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A Survey on Load Balancing Algorithms in WSN

Kumudini S[1], Dr. M. P. Vani[*2]

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Abstract*:* The key idea in distributed systems and computer networking is load balancing, which divides workloads and incoming network traffic among several servers or resources explores the topic of load balancing in wireless sensor networks (WSNs), emphasizing resource optimization and fair task distribution across sensor nodes. The assessment covers a variety of load balancing techniques, addressing issues with data throughput, network lifetime, and energy consumption. The output sums up a thorough understanding of load balancing methodologies in wireless sensor networks (WSNs), provide guidance for future improvements in network resilience and efficiency. Investigates WSN load balancing strategies with the goal of improving network performance by effectively allocating workload across nodes. It looks at several methods while taking into account things like data accuracy, node lifetime, and energy consumption. An overview of the main load balancing techniques and their uses is given in this study.

Keywords: *DODAG, Load Balancing, Routing, WSN*

1. Introduction

This WSN and IOT is rapidly developing in various sectors of real time world. They are applicable in various sectors like home automation, communication and computation WSN have the Sensing ability to intrusion, danger. The WSN devices have constraints with respect to energy supply, transmission mode and memory size.

Load balancing in wireless sensor networks is a very important aspect to ensure efficient utilization of resources and optimal performance. This paper explores the various techniques and algorithms employed to distribute the workload evenly among sensor nodes. Thereby preventing congestion and maximising networklifetime.by dynamically adjusting the traffic distribution and routing algorithms, load balancing helps in enhancing network reliability, scalability and energy efficiency, highlights the significance in achieving seamless communication and data transmission.

If the heterogeneity of sensor nodes aren't configured appropriately, there could be inconsistent energy consumption and load instabilities across the medium of transmission, which would lower network execution. To extend the lifetime of a network, routing algorithms should strive for load balancing and energy efficiency across heterogeneous nodes.

Load balancing helps to improve system performance, scalability, and reliability by distributing tasks or requests among available resources in an equitable manner. Its main objectives are to optimise resource utilisation, maximise throughput, minimise response time, and prevent overload on any single resource. Various load balancing algorithms and techniques are employed to achieve efficient resource allocation and ensure smooth operation of networks and systems. In today's computing environments, load balancing is essential for improving system availability and overall performance. Load balancing in WSN can help in achieving better data accuracy, faster response time.

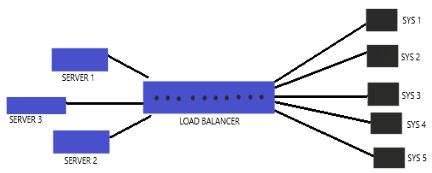

Fig1:- Architecture for Load balancing

A traffic and energy aware routing protocol (TEAR) Sharma et.al [1] is presented to address sensor node energy and traffic heterogeneity challenges. To accomplish load balancing, TEAR steers clear of choosing nodes with enormous traffic volumes and limited energy for the cluster head position. Nevertheless, Repetitive transmission from nearby sensor nodes is not stopped by TEAR.

Wireless sensor networks are plagued by numerous problems. This survey takes load balancing into account. Usually, the load is not dispersed equally among all network nodes by load balancing. In order to lengthen the network's lifespan, it entails determining most ideal load on each node. The article discusses various load balancing strategies, including cluster, protocol, and algorithm-based approaches. The literature review is covered in Part II, the comparative study is covered in Part III, the suggested work

[1] *Vellore Institute of Technology, Vellore, India*
ORCID ID: 0009-0003-8428-2892
[2] *Vellore Institute of Technology, Vellore, India*
mpvani@vit.ac.in
** Corresponding Author Email: kumu_light@yahoo.com*

is covered in Part IV, and the paper concludes with a discussion on future work.

2. Literature Review

To enhance the selection of cluster members, a load-balanced clustering technique [16] employs a Comprehensive weight value that is made up of the member's distance from the head and the residual energy. In order to prevent load imbalance, optimisation threshold values are also used. When establishing a balanced cluster, the algorithm takes load equalisation into account.

