Data Aggregation Using Tabu Search Energy Optimization Based Minimum Spanning Tree Routing (TSEO-MSTR)

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Abstract- Wireless sensor networks (WSN) are one of the critical technologies because of their assorted applications such as medical services observing, PDAs, military, fiasco the board, and other reconnaissance frameworks. Sensor hubs are generally conveyed in enormous number that works freely in unattended brutal conditions. Because of imperative assets, ordinarily the scant battery power, these wireless hubs are gathered into clusters for energy effective correspondence. In clustering hierarchical schemes achieved extraordinary interest for limiting energy utilization. Hierarchical schemes are generally requested as cluster-based and network based methodologies. In this paper proposed Tabu Search Energy Optimization based Minimum Spanning Tree Routing (TSEO-MSTR) data aggregation for low weighted delay and high network lifecycle. The simulation experiments show that, the proposed data aggregation method consumes less energy while aggregating data from sensor nodes, and thus can prolong the network lifecycle.

Indexed Terms- Wireless sensor networks, Tabu Search Energy Optimization, Minimum Spanning Tree Routing, data aggregation.

I. INTRODUCTION

Late advancements in Electronic and remote communication enterprises, has made the capacity of planning small size, least value, low utilization and multi applications sensors. These little sensors have the capacity of getting, handling and sending the ecological information and have made a thought for improvement of organizations that are named Wireless Sensor Networks. The sensor networks design execution is with the goal that the sensors circulated haphazardly and reliably in a district to identify and control the handled occasions, and afterward they send the data to the base Station. These sensors have elite and they have a few limitations while creating in high scale. As far as possible can be ordered into certain classifications, for example, band width limitation, no battery substitution short radio station and low energy utilization conditions much of the time. Each sensor node is generally outfitted with a battery, microcontroller and handset. Sensor nodes are by and large set with communication and preparing ability. In remote sensor networks productivity of energy is a significant issue. Various leveled directing is an expert method to limit the energy utilization inside a bunch. In any case, on the grounds that the group heads (CHs) closer to the sink node are troubled with hefty traffic, they channel a lot quicker than other CHs.

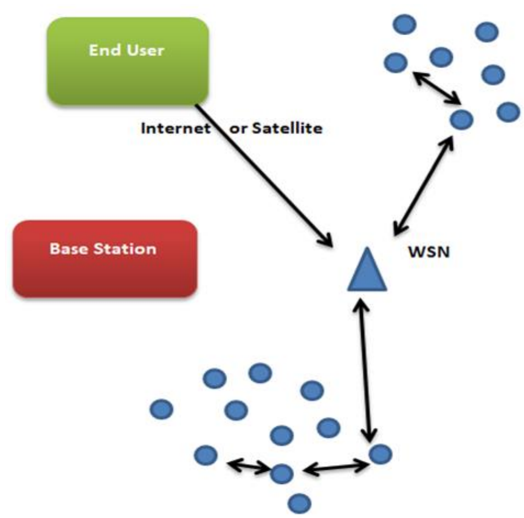

Figure 1: Energy Efficient Routing in Wireless Sensor Network

Some features of sensor network make it dissimilar from other traditional and wireless networks. These features are:

1. High thickness of node circulation in working locale
2. Failure ability of the nodes
3. Data oriented network
4. Memory
5. Dynamic and intermittent topological changes
6. Hardware including size limitations, power supply, measure power and limit
7. Using the transmission communication strategy rather than peer to peer technique.

1.1 Tree Based Data Aggregation Techniques

In this sort of plan nodes are coordinated in a tree topology where the sink is spoken to as a root. All the transitional nodes play out the total and move it to the root (sink). Energy proficient tree development is the primary angle in the tree-based methodology. This part incorporates TREEPSI, PERLA and TCDGP conventions and with their advantages and restrictions.

