layer has its own set of CHs. The layers try to close the gap between the sink node and the CHs. If the distances between CHs and sink nodes surpass a certain level, the third layer is used.

Grid Block Energy Based Data Gathering Algorithms for Wireless Sensor Networks - Grid Block Energy based hierarchical Data Gathering (GBE-DG) algorithms for wireless sensor networks are discussed in this paper. The entire sensor network is divided into grid blocks of equal size. A grid block's energy level is equal to the sum of the energy levels of the sensor nodes within it. The GBE-Chain-DG trees perform better than the GBE-Cluster-DG trees in simulations, and both of these algorithms outperform the well-known LEACH and PEGASIS data gathering algorithms.

AStable Election Protocol for Clustered Heterogeneous Wireless Sensor Networks proposes SEP, a heterogeneous-aware protocol that extends the time interval until the first node dies (we call this the stability period), which is critical for many applications where sensor network feedback must be accurate. SEP is based on the weighted election probabilities of each node to become cluster head based on its remaining energy. Simultaneously, we show that SEP often extends the stability time relative to (and that the average throughput is higher than) existing clustering protocols.

Wireless Microsensor Networks: An Energy-Efficient Communication Protocol-LEACH (Low-Energy Adaptive Clustering Hierarchy), a clustering-based protocol that uses randomised rotation of local cluster base stations (cluster-heads) to evenly distribute the energy load among the sensors in the network, is described in this paper. LEACH integrates data fusion into the routing protocol to minimise the amount of data that must be transmitted to the base station and uses localised coordination to allow scalability and robustness for complex networks. In comparison to traditional routing protocols, simulations show that LEACH can reduce energy dissipation by up to a factor of eight.

HEED: A Distributed Clustering Approach for Ad Hoc Sensor Networks that is Hybrid, Energy-Efficient, and Hybrid We present the HEED (Hybrid Energy-Efficient Distributed Clustering) protocol, which selects cluster heads on a regular basis based on a combination of node residual energy and a secondary parameter, such as node proximity to its neighbours or node degree. HEED takes O1 iterations to complete, has low message overhead, and achieves a reasonably uniform cluster head distribution across the network. We show that, given sufficient bounds on node density and intra- and inter-cluster transmission ranges, HEED can almost certainly guarantee clustered network connectivity asymptotically. Our proposed solution is successful in extending network lifetime and promoting scalable data aggregation, as demonstrated by simulation results.

III. EXISTING SYSTEM

WSNs' energy efficiency can be improved by using a suitable clustering algorithm for grouping sensor nodes. Clustering, on the other hand, necessitates additional effort, such as cluster head selection and assignment, as well as cluster creation. Regional Energy Aware Clustering with Isolated Nodes is a new regional energy aware clustering approach for WSNs proposed in this paper (REAC-IN). CHs are chosen in REAC-IN based on their weight. The residual energy of each sensor and the regional average energy of all sensors in each cluster are used to calculate the weight. Nodes can become isolated from CHs due to poorly constructed distributed clustering algorithms. Such dispersed nodes communicate with one another.

The regional average energy and the distance between sensors and the sink are used to decide if an isolated node sends its data to a CH node in the previous round or to the sink in order to extend network lifetime. The current study's simulation results showed that REAC-IN outperforms other clustering algorithms. For power transmission, the REAC-IN system is used, which is inefficient.

IV. PROPOSED SYSTEM

Many schemes have been suggested to achieve efficiency in extending the lifespan of sensor networks. A clustering protocol is an effective method for extending the existence of a network among these schemes. However, because of the environment in which the collected data of the sensor nodes easily overlaps, some nodes consume energy unnecessarily while using this process. In this paper, we propose a Clustered Multi-hop Routing Algorithm that eliminates data replication and thus reduces unnecessary data transmission between nodes. This approach avoids data loss due to connection failure, resulting in reliable data collection..

As compared to existing clustering methods, our approach decreases energy consumption, improves transmission reliability, and extends network lifetime, according to the results of the performance review.

A. Flow Chart

The flowchart shows the graphical representation of the sequence of functions involved in the proposed system. Firstly the initial energy of the node is obtained then the cluster head selection is done based on the energy of the node. if the node has a good amount of energy then it is capable of communicating with other nodes and the result is obtained.