Sl No	*Title of the paper*	*Author Name*	*Insights*	*Decisions*
1	”Maintain Load Balancing in Wireless Sensor Network Using Virtual Grid Based Protocol ”	Husam Kareem et.al	Reducing energy usage requires sacrificing sensor network activity and network performance.	One simple strategy that is commonly used to reduce the amount of energy needed at Every sensor node is a routing method that uses less energy.
2	“ CLRPL: Context-Aware and Load Balancing RPL for IOT Networks Under Heavy and Highly Dynamic Load ”	Seyydreza Taghizadeh et.al	It was determined that the heavy and dynamic loads are too much for ordinary RPL to manage effectively. To address the problem, the context-aware load balancing protocol known as CLRPL was created.	It can be extended to accommodate a limitless amount of nodes running simultaneously. It operates under the theory that everything is interconnected.
3	“ Energy-Efficient and Load-Balanced Clustering Routing Protocol for Wireless Sensor Networks Using a Chaotic Genetic Algorithm ”	Chuhang Wang et.al	Three major elements determine a wireless sensor network's lifetime: cluster maintenance, routing pattern determination, and node clustering.	Described a clustered routing protocol named CRCGA, which incorporates all three aspects to improvise the efficiency of the network energy and provide load balancing. A chaotic genetic algorithm is used
4	“Load balanced clustering in WSN”	G.Gupta et.al. M.Younis et..al	Clustering of members is dependent on communication costs.	Utilising ‘location-aware clustering’, the maximal gearbox effect is utilised.
5	“Novel load balancing scheduling algorithm for WSN”	E.Laszlo et.al, K.Tornai et.al	Proposes an algorithm called as ‘Optimal scheduling algorithm’ for data forwarding in WSN	Balanced cost design function is used to determine the best scheduling
6	“A Multipath routing Protocol with Load Balancing and Energy Constraining Based On	Peng Li et.al	The alternative multipath routing protocol generated by the AOMDV transmitting protocol reduces source to destination delay and	a load-balancing with energy-constrained routing protocol is proposed that chooses nodes to forward packets from that have a shorter MAC layer

	AOMDV in AD HOC Network”		shortens the time needed for routing reconstruction.	interface queue length and more residual energy
7	”Energy And Load Balancing Routing Protocol For IOT”	Shahzad Kalantar et.al	The management of energy usage because node energy resources are limited.	Implementation of Energy and Load Balancing Routing Protocol for the Internet of Things (ELBRP).
8	“Load Balancing Metric Based Routing Protocol for Low Power and Lossy Networks (lbRPL)”	Sebastian. A et.al	Enhance RPL's route load balancing, as load optimisation problems may arise.	A new routing statistic for RPL called the load balancing index (LBI) is introduced.

The reorganisation of the cluster head for balancing load in the WSN [17] extends the network lifetime by distributing the cluster heads equally. Considerations include the quantity of general cluster nodes as well as the quantity of cluster heads that are within the cluster nodes broadcasting range when the cluster is reconfigured. The algorithm offers efficient means of aggregating data.

Husam Kareem et.al stated that a major issue that surely impacts the sensor network's overall success is the energy required to operate every single sensor node. Reducing energy usage requires sacrificing sensor network activity and network performance. One simple strategy that is commonly used to reduce the amount of energy needed at every sensor node is an Energy Efficient Routing method that uses less energy. By distributing the data traffic load among sensor nodes as evenly as feasible, the proposed method seeks to extend the lifetime of WSNs based on the distributed topology of the sensor network.

Chuhang Wang et.al three major elements determine a wireless sensor network's lifetime: cluster maintenance, routing pattern determination, and node clustering. They described a clustered routing protocol named CRCGA, which combines the three elements to offer load balancing and increase network energy efficiency. The genetic algorithm is chaotic.

In order to determine the best routing patterns, the chaotic genetic algorithm (CRCGA) codes every top cluster head (CH) into a single chromosome at the same time. The method converges fast because of chaotic genetic operators based on a unique fitness function that takes load balancing, lowest energy consumption, and new determination criteria into account.
Simulation studies show that in terms of lifetime, load balancing, convergence speed, and energy efficiency, CRCGA performs better than LEACH, GECR, OMPFM, and GADA-LEACH. An adaptive round time that considers energy and load balance is provided to maintain the clusters in order to further reduce energy consumption.

