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EXPLORATORY REVIEW OF VARIOUS DATA ACQUISITION SCHEMES IN WIRELESS SENSOR NETWORKS

[1*]**Dr. Mrs. Jasmine Samraj** Research Supervisor, PG and Research Department of Computer Science, Quaid-E-Millath Government College for Women (Autonomous), Chennai.
Email id: dr.jasminesamraj@qmgcw.edu.in
[2]**Ms. Shobana.V,** Research Scholar (Ph.D.), PG and Research Department of Computer Science, Quaid-E-Millath Government College for Women (Autonomous), Chennai.
Email id: shobanav.research@gmail.com

ABSTRACT:

The most significant issue with wireless sensor networks is data collecting. The primary objective of data collection is to gather a lot of data and minimize data loss resulting from sensor nodes' limited memory. Sufficient methods for gathering data can enhance sensor network performance. Real-time data transmission is necessary for many practical applications, including tracking, controlling, and other functions, and for a variety of data gathering techniques intended for sensor networks. It is necessary to collect and send the detected data for further analysis in response to end-user inquiries, to a base station. Long network lifetimes require the use of power-efficient techniques for data collection and aggregation because the network is made up of inexpensive nodes with constrained battery power. To optimize the system lifetime in a scenario where every sensor node in a communication round has data to relay to a base station, reducing the total energy usage of the system is essential. By utilizing data fusion and aggregation techniques, a nearly ideal data collection and routing system may be accomplished in terms of network lifetime, provided that power consumption per node can also be balanced while decreasing the overall energy every round. This research surveys data collection methods to get capacity increases, routing protocols, and algorithms suggested for distant wireless sensor networks. Typically, systems maximize node energy usage by finding the shortest energy channel. Our objective is to improve knowledge of the issues surrounding this field's current research.

INTRODUCTION

Wireless Sensor Networks (WSNs) have attracted significant interest due to their versatility and applicability across various sectors. Hundreds of tiny sensors positioned throughout the target region make up a WSN. Every sensor has a low-power battery that powers its ability to sense, compute, and communicate with other nodes. Because sensors have a limited amount of energy, data collection algorithms prioritize energy efficiency [1]. An efficient method for preserving energy in these kinds of networks is clustering. The sensor nodes in this architecture are arranged into several groupings, referred to as clusters. The Cluster Head (CH), a single node per cluster, is in charge of gathering and combining the sensed data from the cluster members [2]. There is a considerable reduction in the size of sent data towards the Base Station (BS) because of the significant correlation between the sensed data in each cluster. This technique preserves the sensor nodes' energy and increases the network's longevity.

Collecting data stands as the foremost crucial undertaking in the functioning of wireless sensor networks. [3]. Reduction in energy consumption occurs through data collection for redundancy removal [4]. A good strategy sent data (information) using a small number of nodes. These nodes are known as aggregator nodes, and the processes they employ are known as data collecting [5, 6]. Before data is forwarded to the sink node, it is first brought together in the cluster by performing minimal processing redundancies to remove and decrease data transmission [7]. Network topology, network flow, and service quality are some of the features that are used to characterize the data collection process [8].

In WSNs, data collection methods are classified into three distinct categories. Three methods of collecting data are: mobility-based approach, static sink approach, and mobile sensor nodes [9, 10]. The main challenges in data collecting are the memory capacity and energy efficiency of sensor nodes.

This study's main objective is to evaluate many innovative data-gathering methods, considering both networking and compression aspects, to gauge their effectiveness in balancing energy consumption (i.e., network longevity) and reliability (i.e., packet loss and reconstruction error). To our knowledge, this is the first research endeavour to undertake such a comparison across different research domains, including signal processing, compressive sensing, information theory, and networking. We aim to develop a straightforward analytical model capable of predicting the reliability and energy efficiency of diverse data collection methods. Additionally, we conduct simulations, systematically exploring the parameter space (number of nodes, transmission range, and sparsity) to validate our model and compare the efficacy of the aforementioned approaches.