1.2 Energy-Efficient Data Collection Protocol for Wireless Sensor Network Based on Tree

Energy-data assortment convention for remote sensor dependent on a (). Here the dispersion of nodes inside the remote sensor network incorporates the sending nodes, the detecting nodes, and sink. The tree structure incorporates various layers. Layer 1 contains the sink node which gathers all the detected data. Layer 2 contains the sending nodes which goes about as moderate nodes and advances the parcels from the leaf nodes to the sink. Layer 3 contains the leaf nodes or the detecting nodes which screens the climate and communicates the data to the sending nodes. This technique incorporates two stages. The main stage is the arrangement of data assortment tree and the subsequent stage is the returning of detected data. During returning of detected data, the data from every node is collected and is sent to the sink node.

1.3 Tree-Based Multiple-Hop Distributed Hierarchical Agglomerative Clustering Protocol

The calculation is proposed to improve the introduction of the, TMH-DHAC receives a tree-like intra-bunch structure to abbreviate information transmission distances inside a group and streamlines the intricacy in the methodology. TMH-DHAC structures a minimum spanning tree (MST) inside a bunch. The CH goes about as the foundation of the tree and each other hub has its parent hub. In TMH-DHAC, a multi-bounce approach is received inside a group to abbreviate transmission distance and consequently energy cost. Information transmissions start from the leaf hubs to their parent hubs which total their own information with those got from their kids and send the collected information to its upper-level hub. The cycle will be rehashed from leaf hubs right to the root hub in a group. By this implies, each hub just speaks with its parent hub and kid node(s). The normal transmission distance is a lot more limited in TMH-DHAC than star-like geography because of the MST development.

1.4 Data Aggregation: An Overview

The data aggregation is a technique used to tackle the collapse and cover issues in data driven routing. Data coming from numerous sensor nodes are accumulated as though they are about a similar property of the marvel when they arrive at the equivalent routing hub in transit back to the sink. Data aggregation is a generally utilized technique in remote sensor organizations. The security issues, data classification and trustworthiness, in data aggregation become fundamental when the sensor network is conveyed in an unfriendly climate. Data aggregation is a cycle of collecting the sensor data utilizing aggregation draws near

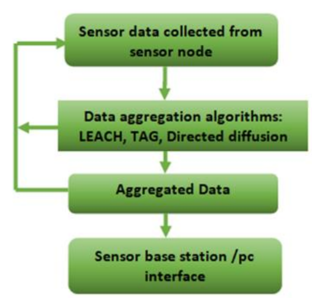

Figure 2: Data Aggregation

a. Data Aggregation Protocols Based On Network Architecture

The design of the sensor network assumes an imperative job in the presentation of various. In this segment, study a few data aggregation protocols which have explicitly been intended for various organization designs.

b. GRID based Data Aggregation Techniques

In grid-based data total, the data aggregator is fixed in every grid and it totals the data from all the sensors. Consequently, the sensors inside a grid don't speak with one another. Any sensor hub inside a grid can accept the part of a data aggregator regarding adjusts until the last hub bites the dust. It is best appropriate for military observation and climate anticipating. In this segment

1. GROUP
2. ATCBG.

1. GROUP

It is an energy-productive and cluster-based routing convention for remote sensor organizations. In GROUP, the nodes are coordinated into clusters. One node is chosen as the cluster head (CH) in each cluster. And all cluster heads structure a virtual cluster grid. The information queries will be sent from sinks to all nodes through cluster heads. Also, the information matched the inquiry are directed back to sinks through cluster heads. Gathering select cluster heads powerfully. The information sending should be possible in three cycles the cluster grid development measure, inquiry sending and information sending.

In Cluster grid development stage after the remote sensor network is conveyed, all sinks in the organization will choose one sink as the essential sink (PS), which starts the cluster grid development measure, in light of their area. The PS is nearer to the focal point of organization than different sinks to keep a base term of grid development. Inquiry sending stage queries are sent through restricted broadcast and unicast separately. There are two common classes of queries sent by sinks, for example area unconscious inquiry and area mindful question. In GROUP, The area uninformed question is sent from one of the sink to its nearest cluster head. The area mindful question will advance the inquiry to one of its downstream cluster heads which is nearest to the objective territory referenced in the inquiry.