Shahzad Kalantar et.al stated that one of the main issues with the internet of things (IOT) is the management of energy usage because node energy resources are limited. As a result, numerous research that concentrate on various strategies have attempted to optimize and manage energy use. Of the numerous important concerns, maintaining traffic balance and network node energy usage are only two, despite the fact that each of these research has enhanced and optimized energy usage. As a result, a new technique is required to keep network nodes' load and energy balanced.

Thus, study introduces the energy and load balancing routing protocol for the Internet of Things (ELBRP), which is based on the development of the RPL routing protocol and the efficacy of data distribution strategy. The ELBRP performance is broken down into three steps.

The state of communicating nodes is assessed in the first phase, which also involves transmitting DODAG information object (DIO) messages. The second phase involves creating the DODAG communication structure using the ELBRP.

In order to balance traffic and energy, data transmission is carried out in the third step using the distribution technique.

In sensor networks, a Threshold-Based algorithm for power-aware load balancing [20] offers a potential in-network technique for adaptive distributed energy consumption control. Alternative approaches such as game theory or market-based algorithms may be employed. The entire network is assumed by the algorithm.

Peng Li et al stated that in the realm of wireless communication, ad hoc networks have expanded rapidly in tandem with the thriving development of Internet of Things

(IOT) research, which is a crucial auxiliary form of 5G, and fifth generation mobile communication (5G). Using alternative multipath, the AOMDV routing protocol reduces end-to-end delay and shortens the time needed for routing reconstruction.

However, factors like residual energy and node load are not considered. Consequently, a load-balancing with energy-constrained routing protocol is proposed that chooses nodes to forward packets from that have a greater leftover energy and a lower MAC layer interface queue duration The improved protocol has fared better in terms of average end-to-end time, routing discovery frequency, and the number of energy-exhausted nodes, based on the simulation findings.

A load regulating clustering method that considers traffic load as the primary parameter has been defined as the load balancing methodology for cluster heads in wireless sensor networks (WSN) [21]. This technique's specific scenario necessitates that every sensor node contribute the same amount of bandwidth. It makes the assumption that every node is aware of the network's existence and employs a centralised approach.

Sebastian. A et.al RPL creates a Destination Oriented Direction Acyclic Graph (DODAG) in order to organise network topology. RPL has rapid network setup times and good scalability. In order to improve the load balancing of routes in RPL—which may have load optimisation problems—this study proposes a load balancing metric-based routing protocol called lbRPL. We offer a new routing statistic for RPL called the load balancer index (LBI). By utilising the load balancing characteristics of RPL nodes, it chooses more load matched parents and routes. LBI uses indicators like Parent count (Pc), Remaining Parent Energy (RPE), and ETX to help with routing decisions.

The outcomes of the simulation demonstrate that IBRPL extends the network's life to RPL and enhances its performance and stability.

In order to balance the reserve power in WSN, a load-balanced group clustering technique for heterogeneous WSN, Y. Deng et.al has initiated the deployment of adaptive route calculation based on the energy distribution state in the network. It employs several energy sources in order to tackle load balancing.

Seyedreza Taghizadeh et.al stated to handle the issue of power depletion and packet loss in an RPL-based network that is experiencing a high volume of dynamic traffic. Three measures are taken to address this issue: begin by introducing the context-aware objective function (CAOF), which considers the node's context when calculating the rank. Additionally, by progressively advancing from a high order score to the actual order score, CAOF circumvents the thundering herd issue. Second, present context-aware routing metric, a brand-new routing metric (CARF), which diminishes the influence of upstream parents as it proceeds down the path and recursively evaluates the parent chain's queue utilization and remaining power status as it approaches the root.

Third, A new parent selection mechanism is described that avoids routing loops by using a simple yet effective counter evaluation to choose the best parent based on CARF and other criteria. The thorough evaluations demonstrate that this metric produces better choices about identifying the appropriate parent instead of relying just on parent rank in a network with strong traffic dynamics. Test results show that, contrary to the conventional definition of RPL, improvements in network lifetime are achieved at the expense of lower packet loss.