LITERATURE REVIEW

Zhang et al [11] the implementation of mobile sink-based ant colony optimization is offered for industrial wireless sensor networks to fulfil delay requirements and minimize energy consumption. Initially, a method utilizing entropy weight is suggested to select rendezvous nodes based on node density, relative residual energy, and distribution homogeneity degree. This decreases the sink's direct node reach and distance travelled. Subsequently, to find the best access route for the mobile sink while efficiently balancing transmission delay and network energy consumption, an ant colony optimization approach is presented. Comparing the suggested approach to current techniques, simulations demonstrate it reduces latency and extends network lifespan.

SreeRanjani et al [12] for wireless sensor networks, it is advised to employ an energy-efficient data collection format. The sensor nodes are gathered for the purpose of choosing possible locations for rendezvous points (RP) using clustering techniques. To conserve energy, the remaining RPs are placed to sleep according to the highest weight at which they may be transmitted. This process is used in sensor networks to collect data effectively. Adaptive Optimization Algorithm is used to identify the mobile sink's (MS) optimal path. NS2 networks are used to test the proposed model, and the results show that the strategy presented in the research works better than the other strategies currently in use.

Shahryari et al [13] a genetic algorithm is suggested as a high-throughput and energy-efficient method for channel assignment, routing, and clustering in a diverse environment. The suggested approach divides the initial problem into two stages, which are then solved using a genetic algorithm. The first step involves creating a spanning tree across super nodes and giving their radios the correct channels. Compared to existing tree-building techniques, a novel multi-objective cost function has been suggested that greatly increases network lifetime. By distributing the perceived disturbance over the network, it also boosts throughput. Phase two of the proposed technique determines the appropriate channel and CH for each normal node. The comprehensive simulations show that the suggested algorithm uses many channels to achieve high throughput.

Roy et al [14] according to the recommended method, the best CP nomination is found by using variable dimensional particle swarm optimization (VD-PSO). To evaluate the quality of the proposed CPs, a multi-objective fitness function is created taking into account several QoS indicators. Dimensionality trimming and a modified particle update technique are implemented to speed up the VD-PSO algorithm's convergence. The suggested protocol is successful in increasing the packet delivery ratio, decreasing end-to-end latency, extending network lifespan, minimizing overall energy usage, and other pertinent metrics, as shown by simulation results.

Kodoth and Edachana [15] the objective is to maximize energy efficiency and network lifespan. In this proposed method, robust node selection for data gathering involves initially creating circular cell clusters across the entire sensor network area. Subsequently, the data-collecting node with the highest

effectiveness is selected in each circular cell cluster using a multi-objective weighted sum approach that takes into account coverage, communication cost, proximity, and residual energy. Furthermore, the hybrid crow search algorithm (HCSA) is utilized to implement routing and dynamic relocation of mobile sinks for data collection from the cluster heads. The efficacy of the suggested strategy is assessed based on metrics including overall energy consumption, active node count, and network longevity.
Cao et al [16] suggested a method for choosing HWSN cluster heads is based on optimal self-organizing maps (SOM) and the improved sparrow search algorithm (ISSA). Using competing cluster head nodes as input vectors during selection, the suggested approach entails constructing a competitive neural network model at the base station. Residual energy, base station proximity, and surrounding node count make up each input vector. The optimal cluster head is found using an enhanced competitive neural network with adaptive learning. To increase the network's longevity, the technique for selecting cluster head nodes is optimized, considering factors such as node distance, remaining energy, and cluster head transition frequency. Simulation experiments validate that the novel algorithm effectively balances network energy consumption, exceeding other algorithms as well as the fundamental competitive neural network, thus significantly prolonging the sensor network's lifetime.
Narender and Anjana Devi [17] a moving sensor visits each cluster head in the network, gathers data, and delivers it to the sink. This study illustrates and describes the feasibility of mobile data gathering utilizing numerous "Movable Sensor (MSR)". The current system uses a single mobile sensor to collect data utilizing the Dual Data Uploading (DDU) and Load Balancing Cluster (LBC) algorithms. This approach does not optimize the device's energy consumption or data transfer capabilities. To improve the optimization, we are collecting the data with several Movable Sensors. The energy capacity of the Movable Sensors surpasses those of the Cluster head. Each of the several Movable Sensors follows a different route, covering a different group of Cluster heads along the way and collecting data from them. As a result, the Cluster head life duration is extended (because they are no longer continuously communicating to the distant Sink, but just to the local Movable Sensor during its visit). We developed a model of the technique described above, tested the system's efficacy under various conditions, and conducted numerous stimulations runs.
Acharya et al [18] Presented Ant Colony Optimization here aims to equalize enhance network lifespan and the nodes' energy dissipation by considering these two factors. Instead than using the greedy strategy employed in PEGASIS, we additionally apply the chain's construction using the Ant Colony Optimization method. By minimizing the inter-nodal transmission distances, the use of ACO guarantees that the chain generated is as short as feasible, improving network performances even more. Numerous simulations confirm that the suggested approaches perform significantly better than PEGASIS.
Wang et al [19] a suggested sleep scheduling system for CDG, called RLSSA-CDG, incentive learning is the foundation. Modelling the process of choosing active nodes involves a finite Markov decision process. The best course of action is found by searching with the mode-free Q learning algorithm. For correct data reconstruction and load balancing of energy consumption, the Q learning algorithm takes sampling uniformity and residual energy of nodes into account in its reward function. Because it is a distributed method, exchanges of control messages are mostly avoided. Because each node only takes part in one decision-making step at a time, sensor nodes are spared from an excessive amount of computing overhead. In MATLAB, simulation experiments compare the proposed RLSSA-CDG to the distributed random sleep scheduling method for CDG (DSSA-CDG) and the sparse-CDG approach without sleep scheduling. Simulations indicate that the RLSSA-CDG outperforms the two comparator algorithms in terms of data recovery accuracy, network longevity, and energy economy.
Zhang et al [20] provide a distributed sensing rate and routing control (DSR2C) method to ensure network fairness while simultaneously optimizing data transmission and sensing. With DSR2C, every sensor has the ability to adaptively modify how much energy it uses to transmit during network operations based on the quantity of energy that is available. This enables sensors to select optimal routing and sensing rates, thereby enhancing data collection efficiency. Additionally, we decrease