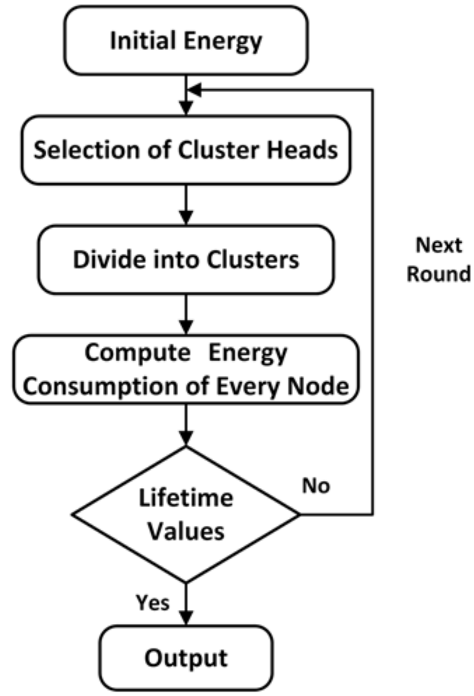


Fig 1: Flow Chart

B. System Model and Assumptions

For the proposed network, the following assumptions have been made.

- With an initial energy of 1 J, the nodes are homogeneous.
- The data is sent to the BS in several hops by the nodes.
- Hops are calculated based on the distance from the BS.
- The sensors used have a transmission range of 100–150 metres (indoor) and 50–75 metres (outdoor) (indoor). It is assumed that (150 m) and (75 m) reflect transmission and sensing ranges, respectively, as shown .If another sensor is inside the sensor's transmitting range, the sensed information is the same for both sensors.
- The nodes are distributed at random.
- Sensornodes are in a fixed position.
- BShas been fixed and placed in the network's centre
- The nodes are constructive, in the sense that they send data to the BS at regular intervals.

- The CHs are chosen at the beginning of the network. If the CH's energy falls below the threshold, the CH is reselected or rotated according to the proposed algorithm.

C. System Model

The use of clusters for data transmission keeps the number of nodes transmitting to BS to a minimum, preventing transmission over short distances. Different assumptions about radio characteristics, such as energy dissipation in transmitting and receiving nodes, path loss exponent, and so on, will alter the advantages of different protocols in the first-order model [2] shown in Figure 1. To run the transmitter/receiver circuitry, we've assumed a simple model where the radio dissipates 50 nJ/bit. Furthermore, as shown in Table 2, the transmit amplifier needs 100 pJ/bit/m2 to achieve an appropriate result. These parameters outperform the existing state of the art in radio design by a small margin.

The proposed algorithm distinguishes clusters and CHs based on the position of different nodes. The CHs are chosen based on the number of neighbour nodes, the number of unique connected nodes, and the residual energy. Following CH recognition, data is transmitted from a particular node using CHs until it enters BS. Each CH collects data from its connected nodes and performs data aggregation to minimise the amount of data that must be transmitted. According to the routing table defined earlier, the aggregated data is sent to the BS via the intermediate CHs. The following section explains the stepwise algorithm.

Step 1: A random number of motes is deployed in the area to be sensed. The BS has the id 0 and must be manually located in the network field

Step 2: Using the transmission range as shown, calculate the set of neighbour nodes and the number of neighbour nodes for the node.The neighbour info function returns all of a node's neighbouring nodes.Within the transmission range, the distance between a given sensor and is determined by a collection of neighbour node IDs (). For all motes and the BS, the neighbour info function is repeated.

Step 3: BS acts as the CH at all times. From BS, the CH selection (CHS) process begins. The CH selection message (CHS msg) is sent by BS to all neighbouring nodes. Nodes with residual energy greater than the threshold energy can become CHs

Step 4: The unique neighbour info function returns the nodes that are attached to a node. The special nodes in the ()th hop are those that are not connected to any other nodes.

Step 5: Think about the parts of Neighbours that aren't flagged.

Step 6: Steps 3–5 are replicated until all nodes have been filled by elected CH. Depending on the distance between the node and the BS, all nodes should have a path up to the BS through single or multiple hops.

Step 7. If one of the CHs dies during the transmission of data after clustering, the CH at the previous hop is notified because the data from the dead CH did not enter it. If the CH at the th hop dies, the clustering algorithm is repeated for the entire network after the (th)th hop.

Step 8: If the CH's residual energy falls below the threshold energy (), the CH selection phase must be re-initialized. If the CH's residual energy at the th hop is less than the threshold, the clustering algorithm is repeated for that direction after the ()th hop.

Step 9: Once the routing path has been identified, data is sent through it.