A. *Cluster based method*

User requests are distributed equally across the participating nodes thanks to the integration of these systems' nodes. The idea of cluster operation is the sharing of loads among multiple servers. Progressively raising the level of performance.

According to Mohammed A. Merzoug et.al [23] For wireless sensor networks, the best communication protocol gathers information from the central station's scattered sensor nodes while distributing the energy consumption evenly and gradually. Stated differently, this prevents an abrupt and unequal loss of energy because the sensor nodes all perish at the exact same moment. Protocols for communication based on clusters are particularly efficient. These protocols reduce the distance that sensor nodes must travel to transmit data, disable their radios, aggregate data, switch up the cluster head position, and other methods to save energy.

There are several rounds in the protocol procedure. The three primary phases of each cycle are the data transmission phase, the clustering phase, and the initialization phase

The choice of the clustering phase is initiated by cluster heads and cluster creation. Each sensor node performs a distributed clustering algorithm in order to become a cluster head or join a cluster based on the data shared during the start phase. A TDMA schedule is created by each cluster head in order to decrease intra-cluster collisions. Information gathered by cluster participants is sent to the cluster head in accordance with the table throughout the transmission phase. The information is aggregated by the cluster head and transmitted to the top layer. After that, the data is transmitted between cluster heads until it reaches the base station.

Data organizing or grouping is not a goal. Even while rotating cluster heads has benefits, the frequent change is not desired as it adds a significant overhead. To address this issue and reduce the energy used the transmission step takes longer than the other two stages combined for initial operations and clustering.

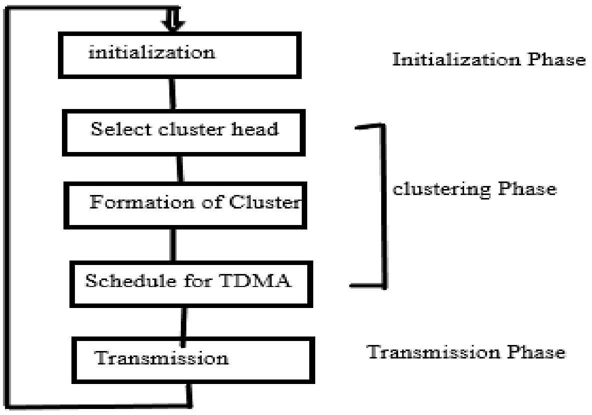

Fig 2. Cluster based communication

B. Protocol Based

TEAR (Traffic and Energy Aware Routing)

Multi-level heterogeneity, or variations in the energy and data generation rate of the sensor nodes, is taken into consideration in TEAR [1]. The CH Selection probability in TEAR is determined by the traffic load, the node's beginning and residual energy, as well as the average energy of the round.

The objective of the TEAR protocol is to prevent the choice of low energy and high traffic nodes while simultaneously ensuring that Low traffic volume, high energy nodes are proposed for the CH role. Low energy node with enormous traffic is more likely to perish quickly hence the data volume was higher than that of an energy-intensive node with a low traffic frequency. The realistic WSN can be modelled with the assistance of the TEAR strategy. It does not, however, offer the essential energy-saving function.

C. Algorithm based

1. **Centralized load balancing**: With this method, jobs or data are distributed based on the load on each sensor node, which is tracked by a central controller or base station. Although this approach may create a single point of failure, it can successfully balance the workload.
2. **Distributed load balancing**: in this decentralized approach, sensor nodes collaboration with each other to distribute the workload based on local information. Examples of distributed load balancing algorithm include LEACH and HEED

LEACH (Low energy adaptive clustering hierarchy)

LEACH is the first cluster-based routing system for WSN that is most well-known [21]. Each round of the periodic round-based clustering algorithm LEACH is divided into two stages: (1) phase of cluster creation and (2) phase of data transfer. During the cluster construction phase, a CH (Cluster Head) is selected at random using probability from amongst the chain of nodes.