computing performance using topological control and an upgraded BEAS for dynamic energy management. Energy allocation-based data sensing and routing optimization changes would necessitate significant communication for information exchange and computation. The algorithms' efficacy against state-of-the-art approaches is shown via extensive simulations.

Table 1 Comparison of Existing Methods and Data Collection Techniques

Author	Methods	Merits	Demerits
Zhang et al [11]	Ant Colony Optimization Algorithm	To maintain a balance between the network's energy use and transmission delays	Industrial wireless sensor networks need the construction of a comprehensive communication protocol for data gathering with mobile sinks
SreeRanjani et al [12]	Adaptive Optimization Algorithm	The Mobile Sink's Optimal Path Selection is carried out effectively	The data aggregation techniques do not fully cover.
Shahryari et al [13]	Genetic Algorithm	It improves energy exhaustion per transmitted bit, throughput, and overall energy consumption	To bridge this gap, heterogeneous WSNs must implement the Multi-Channel (MC) protocol
Roy et al [14]	VD-PSO	It increases the packet delivery ratio, end-to-end latency, network lifespan, overall energy consumption, etc	Enhancement of the primary threat to the maintenance of QoS in WSN
Kodoth and Edachana [15]	HCSA	The number of active nodes, overall energy usage, and network lifetime all rise as a result	It is necessary to enhance the mobile sink's routing and dynamic relocation
Cao et al [16]	Energy Efficient and Collaborative optimization	It may extend the lifespan of the sensor network and lower, balance, and Optimize the power usage of the network	Mobile nodes' effect on heterogeneous sensor network cluster head selection will also be examined
Narender and Anjana Devi [17]	Multiple Movable Sensor	In partitioned WSN, many mobile components increase base station data collection efficiency	For data collection and recovery from failing WSN sensor nodes, use Priority-based Load balanced Clustering
Acharya et al [18]	Ant Colony Optimization	Maximizing the reduction of inter-nodal transmission lengths to improve	Information transmission to the base station requires

		network performances	uneven energy dissipation
Wang et al [19]	Reinforcement learning based sleep Scheduling algorithm	It has enhanced energy efficiency and network durability, and data recovery accuracy than the two contrast algorithms	Need to improve shortest path routing strategy.
Zhang et al [20]	Dynamic Sensing and Routing (Dosr)	Its enhanced BEAS uses a topology control approach to lower computing complexity and regulate energy allocation in dynamic situations	Minimal battery capacity and intermittent renewable energy resources, data collection must be optimized

DATA GATHERING SCHEMES:

The data collection methods that we will be talking about here are multiple partition algorithms.