Any method in which data is collected and expressed in a summary form is referred to as data aggregation. Many studieshave shown that aggregation at the CH decreases the amount of data routed through the network, improving throughput and extending the sensor network's lifespan.

Data aggregation also addresses the problem of estimating a sensor's missing value . In the event that data from one of the sensors fails to enter the cluster head, the Jackknife estimate can be used to forecast the value of the sensed parameter. It is also capable of fault tolerance. If the data from one of the sensors differs from the calculated value, corrections are made.

D. Enhanced Selection of Cluster Heads

Despite the fact that a worthy topology structure relies on a rigorous estimation methodology, the supremacy of topology mechanisms has an influence on the lifetime and understanding of networks. Three subsequent pointers are taken into foremost attentions to appraise the sensor network topology process, comprising certain appeals and device structures:

- **Coverage**: This is a metric of a sensor network's service dominance that focuses on the coverage percentage of preliminary sensor node placement and whether these sensor nodes can receive signals from the ROI in an absolute and precise manner.

- **Communication**: Since WSNs are typically large in scale, connectivity ensures that data collected by sensors can be sent to sink nodes.

- **Network lifetime**:The phase interval from fright to when the fraction of deceased nodes rises to a verge is widely used to characterize the lifetime of a network.

V. WORKING PRINCIPLE

The given block diagram shows the pictorial representation of the working principle of this sensor network. The system comprises of four different modules namely initial energy level module, formation of cluster heads module, nodes communication module and network lifetime module.

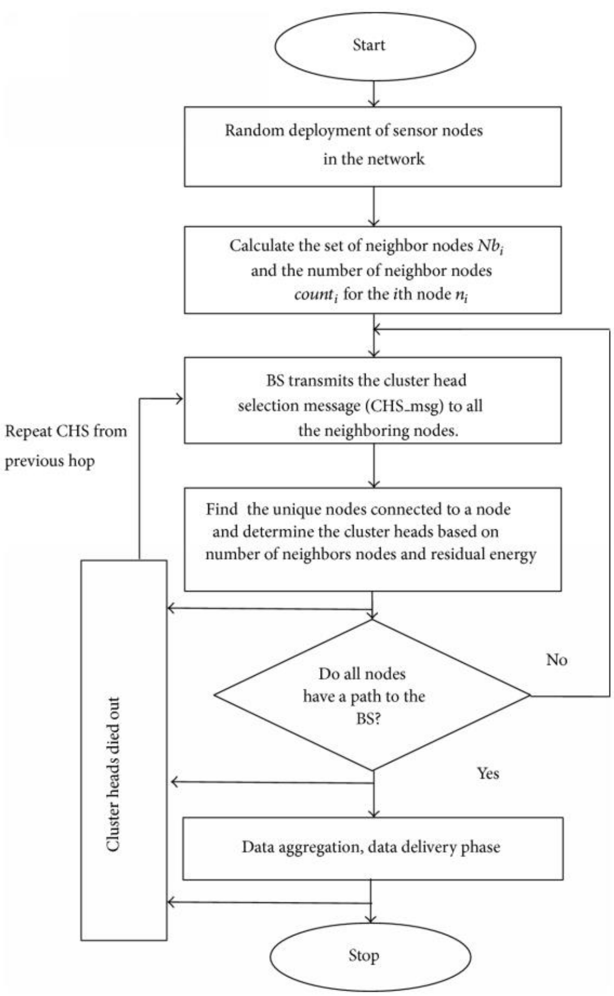


Fig 2:Block Diagram

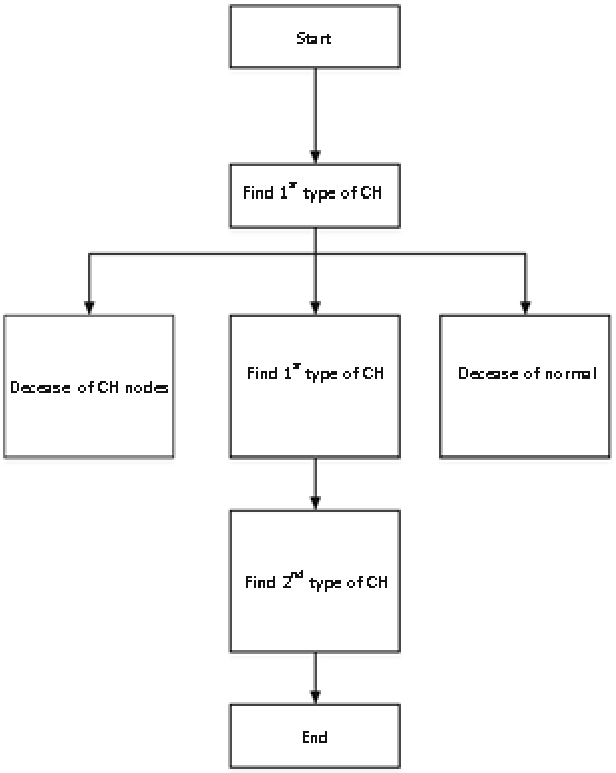
Initially, a Voronoi graph is used to distribute the observing area in order to ensure optimal coverage, and the distributed region is divided into small clusters. CH selection is based on the same coverage area as the distributed region, but with the most redundant sensor nodes. As a result, small clusters can maintain the longest period by changing the CH rather than changing the entire coverage area. The improved CHs election procedure is seen. Election process for CHs has been improved.Further down, we'll go over - stage indetail:

STEP 1: The BS obtains the positions of all nodes in the observing area, as well as the remaining energy of all sensor nodes.

STEP 2: Using a Voronoi graph, the observing area is divided into selected clusters, and the perception probabilistic model is predicted. The offsetting probabilistic method is used to select system redundant nodes, and these sensor nodes are the first type of hibernation CH node.

STEP 3: When a current CH node dies, a new redundant CH node becomes active. If the demise node is a current common node, the redundant node becomes inactive and becomes a regular node.

STEP 4: If the first type of CH nodes has all died, the endurance time approximation method can be used to estimate the system's average remaining capacity. On the basis of the ratio of remaining energy to average energy of system nodes, choose the second class of CH nodes.



A. Energy Model for WSN:

It is defined as the total amount of energy consumed by nodes in a network. Figure 3 shows the energy model for a WSN with k number of bits being transmitted over a distance of d.

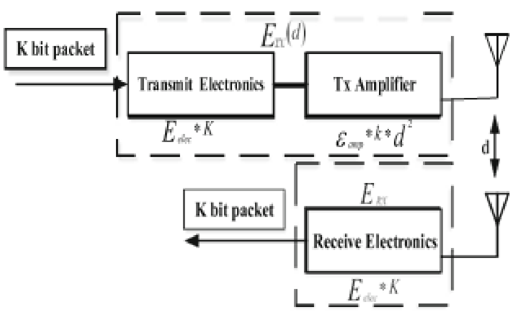


Fig 3: Energy Model For WSN

VII. SIMULATION RESULTS

As a result, the nodes with high energy will be able to communicate with other nodes.

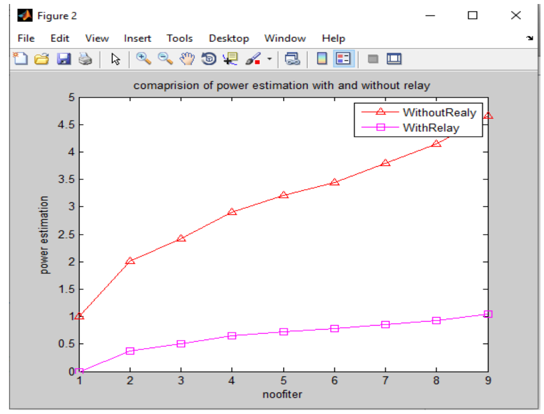
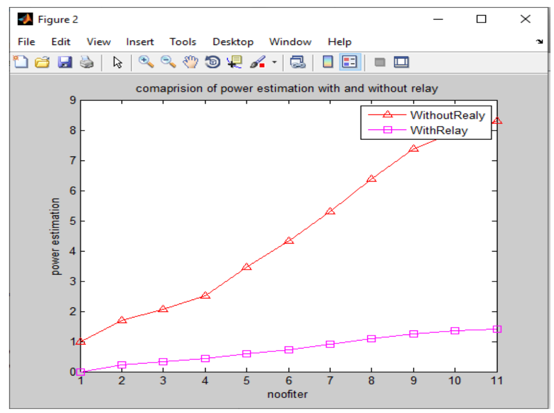


Fig 4: Power Consumption

In the above Figure,consumption of the power estimation is displayed with and without delay is depicted. The below screenshots will compare the power consumptions



The power line interference is represented in the below diagram where the if the graph has blue line it represents the inter-cell method and the green line represents the flexible co-operation of the nodes and if the graph is generated with brown line it shows that the nodes show full co-operation.