2. Aggregation Tree Construction Based On Grid (ATCBG)

The aggregation tree development calculation (ATCBG) is to having a few upgrades over GROUP. The principle thought of ATCBG is that aggregation tree is built by accepting the sink as the focal point of a grid. The entire organization is separated into grids. Every grid shapes a cluster. The cluster head is chosen by thinking about remaining energy, distance to the focal point of the grid and different components. The cluster head take answerable for information aggregation. All the cluster heads structure a tree-structure. Structure a tree-structure. The aggregation tree development is started by sink. Sink communicates tree development message. In Cluster Head Replacing Scheme: The cluster head will devour more energy due to accepting and melding all the information from its part hubs and kid hubs. To maintain a strategic distance from sudden passing of the cluster head, the cluster head should be supplanted after a specific time.

II. LITERATURE REVIEW

1. Low-Energy Adaptive Clustering Hierarchy (LEACH)

Heinzelman et al proposed the LEACH protocol. It is the first dynamic cluster head protocol specifically for WSN using homogeneous stationary sensor nodes randomly deployed. LEACH is suited for applications which involve constant monitoring and periodic data reporting. LEACH protocol runs in many rounds. Each round contains two phases: cluster setup phase and steady phase. In cluster setup phase, it performs organization of cluster and selection of cluster head. Selected cluster heads broadcast a message to all the other sensors in the network informing that they are the new cluster heads. All non-cluster head nodes which receive this advertisement decide which cluster they belong to base on the signal strength of the message received. All non-cluster head nodes transmit their data to the cluster head, while transmit the data to the remote base station (BS). Cluster head node is much more energy intensive than being a non-cluster head node. Head nodes would quickly use up their limited energy. Thus, LEACH incorporates randomized rotation of the high-energy cluster head position among the sensors.

2. Clustered Aggregation Technique (CAG)

It is an algorithm to compute approximate answers to queries by using spatial and temporal properties of data. CAG forms clusters of nodes sensing similar values. It ignores redundant data using the spatial and temporal correlations provide significant energy savings. CAG can work in two modes: a) interactive mode and b) Streaming mode. CAG generates a single set of responses for a query in the interactive mode. In the streaming mode, periodic responses are generated in response to a query. The interactive mode of CAG exploits only the spatial correlation of sensed data. CAG builds a forwarding tree when a query is sent out. Thus, the forwarding path is set along the reverse direction of the query propagation. However, the interactive mode requires the overhead for broadcasting a query each time a user wants new data from the network. In the streaming mode of CAG takes advantage of both spatial and temporal correlations of data. A query for the streaming mode uses the clause “epoch duration i” to define the sampling frequency. The query is injected into the network only once with this clause, it generates a query reply for every second.

3. Energy Efficient Clustering and Data Aggregation (EECDA)
EECDA combines energy efficient cluster based routing and data aggregation for improving the performance in terms of lifetime and stability. It is for the heterogeneous WSN. EECDA balances the energy consumption and prolongs the network lifetime by a factor of 51%, when compared with LEACH.

4. Power Efficient Gathering in Sensor Information System (PEGASIS)
It is a near optimal chain based power efficient protocol based on LEACH. The cluster formation and cluster head selection is not used in PEGASIS. Each node determines the distance to its neighbors using the signal strength and then adjusts the signal strength to communicate only with the closest neighbor. Collected data moves across the nodes, gets aggregated at each node, and eventually, a single designated node transmits data to the base station. Nodes take turns in transmitting to the base station so that the power dissipation for communicating with the base station is distributed uniformly among all the nodes. In PEGASIS the chain construction is done in greedy fashion with the assumption that all the nodes have global knowledge of the network. The leader in each round of communication is selected from a random location in the chain.

