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Survey on Clustering Techniques for Wireless Sensor Networks and Cluster Head Selection Model

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ABSTRACT. *Low-powered wirelessly connected devices create a system that is self-contained and called Wireless sensor network (WSN), this system has a number of practical applications in the modern world. Nodes in WSN are spread out spatially and have wireless communication with other nodes in the network, these nodes are primarily dedicated to sensing the vicinity and recording the physical properties of the area, including collect observations pertaining to humidity, noise, load, temperature Sensors and other factors at a central station. From there, the end user analyzes the information. After distribution, a cluster is formed between nodes, called a cluster. One of the nodes is selected as the cluster's head, which is used to migrate the data across the network. Clustering is essential in addressing many issues in WSN, particularly in regards to their lifetime, energy savings, and interoperability. Many approaches exist for clustering WSN, the difference between them is in the choice of CH, the number of clusters, the structure of clusters, the policy for data aggregation, the efficiency of communication between clusters, and the choice of communication between internal and external clusters. This article provides a comprehensive comparison of various methods of clustering and their advantages and disadvantages in WSNs. It also describes the principles of CH selection and how it works within each category. This helps the end user to choose the most suitable one protocol for their needs, and also will assist researchers in addressing the problems revealed in the process of clustering WSN.*

KEYWORDS: survey, clustering techniques, wireless sensor networks, cluster head selection model

INTRODUCTION

Wireless sensor networks (WSN) are composed of a considerable quantity of cost-effective, energy-efficient, and multifunctional sensor nodes applied in a specific domain. These sensor

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nodes possess a slender structure, yet they are equipped with embedded microprocessors and radio transceivers, enabling them not only to detect but also to process data and establish communication. Their communication occurs over a limited period through a wireless channel, and they collaborate harmoniously towards a shared objective, such as monitoring the environment, conducting military surveillance, or managing industrial operations [1]. In comparison to traditional wireless communication networks, sensor networks exhibit distinct characteristics and limitations, including extensive deployment of nodes, the application of rechargeable batteries, the inclusion of nodes that can configure themselves, the presence of sensors that may become unstable, the adherence to specific energy, processing, and storage limitations, the lack of a universal identification system, the occurrence of regular changes in network structure, the existence of data redundancy, and the prevalence of multiple data sources feeding into one central location[2]. The wireless sensor network consists of numerical node, each equipped with one or more sensors that are placed in the range of hundreds to thousands. A portion of the sensor is illustrated in Fig. (1) has a sensor, a processor, a transceiver, and a controller. It additionally features enhanced features that include a positioner, generators, and cellular device. ADC converts the analog data from the sensor into digital form that is then transferred to the processing unit. [3].