Direct Transmission

To the base station, every sensor node openly communicates its data, which incurs high energy costs, particularly when the base station is distant from certain nodes. Moreover, nodes must alternate transmissions to the base station to prevent conflicts, resulting in significant media access delays. Consequently, this approach exhibits poor performance concerning the combined energy and delay metrics.

Power-Efficient Gathering for sensor information systems (PEGASIS)

The PEGASIS protocol is used to collect data under the premise that each sensor node is aware of every other node's location, thereby establishing a routing topology accessible to each node [22]. Illustrated in Figure 1 is the process of data gathering using the PEGASIS scheme, involving the base station (BS), leader, and sensor nodes. The objectives of PEGASIS are as follows:

- Reduce the maximum distance that each node travels while transmitting.
- Reduce the overhead of transmitting
- Optimize the total transmission of messages to the base station by minimizing their quantity.
- Equally distribute the amount of energy used by each node

Chain- based Three- Level Scheme

The chain-based three-level designs are shown in Figure.1, where a chain similar to PEGASIS is established. To reduce interference, this chain is divided up into many groups to stagger simultaneous broadcasts. Every node in every group broadcasts individually. After collecting data from every member, a chosen node from each group moves on to the next phase [23]. Predetermined is the index of the leader node. After dividing all nodes into two groups at the second level, nodes from each second-level group exchange messages with one another at the third level. In the end, the BS receives a single message from the leader.

STEP 1
S0→S1…. S6→ S7 ←S8←S9 S10→S11→.. S16→ S17 S97 ←S18…. S90→S91→… ←S98←S99
STEP 2
S7→ S17 ←S27←S37←S47 S57→ S67 ←S77←S87←S97
STEP 3
S17 ←S67
STEP 4

S17→BS

Figure.1. Three-Level Chain-Based Schemes

Binary scheme

With PEGASIS, this technique organizes nodes into distinct levels using a chain-based methodology. At each layer, nodes that gather messages advance to the next tier [24]. When nodes advance from one tier to the next, their number is cut in half (refer to Fig. 2). BS denotes the Base Station, while C0 to C7 represent nodes.

c0→c1 c2→c3 c4→c5 c6→c7
c1→c3 c5→c7
c3→c7
c3 ↓ BS

Figure. 2. binary scheme

Wireless Sensor Network

A wireless sensor network consists of many sensor nodes and a central base station that are interconnected. A collection of networked sensor nodes makes up the basic components of a wireless sensor network, as shown in Fig. 3. Wireless sensors are lightweight, widely dispersed nodes that are used in huge quantities to monitor a system or environment [25]. These sensors are part of an ad hoc distributed network; as such, they use wireless connectivity and have onboard CPUs in their sensor nodes.

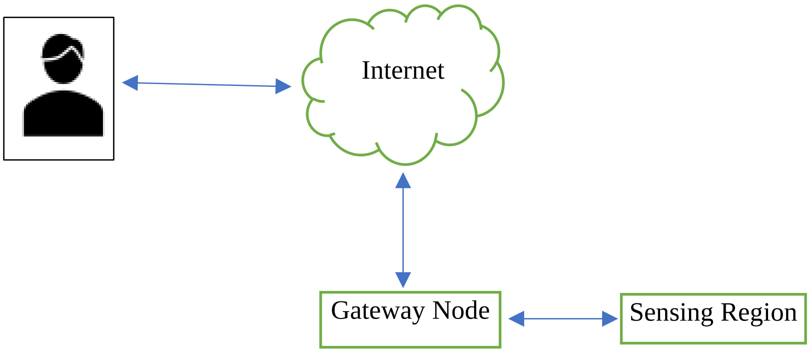

Figure.3. Architecture of Wireless Sensor Network

The Sensor Subsystem, Processing System, and Communication System are just a few of the many functionalities that these sensor nodes may have. We will now quickly go over these features.