III. EXISTING SYSTEM

a. Single-Hop Hierarchical Agglomerative Clustering (SH-HAC)
The SH-HAC algorithm is based on the traditional HAC for the formation of the clusters of nodes. The adopted similarity measure is the nearest neighbor in terms of Euclidean distance. Unlike the Kmeans clustering where the number of cluster is given as an input, the number of resulting clusters is based on sudden change criteria. The selection of the cluster heads (CHs) obeys to the following three steps: Initial Clustering, Re-Clustering, CH selection, as described hereafter. Note that this overall procedure is re-executed after a predefined number of communication rounds between the sensor nodes and the BS.

Initial Clustering: Let assume that we obtain k clusters from HAC. For each cluster, the CH selected initially is the closest one to the BS.

Re-Clustering: Now that every node is associated to one of the k clusters, we calculate for each cluster a virtual position opts having the following coordinates.

CH selection: Among the cluster members, the selected CH is the one having the smallest Euclidean distance to the opt point defined previously. As the network operates, the opt point moves towards the nodes having the highest amounts of residual energy. Consequently, the new CH will be selected among these nodes. This rule is devised to extend the network lifetime as CHs dissipate more energy by forwarding the traffic to the BS.

b. Multi-Hop Hierarchical Agglomerative Clustering (MH-HAC)
MH-HAC follows the same steps as SH-HAC, except that the CHs are no more restricted to send their data directly to the BS. Hence, CHs can also act as relays for data traffic coming from other clusters. The pursued advantage is to minimize CH’s transmission cost, which increases dramatically as a function of distance as shown by (4). Our strategy is to build a minimum spanning tree between the BS and the selected CHs, where the weight of each edge corresponds to the Euclidean distance between the two ends. We rely here on the Prim’s algorithm in

(WeiWang et al., 2014), which we provide here for the sake of completeness.

c. Range-Limited Hierarchical Agglomerative Clustering (RL-HAC)

The previous schemes assume implicitly that transmission range is unlimited. That means that every node in the networks can reach directly any other node by setting enough transmission power. This is not the case in real-world applications, where real sensors, such as those equipped with IEEE 802.15.4 transceivers, are range-limited. Thus, SH-HAC and MH-HAC are not applicable with this kind of technology. To cope with this restriction, we introduce in this subsection a third clustering scheme called Range-Limited HAC (RLHAC). RL-HAC executes the HAC phase by enforcing two more conditions:

- A sensor can transmit a data packet only to another nodes located at a distance not greater than d.
- To merge two clusters, there must be at least one member node which is able to communicate directly with the other members of the two clusters.

IV. PROPOSED SYSTEM: TABU SEARCH ENERGY OPTIMIZATION BASED MINIMUM SPANNING TREE ROUTING (TSEO-MSTR)

- Data Aggregation

The principle objective of data aggregation algorithms is to accumulate and total data in Wireless Sensor Network (WSN) in an energy productive way so that network lifetime is improved. Data aggregation might be successful technique in this setting since it diminishes the quantity of packets to be shipped off sink by amassing the comparative packets. The exhibition of data aggregation protocols are described by execution measure, for example, energy consumption, latency advertisement data accuracy. In this paper, we present a survey of data aggregation algorithms and approaches for taking care of the compromises in data aggregation schemes. The data aggregation based on architecture separated into parts, for example, Flat Networks and Hierarchical.

- Hierarchical data aggregation: It can be additionally isolated into four parts cluster, chain, tree and grid.
- Flat Networks: In flat network, aggregation is done in data driven routing strategy, the sink transmits a query message to the sensors, and sensors which have data coordinating the query send reaction messages back to the sink. Extreme communication and computation are acted in sink hub, bringing about a faster depletion of its battery power. The disappointment of the sink hub separates the usefulness of the network.

To build up a Tabu Search Energy Optimization based Minimum Spanning Tree Routing (TSEO-MSTR) Technique in wireless sensor network for expanding the network lifetime.