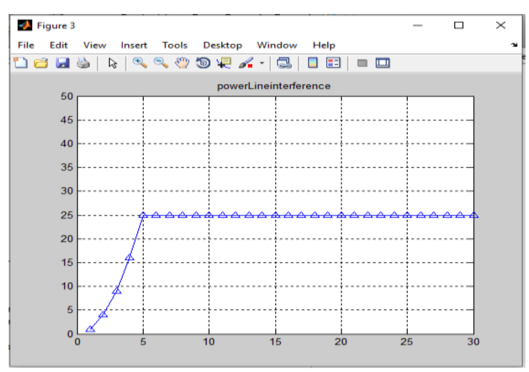


Fig 6:Power Line Interference

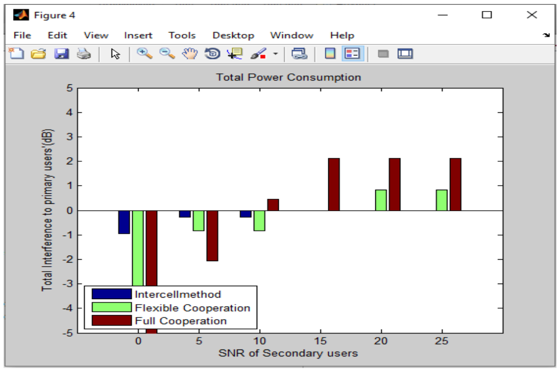


Fig 7: Total Power Consumption-Comparison

Basically, The above mentioned picture is the comparison diagram. Here, the comparison is done between primary users to the secondary users

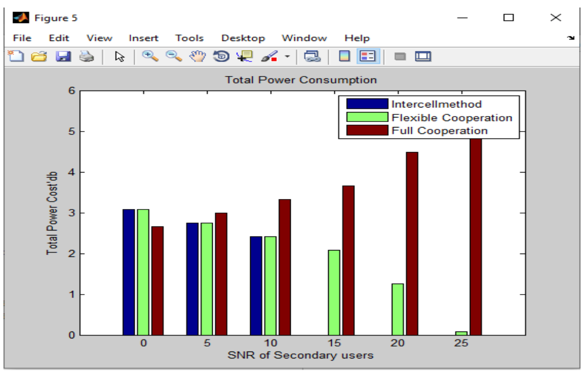


Fig 8:Total Power Consumption

MHC is divided into three stages:preliminary, hierarchical, and final. This algorithm only performs the initial step at the start of network clustering and the final phase after network clustering is complete. The algorithm, on the other hand, repeats the hierarchical phase from the first to the last step, hierarchically clustering the entire network. Sensors compare gathered environmental data with data from nearby sensors during the data collection process. If the data is identical [4,] the sensor saves the message sender's ID in a list of its neighbours, counts the number of neighbours, and assigns it to the Ni variable..

VIII. CONCLUSION

In this paper,anenergy-efficient cluster-based routing algorithm is proposed to extend the lifetime of wireless sensor networks. The cluster heads are chosen by MHC based on two parameters: remaining energy and node degree. MHC is completed in three steps.

Members also enter the cluster heads based on two factors: maximum energy and distance to the cluster leader. After that, A wireless sensor network (WSN) is a combination of long-distance communication and sensor hubs. The company must be highly efficient and healthy, as well as having a longer lifespan. Our system lowers energy consumption, improves transmission reliability, and extends community lifetime..

As compared to current gathering approaches, our system decreases energy consumption, improves transmission reliability, and extends group lifetime. It is set up with a clustering multi-hop algorithm

Wireless sensor networks (WSNs) are usually made up of a large number of low-energy sensor nodes (SNs).

The aim of our project is to reduce energy consumption and extend the life of WSNs. In comparison to current routing protocols, the proposed IEE-LEACH protocol's threshold adds four parameters: initial node energy, residual node energy, total network energy, and average energy of all nodes. This mechanism will increase the network's robustness and prolong its lifespan..

IX. FUTURE WORKS

For future studies, we will try to improve on how to build and execute a time frame or time slots using digital electronics or software switching systems that provide two switching modes: active and sleep mode, as discussed in the study. As a result, the transmitting electronics is in "active" mode while the transmitting amplifier is in "sleep" mode during data computations, and vice versa. It's also crucial to conduct further research into how to create a software program or digital circuit that specifies or adjusts the transmitting distance between the transmitting and receiving nodes to determine the RF signal's operating frequency.

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