Each node in LEACH produces a random integer between 0 and 1 in order to construct clusters. If the sensor node's produced integer is less than the threshold value that has been specified, it announces to other nodes within its transmission range its decision to become the CH. After getting the transmission of the message Based on the signal it receives, each sensor node invites the other nodes to join its most immediate range CH.

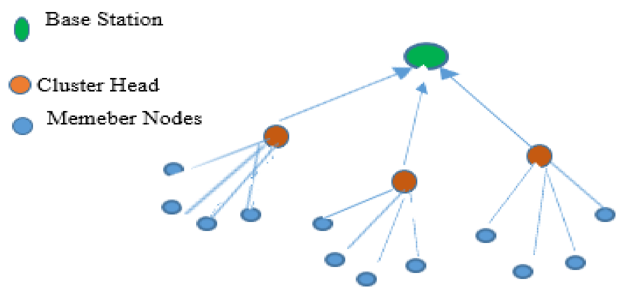

Fig 3. Cluster Hierarchy architecture

The CH gathers sensed information from its CMs (Cluster Members), aggregates the data, and sends the combined information straight to the sink in the phase of data transfer.

As a result, the CH consumes enormous amount of energy than its constituent network elements and, should it survive for the remaining data transmission rounds, perishes rapidly. To solve this issue and preserve each network elements battery, LEACH replaces the CH in a random manner. Among LEACH's many benefits is the use of a clustering method that lowers communication between them reducing network energy consumption between network elements and the base station (BS).

By using data aggregation techniques, the CH (Cluster Head) in LEACH reduces data duplication locally and saves a significant quantity of network energy. Additionally, the CH uses TDMA schedules to assign time slots to cluster members. By allowing the cluster members to enter sleep mode, intra-cluster collisions are prevented, and the network's lifespan is extended. The LEACH protocol's random rotation of CH improves load balancing and lengthens network longevity. Nevertheless, the LEACH procedure includes a lot of disadvantages in addition to the mentioned advantages.

Regardless of each node's energy level, every sensor node in LEACH has an identical chance of becoming CH. The node that uses less energy dies faster if it is assigned to the CH job. As a result, network performance suffers. Secondly, because LEACH uses randomised cluster generation, it is not possible to assure its CH position, the quantity of clusters, or the cluster frequency.

Uneven energy usage results from this. Lastly, LEACH utilize a single HOP to facilitate between the CH and the BS, immediate interaction. Those CHs farther away from the Base Station dissipate more energy than those closer to it. This results in inconsistent energy usage, shortening the network's life.

HEED (Hybrid Energy-Efficient Distributed):

Proposes [3] clustering technique. The two main factors considered while choosing a CH in HEED are the node residual energy and the degree or proximity of the neighbour. HEED transmits information to BS through multi-Hop. The lowering of intra- and inter-cluster communication costs is one advantage of HEED over LEACH. A dual static CH selection method was presented by Panag & Dhillon in [4]. The network's structure is divided into comparable-sized fixed clusters, according to Panag & Dhillon.

Each cluster has two CHs chosen for it in each communication round. While data transfer occurs over the other CH, the first is used for data aggregation. This method is used as the foundation for the CHs selection criterion, the node's residual energy and its distance from the sink and other cluster members. A node that is farther from its cluster neighbours has a better chance of being nominated as the aggregate CH; nonetheless, the Broadcasting CH will be selected from among the nodes that are closest to the sink.

In [5], a reservation-based CH selection technique is proposed to reduce the overhead energy consumption in clustering. This technique gives each node a specific period of time to act as a CH, eliminating the need for network nodes to send signals in competition for the role of CH selection. However, if two CHs are chosen for each communication round, the quantity of information exchanged during the CHs selection process may result in an enormous network overhead.

The CHs are chosen in the first round using a LEACH-based methodology. Each node chooses the turn in which it will act as the CH during the preparatory phase, creating a reservation matrix with one row and R columns, Next, every node designates a value of 1 for the rounds in which it will function as a CH and 0 for the rounds in which it will function as a regular node.