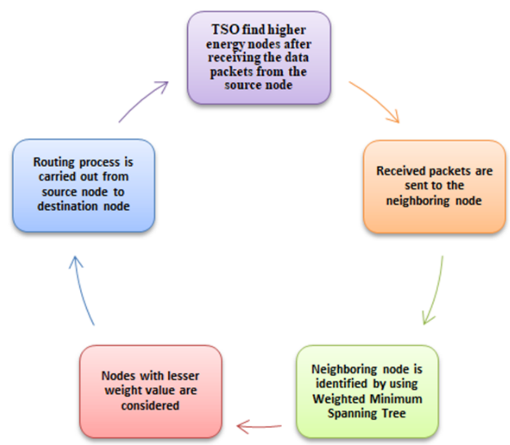

Figure 3: Proposed workflow process

The essential type of Tabu Search (TS) is established on thoughts proposed by Fred Glover (1977, 1986). The technique is based on strategies intended to cross limits of achievability or local optimality, rather than regarding them as barriers. In its most popular structure, tabu search can be seen as starting similarly as normal local or neighborhood search, continuing iteratively from one point (answer for) another until a picked termination rule is satisfied. Wireless sensor network (WSN) comprises of number of sensor nodes. Tabu search optimization (TSO) is completed to discover higher energy nodes in the wake of getting the data packets from the source node. At that point, the got packets are shipped off the neighboring node to lessen the routing overhead.

WSN network can be considered as an associated undirected graph spoke to by $G = (N, E)$, where N is the number of nodes (N_1, N_2, N_3……N_n), E is the edges of nodes (E_1, E_2,E_3……E_n) the connection between nodes. In this work the normalized estimations of mobility, delay, and remaining energy are spoken to on the edges. Each edge may then be characterized by the qualities spoke to in positive genuine numbers and signified by.

$$\omega_{i,j=}\omega^1_{i,j,}\omega^2_{i,j,....}\omega^m_{i,j}$$

Presently cluster head selection technique comes in real life to choose a portion of the sensor nodes is high energy node as cluster heads.

$$T(s) = \begin{cases} \frac{P_{opt}}{1 - P_{opt}\left(r.\text{mod}.\frac{1}{P_{opt}}\right)}, \text{if S} \\ \in G' \dots\dots 0 \text{ otherwise.} \end{cases}$$

$Let\ x = x_{1,2,}x_{i,j,....,}x_{n-1,n}$ be defined as the connectivity between node i and j:

$$x_{i,j=}\begin{cases} if\ e_{i,j=1}\ \ and\ is\ selected \\ 0\ othewise. \end{cases} \quad (1)$$

The proposed technique can be formulated as in

$$\min f_{1(x)} = \sum \omega^1_{i,j}\, x_{i,j}$$

$$\min f_{2(x)} = \sum \omega^2_{i,j}\, x_{i,j} \quad (2)$$

.

$$\min f_{m(x)} = \sum \omega^m_{i,j}\, x_{i,j} \quad (3)$$

Where $f_i(x)$ is the objective to be minimized for the problem, $i = 1, \dots n-1; j = 1, \dots, n$ subject to$x \in X$. These objectives either can be formulated as a multi objective function or can be represented.

$$\min f_{i(x)} = \propto \sum \omega^1_{i,j}\, x_{i,j} + \beta \sum \omega^2_{i,j} + \cdots,$$

where $f_i(x) = \propto (\min(\text{mobility})) + \beta(\min(\text{delay})) + \gamma\ (\min(1 - \text{remaining energy}))$. (4)

The accompanying suppositions are made for the sensor network.

1. Nodes are scattered randomly.
2. The energy of sensor nodes is restricted and uniform initially.
3. Nodes are area unconscious.
4. The communicating intensity of the nodes changes relying upon the distance to the receiver.
5. Approximate distance is assessed based on the got signal strength.