Sensor Sub Systems: This subsystem of sensors consists of proprioception, tactile, inertial, visual, and auditory units. The sensory receptors called proprioceptors are those that pick up internal body inputs, particularly those that react to changes in position and movement. High definition and high-speed cameras make up the visual unit. Similar to this, the sensor subsystem is built using an audio system that has microphones, an inertial measurement unit, and force-sensitive resistors.

Processing system: An operating system, memory, and a microcontroller unit (MCU) make up the processing system. The microcontroller unit (MCU) processes incoming data, determines the subsequent path to the sink, regulates and tracks battery life, and more. Program code is placed in the Memory section, where nonvolatile RAM is used to compute the process. Operating systems like as TinyOS and Contiki are used by Sensor.

Communication system: In this system, radio transceivers are used to transfer data between the sensors. After processing the query, this unit sends the devices with the data that the MCU has processed.

Power generator: This device, which consists of a battery and a DC-DC converter, supplies electricity to the sensor node.

Large wireless sensor networks (WSNs) may use cluster-based sensor nodes, where a cluster head collects data from many nodes. One well-known method for ensuring scalability and hierarchical or cluster-based routing provides WSN energy efficiency. In addition to relieving the pressure on the nodes nearer a sink, a mobile sink solution will extend the life of the network by giving users a way to access and gather data from disconnected network locations. On occasion, data from each monitoring network node is sent to the sink node. Generally, this kind of All-to-One communication architecture has two processing mechanisms.

One has to do with data aggregation, where a fusion function can be used to aggregate various packets into a single packet of the same length. The other does not use data aggregation, which is another name for data collection. While the fact that transmitting fewer packets using the data aggregation approach may lower power consumption, this scheme is not suitable for many real-world scenarios. Evidently, the data gathering plan makes it simple to fulfill this need. Wireless sensor networks quickly get overloaded with high contention and interference along the nearest multi-hop routing paths and in the vicinity of data collecting sites like the sink when a large number of nodes start reporting data.

TECHNIQUES FOR GATHERING DATA IN WSN

A specific routing protocol is used to carry out the data collection operation. Our objective is to collect information in order to lower energy use. Therefore, in order to advance network collection, according to the data packet's content, sensor nodes are supposed to route packets and choose the subsequent hop. Routing protocols are dependent on the techniques that are taken into consideration because they are essentially divided by the network structure. Wireless Sensor Networks (WSN) experience severe congestion when collecting data, especially at nodes that are closer to the sink node. Either extremely complicated MAC layer protocols or non-scalable data collection methods have been developed in an effort to tackle this issue. The proposed method makes use of many disjoint collection trees with non-overlapping duty cycles that are rooted from the sink.

Tree-Based Technique

Tree-based data is aggregation tree data. The least amount spanning tree (Figure 4) shows this structure with the source node as a leaf and the sink node (base station) as a root [26]. Data starts to flow from the leaf node and ends at the sink (base station). One drawback of this method is that, as wireless sensor networks are known to collapse in the event of any tree level data packet failure, both the level and the whole connected sub-tree will lose their data. This method is suitable for creating the best collection strategies. Two parts are necessary for the tree-based approach to function.

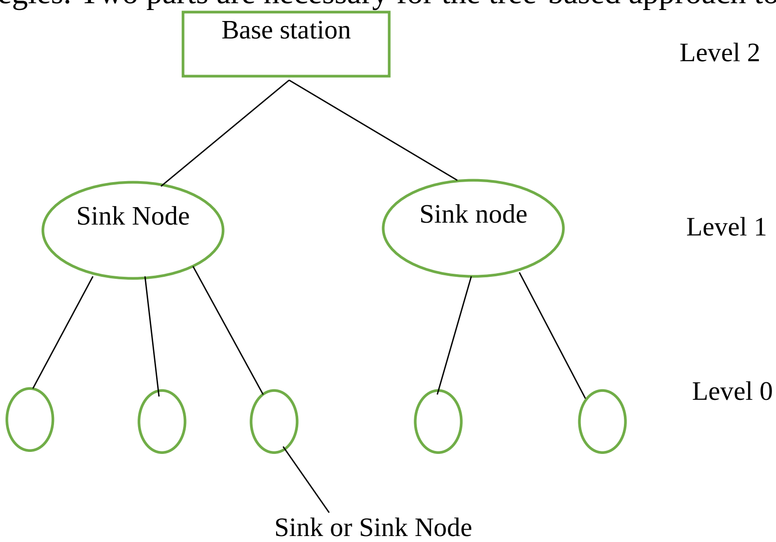

Figure.4. Tree-based techniques

Distributed segment

Collection queries are sent down into the network in the dispersed section.