Once the process of reserving phase is over, all other nodes receive the reservation matrix that each node delivers. A matrix known as the whole matrix is created, using this matrix as a base. Every round R's CH node is displayed in the total matrix, which is viewable by all other nodes.

This method reduces the messaging overhead, but because it ignores a crucial CH selection criterion, it is still believed to be inefficient with contemplation to energy.

These consist of residual energy, node density, and other things. Because they require a significant amount of memory on each node to store the whole matrix, they are only suitable for small-scale networks. It also refrains from minimising duplicate data sensing and broadcasting between network nodes.

SEED (Sleep-awake Energy Efficient Distributed): One of the most advanced routing schemes, the Sleep-awake Energy Efficient Distributed (SEED) Algorithm [14], and uses duty-cycling to reduce communication of duplicate data from the sensor nodes, where the expectation is for compatibility among various heterogeneous components. A Wireless Sensor Network (WSN) is composed of an enormous number of tiny nodes called sensor nodes. Numerous variables, including as energy, traffic, link connection, and other irregularities like migration situations can be used to characterise node uniqueness in WSNs [7].

Nevertheless, idle listening is a problem for SEED and comparable routing systems, this results in the network using unnecessary energy. The period of time that the radio transceiver of the sensor node is turned on Nevertheless, passive listening occurs when a sensor node transmits or receives no data [15]. The SEED algorithm causes a network's idle listening issue by using traditional TDMA scheduling among Cluster Members (CMs) [14]. Each cluster member in a traditional TDMA is given a single slot. Therefore Despite the absence of any data for the sensor node to submit to the cluster head (CH), it still needs to wake up and turn on its broadcaster within the time frame specified window. As a result, the node consumes a significant amount of energy while operating in an idle state. Similar to this, during these idle time intervals, the current CH consumes energy by running in an idle condition. SEED cannot operate in a condition where sensor nodes have different data rates [13].

SEED ignores traffic heterogeneity amid sensor nodes as paired nodes round-robin switch between sleep and waking modes. As a result, sensor nodes with high data rates will eventually perish because they will waste more energy than those with low data transmission rates [1]. As a result, in SEED, it is possible that the node that awakens next won't have enough energy to send data during a particular round.

EESAA (Energy Efficient Sleep Awake Aware) [2]

The notion of characteristic pairing between sensor nodes was first presented by EESAA. For the purpose of detecting and communicating about the environment, sensor nodes that are closest to one another and that send redundant data form pairs. The pair of nodes switches back and forth between the "Awake" and "Sleep" modes following each data transmission interval. Despite the fact that this method has extended the network lifetime, nodes that switch from being awake and asleep after each communication round will use more energy in the network because of the energy required to turn sensor nodes' radios on and off repeatedly. Furthermore, the nodes energy is not considered when the pair nodes alternate between sleeping and waking up, therefore it's possible that the node that awakens next won't have enough energy to provide data during a particular round.

Additionally, this method assigned a time window to each CM (Cluster Member) so they could transfer data to CHs via traditional TDMA.

There will be more latency and from the amount of energy used when listening to nothing since the CMs must wake up within the specified time interval even when there is nothing for the node to send to the CH. The EESAA architecture makes the assumption that the sensor nodes have homogenous energy and traffic rate.

ETASA (Energy and traffic aware sleep-awake) [6]

Implementation of Energy and traffic aware sleep-awake (ETASA) is a hybrid approach that N.M. Shagari et al. presented to increase regulating loads and maximizing energy in heterogeneous WSN scenarios. The pairing technique, used by ETASA, group's sensor nodes in close proximity to one another in order to transmit data. Unlike previous approaches, by allowing paired nodes to alternate from sleep and awake modes influenced by the traffic rate and node energy, ETASA enhances load balancing and energy efficiency.