The neighboring node is distinguished by utilizing Weighted Minimum Spanning Tree where the distance between the two nodes are considered as loads. The nodes with lesser weight esteem are considered as best neighboring node and the data packets are shipped off that specific node. Thusly, the routing process is done from source node to destination node. This assists with diminishing the routing overhead.

The node energy model is based on. The energy dissipated to transmit it N bit is given in $E_{diss.Tx} = N\big(\text{Energy} - \text{dissipated} - \text{tranmitter} - \text{electronics} + (\text{Energy} - \text{dissipated} - \text{transmitter} - \text{amplifier} * \text{distance} - \text{squared})\big)$ (5)

The energy scattered to receive N bit is yielded $E_{diss.Rx=N}$(energy _ dissipated receiver_electronics (6)

Power devoured for a given time period t can be processed by partitioning the dispersed energy by time and is given by

$$\frac{E_{diss_{Rx}}+E_{diss\_Tx}}{t} \quad (7)$$

The mobility of a node is assessed utilizing the free Space Path Loss (FSPL) model. The relation between FSPL, frequency of radio signal, and distance between the transmitter and receiver is given by

FSBL (db) =20 log (d) + 20 log (f) + k, (8)

To discover the distance went by nodes I and j with the respect to one another during time n, the distance between the nodes is figured at time t and t=n if high mobility increases the re-clustering process and increasing the energy consumption. The objective is to frame clusters based on low mobility which prompts low energy consumption and lower delays because of lower link breakages. The mobility of node can be figured by

$$m = \frac{d_t - d_{t+n}}{D}\begin{Bmatrix} > 0.5 \text{ impiles high mobility} \\ \leq 0.5 \text{ impiles normal mobility} \\ 0 \text{ impiles no mobility} \\ < 0 \text{ impiles node converging} \end{Bmatrix} (9)$$

Parameters	Description
N_i	$Node_i$
N_j	A neighbor node in cluster range of N_i
RE_{Ni}	Residual energy of N_i
Dis N_j	Distance between N_i and N_j
RE_{Nj}	Residual energy of N_j
Ech_Msg	Elect cluster head message
Crt_Msg	Create tree message

Step 1: - Initialize the wireless sensor network with the different qualities.
Step 2: - Define sensor field with the respective position of the sensor nodes and furthermore the base station.
Step 3: - Now cluster head selection technique come in real life to choose a portion of the sensor nodes is high energy node as cluster heads.
Step 4: - Now update the routing table getting to energy of nodes.
Step 5: - Find course between CH utilizing minimum routing spanning Tree
Step 6: - Again update the routing table with high energy node and less distance between two nodes
Step 7: - Transmit the data from source node to destination node

- Transmission Model

Recently, there is a lot of work in the area of building low-energy radios. In this predefined transmission model, the energy dissipation of the transmission to run the transmitter or receiver circuitry is equivalent to Eelec = 50nJ/bit, and to run the communicate amplifier it is equivalent to Eamp = 100pJ/bit/m2. It is likewise accepted a r2 energy loss because of channel transmission. Therefore, the energy consumed to communicate a k-bit packet to a distance d and to receive that packet with this transmission model is:

$$E_{Tx}(k,d) = E_{elec} * k + E_{amp} * k * d^2 \quad (10)$$

$$E_{Rx}(k) = E_{elec} * k \quad (11)$$

It is additionally expected that the radio channel is symmetric, which implies the cost of communicating a message from A to B is equivalent to the cost of sending a message from B to A.

The energy required for receiving a message isn't so low. Therefore, the routing protocols should likewise limit the quantity of receive and send operations for a particular node while limiting the communicate distances. It is likewise essential to take note of that the cost of one transmission of a k-bit packet to the system is by the same token:

$$C_{ij}(k) = 2 * E_{elec} * k + E_{amp} * k * d_{ij}^2 \quad (12)$$

$$C_i'(k) = E_{elec} * + E_{amp} * k * d_{ib}^2 \quad (13)$$

Where c_{ij} is the cost of transformation between node i and node$j$,c_i' is the cost between node i and the base station,d_{ij} is the distance between node i and node j , and d_{ib} is the distance between node i and the base station. Since c_i' is smaller than c_{ij} when the term with E_{amp} is much smaller than the term with E_{elec} , for overall system lifetime it can be advantageous to increase the number of transmission to the base station.