Gathering segment

In the collection phase, the values collected continuously ascend from leaf nodes to parent nodes. It's important to note that our query semantics divide time into epochs of intervals, and during each epoch, when gathering the readings from all of the network's devices, we must create a single collection value that combines.

Cluster-Based Technique

In large-scale energy-constrained sensor networks, it is not possible for sensors to transmit data directly to the base station. In these sorts of scenarios, cluster-based approaches are hierarchical. Figure 6 illustrates the cluster-based approach, which partitions the entire network into numerous clusters [27]. One member of each cluster is selected as the cluster head. The cluster heads serve as data collectors, gathering data that is locally acquired by members of the cluster and relaying it to the base station (also known as the sink). For wireless sensor networks, several cluster-based network organization and data collection methods have been developed. Cluster heads may connect directly with the base station via long-range broadcasts or relay data via several hops via other cluster heads.

Low-Energy Adaptive Clustering Hierarchy (LEACH)

Wireless sensor networks' energy depletion is reduced through the clustering-based algorithm LEACH. LEACH distributes the high energy consumption required for cluster heads to interact with the base station across all network nodes by randomly selecting cluster heads and doing re-elections regularly [28]. A round is the name given to each round of cluster-head selection. Set-up and steady are the two stages of LEACH's operation. During the setup phase, each sensor node selects a random integer within the range of 0 to 1. When the value decreases below the appropriate threshold T(n) for node n, the sensor node takes on the function of a cluster head. Equation (1) defines the threshold T(n).

$$T(n) = \begin{cases} \dfrac{P}{1 - P\left\{r + mod\left(\frac{1}{p}\right)\right\}}, & if\ n\varepsilon G \\ 0 & , otherwise \end{cases} \qquad (1)$$

Where G is the set of nodes without cluster heads for the past 1/P rounds and P is the cluster-head nodes' required gain, and r is the current around. This guarantees that, in the end, the energy used by each sensor node is equal. Following selection, all nodes are informed of the cluster chiefs' decision. Based on the signal strength they get; all nodes select the cluster heads that are closest to them when they receive advertisements. The stable phase lengthens to reduce cluster formation overhead. Local computing involves cluster heads fusing and aggregating data during the steady period of TDMA transmission. Only aggregated data from cluster heads is gathered by the base station, which is crucial for energy conservation. Cluster heads are selected once more during the setup phase following a brief amount of time in the steady phase.

Multi-path Technique

The system's imperfect robustness is the drawback of the tree-based method. Numerous researchers suggested a novel method to get over this drawback. A node may use many paths to convey partially collected data to a single parent node in an aggregation tree [29]. The multipath approach, which allows every node to deliver data packets to its potentially numerous neighbors, is shown in Fig. 7. As a result, there are many paths for data packets to travel from source node to root node. Since there are many intermediate nodes between leaves node and root node, gathering is done at each intermediate node. The network is divided into circles and its level levels are determined by the distance from the root hop in ring topology, an example of this technique.

Both robustness and energy efficiency are problems with these strategies. It uses more energy but has a higher danger of link collapse when using the solo route to connect each node to the sink node. However, using a multipath strategy would necessitate more nodes, which would result in energy waste.

Hybrid Technique

A hybrid approach combining tree, cluster-based, and multipath methods was used. wherein the structure for collecting data can be modified based on specific network conditions and performance metrics.

CRITICAL ANALYSIS

Table 1 below analyzes the essential uniqueness of the main data collection techniques for WSN.