3. **Energy aware load balancing:** These algorithms distribute tasks in a way that minimizes energy usage and extends the lifetime of the network by accounting for the energy levels of sensor nodes. For instance, EEUC and EELB

Protocol	*Network Lifetime*	*FND(first Node Died)*	*Throughput*	*Remaining Energy*	*Type of node selected*	*Findings*
TEAR	hasn't performed well	Demonstrate a substantial rise in the quantity of dead nodes.	higher performance	Lowers to reduce the amount of duplicated data sensing and network node communication	TEAR takes into account the various stochastic energy levels and traffic variations in sensor nodes.	This duplicate information may cause extra data transfer and collisions, which will impair the network's performance.
SEED	Improved using pairing and sleep-awake mechanism	Demonstrated improved performance when compared to TEAR since SEED's energy-saving approach prevents needless data transmission.	lowest throughput	Less remaining energy	not consider nodes traffic heterogeneities	Round-robin rotation is used to switch between sleep and awake modes for paired nodes.
ETASA	enhanced sleep-wake mechanism and pairing	requires more communication rounds until FND than TEAR and SEED	increase in throughput	Has more energy left after using energy-saving technique?	For the role of CH, the node with the highest energy, most pairings, and least traffic is chosen.	In order to upgrade energy efficiency and load balancing, the paired nodes in

						ETASA switch between resting and waking up in response to changes in their energy and traffic volume. .

4. **QOS aware load balancing**: These algorithms rank activities according to criteria related to quality of service, like data accuracy, latency, and reliability. Routing protocols and clustering algorithms that are cognizant of QOS are two examples.

The decision of an algorithm is contingent upon the particular needs and limitations of the network lifespan. These algorithms seek to maximise resource utilisation, enhance network performance, and prolong the network lifetime in WSNs.

3. Proposed Method

Upon comparison with various load balancing methods, we propose a method using DODAG algorithm which involves distributing the degree of traffic between the nodes in the structure to prevent congestion, optimize energy consumption and improve overall network performance.

One approach to load balancing using DODAG is through the selection of appropriate parent nodes for each sensor node in the network.by strategically choosing parent nodes based on factors such as energy levels, distance and traffic load, In order to prevent any one node from becoming overwhelmed, the burden can be distributed evenly throughout the network

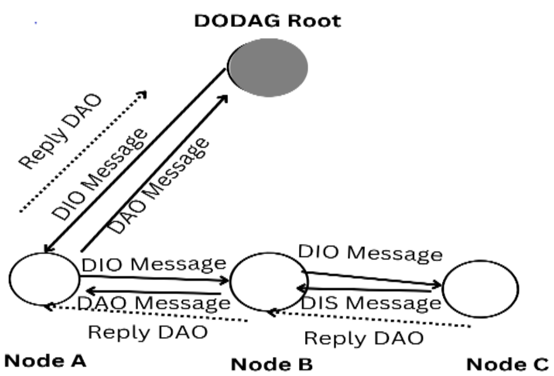

Fig 4. DODAG Algorithm

Additionally RPL allows for the implementation of objective functions that can be used to optimize the selection of parent node based on specific metrics, such as energy efficiency or latency.by adjusting these objectives functions, the network can dynamically adapt to changing conditions and ensure efficient load balancing.

Overall Load balancing using DODAG in a WSN is crucial for maximizing network efficiency, prolonging the network lifetime and ensuring reliable data transmission. By intelligently distributing the workload among nodes in the network, DODAG based load balancing can help optimize resource management and improve efficiency in general for the WSN.

4. Conclusion

In summary, addressing load balancing concerns in heterogeneous Wireless Sensor Network (WSN) environments is crucial for optimizing network performance and prolonging its lifetime. Failure to leverage the heterogeneity among sensor nodes can result in uneven energy consumption and load imbalance, ultimately degrading network efficiency. Routing algorithms play a pivotal role in achieving load balancing among these diverse nodes, with the potential for further enhancement through suitable techniques. While some existing routing schemes, such as SEED, encounter issues like idle listening leading to unnecessary energy drain, alternatives like ETASA offer promising solutions. Future endeavours should focus on refining load balancing techniques and implementing advanced routing structures like Directed Acyclic Graphs (DOODAG), potentially leveraging tools such as CISCO Packet Razor, to enhance network performance and efficiency

Author contributions

Kumudini S: Conceptualization, Writing-Original draft preparation. **Dr. M.P.Vani:** Visualization, Reviewing.

Conflicts of interest

The authors declare no conflicts of interest.

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