- Minimum Spanning Tree based Routing

The energy dissipations in MTE (Minimum Transmission-Energy) routing and direct transmission are compared and it is figured out that an ideal system should utilize a crossover of both when the base station is far away from the nodes. The authors propose a two-level clustering hierarchy based routing scheme, in which the quantity of nodes (cluster heads) that communicate data to the base station is reduced to 5%, while all of different nodes decide their nearest entryway (cluster-head) to the base station to send their data. The cluster-heads are picked randomly to make the system lifetime longer. Nonetheless, since this algorithm is purely irregular, it is a long way from ideal.

In a nearby neighborhood, the cost of running receive or communicate circuitry is bigger than the cost of running the amplifier circuitry for a single node. So they propose a scheme where all nodes receive and send just a single time over the edges of a chain going through all nodes and whose length is near minimum. In each cycle, an exceptional node is chosen randomly to send the fused data to the base station. Subsequently, just a single node speaks with the base station. The algorithm works fine when the base station is far away from the field in which case the cost of sending data to the base station is nearly the equivalent for all nodes. All things considered, regardless of who sends data to the base station, for a series of communication the algorithm attempts to limit the energy devoured by every node, thusly expands the lifetime of the nodes. Figure 4 shows a routing scheme that processes for an example network.

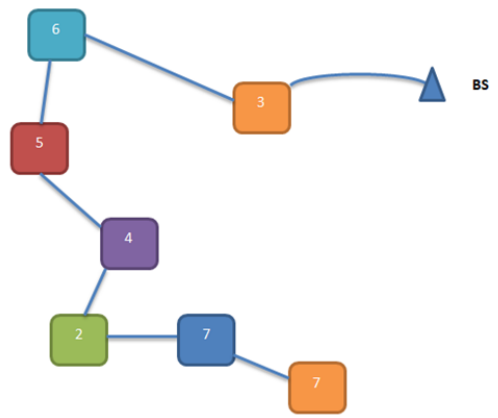

Figure 4: Routing scheme on a sample network

Nonetheless, when the base station is inside the field (near the middle), both of the protocols perform poor. This is essentially on the grounds that they don't take the specific cost of sending data to base station into account and make a choice as indicated by that. Also, the approaches so far have not considered limiting the all-out energy devoured per-round in the system. We accept that the principle thought, to expand the network lifetime, should be to limit the absolute energy exhausted in the system in a series of communication, while adjusting the energy consumption among the nodes.

V. EXPERIMENT RESULT

Experimental evaluation is carried out on factors such as energy consumption, network lifetime and routing overhead with respect to number of data.

1. Energy consumption

No of Nodes	CAG	PEGASIS	TSEO-MSTR
50	0.7	0.65	0.54
100	0.67	0.61	0.46
150	0.61	0.57	0.39
200	0.55	0.52	0.32
250	0.49	0.43	0.29

Table 1: Energy consumption

The comparison Table 1 of analysis Energy consumption Existing and Proposed shows the different values. When comparing the Existing and Proposed the Proposed value provides the better results than the Existing value. The Existing value starts from 0.7 to 0.29 and the proposed values starts from 0.54 to 0.29 Every time the proposed value provides the better results.