Table 1: Analysis of Data Gathering Methods for WSN

Methods	Path Formation	Aim	Spatial Relationship	Temporal Relationship	Overhead	scalability	Disadvantage
EEDC	Single Hop	minimize the Overhead of Control	Yes	No	Extremely low	Extremely Low	The only single-hop network that is central
CAG	Tree-based cluster	minimize redundant data	Yes	No	Extremely High	Average	Data-centric preservation
GSC	Tree-based Cluster	minimize redundant data	Yes	No	high	Low	Multiple hop members are not covered by it
SBR	Tree-based cluster	minimize redundant data	No	Yes	Average	High	Previous information may be obtained using the sink node
SCCS	Tree-based cluster	minimize redundant data	Yes	Yes	Average	High	Previous information may be obtained using the sink node
DQEB	Dynamic query-tree	minimize the cost of broadcasting	-	-	Average	Average	Prevents a disconnected tree from having its structure
LEACH	Cluster-based	periodic re-election	-	-	High	-	Experience a massive overload in a cluster setup
PEGASIS	linear-chain scheme	minimize transmitting overhead	-	-	Low	Average	Consumption of energy is increased

Discussion

Based on our analysis of numerous studies, we can conclude that there are varying strengths and weaknesses in wireless sensor network data collection methods with regard to network lifetime and energy usage. A few fundamental needs must be met by any data gathering algorithms [30]. The most crucial prerequisite is that a data collection algorithm must be undetectable. To further characterize an algorithm's imperceptibility, they have a set of requirements. The following criteria must be met:

Network Density

The number of nodes per square meter is known as the network density. Depending on the node distribution, it differs between deployments as well as between nodes within a deployment.

Energy

An essential parameter in a network with limited resources, like the WSN, is energy. While not the only value in this parameter, it seems that the battery's remaining capacity is the most important factor. As a result, the agent will decline some requests for collaboration on the grounds that there is insufficient energy.

Position within the network

Three sorts of node positions normal, edge, and critical are used in the numerous works that have been defined thus far. The location within the network where a node has several neighbors is known as its typical position. A node at the edge of the network, an edge node can only see its single neighbor's portion of the network. If a node links two sections of the network together, it is deemed to be in a vital position.

Residual Energy

The power that a sensor node has left over after topology changes is known as residual energy, and it can be used to determine a link's stability and a node's longevity.

Energy Level

In our work, we define energy lever as follows: The minimum energy level between all of the nodes on the route from a sensor node to the sink is known as the energy level of a path. A node's energy level is defined in the first specification as the maximum number of packets it can send to its neighbors while maintaining its remaining energy.

Network Throughput

Sink node data packet collection before every data routing link fails owing to a residual energy shortfall is how it is measured. This illustrates how the routing protocol can maximize network performance while adhering to energy conservation measures.

Network lifetime

It is the mean quantity of dead nodes resulting from path failure over several data gathering cycles. It displays the rounds' efficiency. It illustrates how well a protocol works to increase the number of active nodes and network lifespan.

Network Topology

A sensor node should have the ability to decide how important the information it has sensed is, for example. Additionally, it should be able to collaborate with other sensor nodes to concatenate data and/or remove redundancy between sensor nodes.

Latency

The applications determine the required latency. When an event is observed in an environment surveillance application, to enable prompt implementation of the required actions, sensor nodes should be able to transmit the local processing result to the sink instantaneously.

Sensor Node

The main element of a WSN is a sensor node. Sensing, many tasks include data processing, storage, and routing that sensor nodes in a network might do.

Base Station

The base station is positioned at the summit of the hierarchical WSN structure. Between the end user and the sensor network, it serves as a communication channel.

Power

When sensors carry out sensing, processing, and communicating functions, power is used in the sensor network. The effective utilization of this energy is necessary to maintain network longevity because sensor nodes have finite energy.

Conclusion

In this research, to examine many approaches for gathering data in wireless sensor networks. Furthermore, wireless sensor networks will be an essential part of daily life due to their vast array of potential uses. In this research, they looked at a variety of wireless sensor network routing protocols and data collection techniques. While many strategies are more effective at removing interference, new and varied techniques for wireless ad hoc networking are needed to fulfil various goals such as power consumption, QoS, fault tolerances, scalability, anticipated cost, hardware, topology change, and fast data transfer. Extending the lifetime of a wireless sensor network is important in order to enable the sink(s) to collect more data. It is commonly understood that energy efficiency is essential to a network's lifespan. This work identified several important problems with wireless sensor networks generally and conducted a thorough analysis of several problems related to current data collection algorithms before concentrating on two major problems. There is a network lifetime and energy saving on these problems.

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