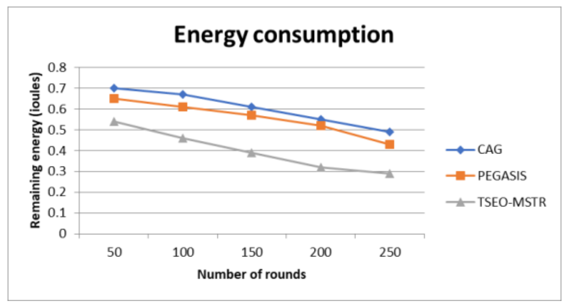

Figure 5: Energy Consumption

The comparison chart of Energy Consumption Method of Existing and Proposed shows the different values in Figure 5.The Existing value starts from 0.7 to 0.29 and the proposed values decreased time 0.54 to 0.29seconds. Every time the proposed value provides the better results than the Existing value.

2. Network Lifetime

No of Nodes	CAG	PEGASIS	TSEO-MSTR
100	20	30	35
200	37	40	43
300	47	53	57
400	63	67	72
500	77	84	89

Table 2: Network Lifetime

The comparison Table 2 of analysis Energy consumption Existing and Proposed shows the different values. When comparing the Existing and Proposed the Proposed value provides the better results than the Existing value. The Existing value starts from 20 to 84 and the proposed values starts from 35 to 89. Every time the proposed value provides the better results.

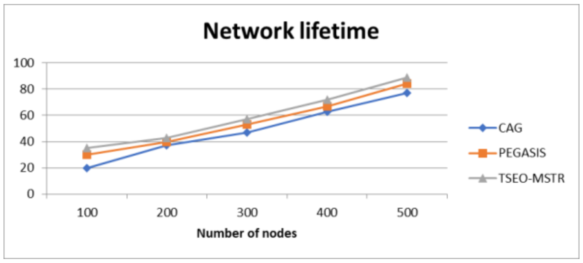

Figure 6: Network Lifetime

The comparison chart of Energy Consumption Method of Existing and Proposed shows the different values in Figure 6. The Existing value starts from 20 to 84 and the proposed values increased time 35 to 89seconds. Every time the proposed value provides the better results than the Existing value.

3. Routing Overhead

Number of Nodes	CAG	PEGASIS	TSEO-MSTR
50	0.5	0.63	0.55
100	0.65	0.61	0.43
150	0.59	0.55	0.35
200	0.51	0.49	0.31
250	0.47	0.41	0.23

Table 3: Routing Overhead

The comparison Table 3of analysis Energy consumption Existing and Proposed shows the different values. When comparing the Existing and Proposed the Proposed value provides the better results than the Existing value. The Existing value starts from 0.5 to 0.41and the proposed values starts from 0.55 to 0.23. Every time the proposed value provides the better results.

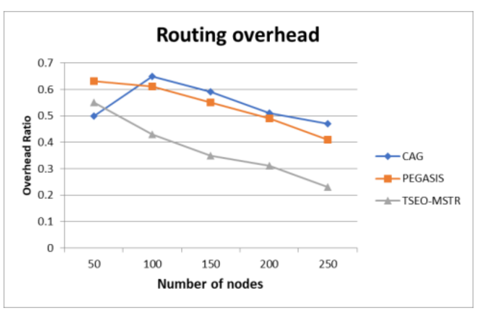

Figure 7: Routing Overhead

The comparison chart of Energy Consumption Method of Existing and Proposed shows the different values in Figure 7. The Existing value starts from 0.5 to 0.41 and the proposed values decreased time 0.55 to 0.23 seconds. Every time the proposed value provides the better results than the Existing value.

CONCLUSION

The data aggregation is a technique used to tackle the collapse and cover issues in data driven routing. Data coming from numerous sensor nodes are accumulated as though they are about a similar property of the marvel when they arrive at the equivalent routing hub in transit back to the sink. Data aggregation is a generally utilized technique in remote sensor organizations. In this paper proposed Tabu Search Energy Optimization based Minimum Spanning Tree Routing (TSEO-MSTR) data aggregation for low weighted delay and high network lifecycle. The simulation experiments show that, the proposed data aggregation method consumes less energy while aggregating data from sensor nodes, and thus can prolong the network lifecycle.

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