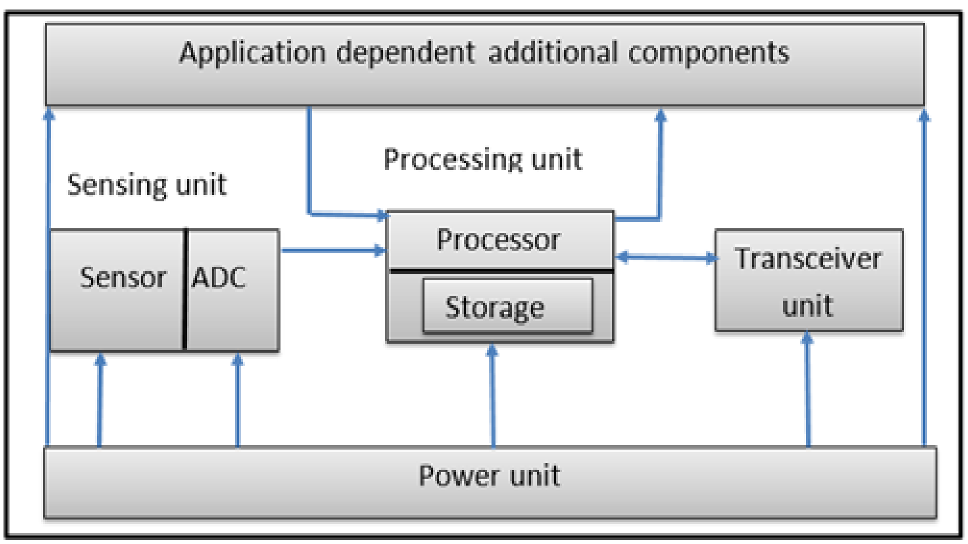


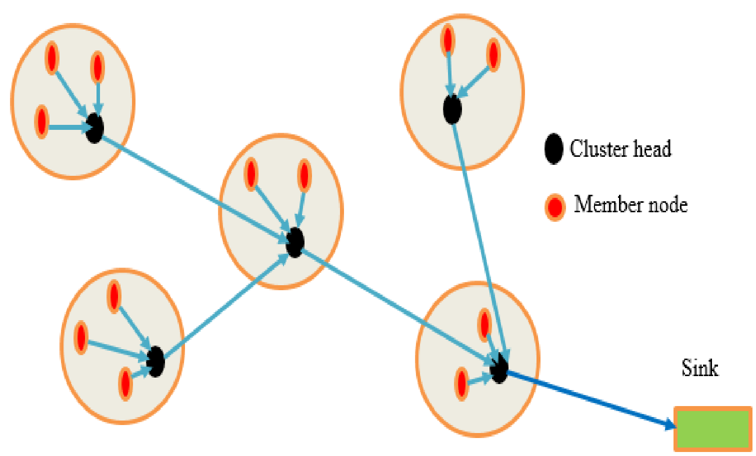
Fig.1. Component of sensor nodes

The unit responsible for processing is typically connected to a lesser storage device, this enables the sensor node to participate in other nodes' processes in order to complete the assigned task.

Energy derived from a power system like solar cell[4].The tremendous increase in the number of WSN's over the past decade has led to the creation of protocols for assembling large regions. This is accomplished via a clusterization protocol that typically involves CH in the more intricate tasks like data aggregation and fusion, however, member node (MN) typically deal with the fundamental sensors (Main Node). The procedure of cluster formation creates a system with a higher number of CH components and a lower number of cluster components [5]. CH node have a greater propensity to consume resources in the transmission of large data packets than other participants

CLUSTERING IN WSNs

A cluster is composed of the cluster members and a cluster head (CHs) that governs the interaction between member of the cluster, as illustrated in Fig.(2). Clusters participant help the leader of the cluster by saving time and combining the data from the gathered sources into a cluster head(CH) [6].



Fig(2). Cluster's in WSN

The clustering of WSNs has multiple advantages.

It facilitates increased network efficiency and reduces energy expenditure by combining information. It will cluster the route configuration into a cluster. Limits the number of connections

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between clusters to the leader of the cluster. It prevents multiple messages from being passed across the sensor increase scalability network.Perceive, but also process data and establish communication. They engage in communication within a restricted timeframe. Prior to delving into the diverse categorization alternatives for clustering algorithms in WSNs, it is crucial to grasp several pivotal parameters concerning the entirety of the clustering process in WSN [7],[10]. Moreover, these parameters are employed to assess and classify the distinct clustering methodologies.

- **Count of cluster:** The choice of CHs method and associated probability distribution has different effects for state-of-the-art stochastic and probabilistic clustering. However, the total number of clusters as well as the number of CHs are still predetermined in some formal procedure
- **Intra-cluster communication:** Intra-cluster communication. In certain clustering methodologies, it is anticipated that the connection between a sensor and the assigned cluster head is established promptly. However, in scenarios where sensor nodes possess limited range for interaction and the numbers of sensory node is exceedingly large, coupled with a scarcity of cluster heads, intracluster multi-hop communication becomes an integral necessity.
- **Message count:** Prior to the several massages that need to be sent for cluster head selection process, there are numbers of message that have to be exchanged for range determination of cluster head .The transmission of these messages take plenty of resources to accomplish the cluster head selection process.
- **Stability**: It's said that a clustering scheme is adaptive if the members of it are not predetermined. Otherwise, since the number of clusters is not altered during the process ofclustering, we can consider it constant. The reliability of a sensor network is increased by utilizing a pre-established cluster number**.**
- **Intra-cluster topologies** : It determines whether communication between sensor nodes in the cluster is direct, indirect, or hopeless. However, the span of the sensor has an impact on contact. The number of employees in the cluster is limited by the region.
- **Method of cluster formation**: If CHs are just ordinary sensors and efficiency is the only design decision, then the clusters in state-of-the-art approaches are distributed and without coordination. Some previous approaches have used centralized (or hybrid) approaches. Deploy one or more coordinators to isolate and manage the entire network offline.

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- **Cluster-head selection :** Some algorithms that have been put forward, particularly those that are heterogeneous, permit the pre-assignment of cluster heads. Nevertheless, in the case of homogenous environments, cluster heads are typically chosen either probabilistically or entirely at random from the set of deployed nodes, or in accordance with more precise criteria such as residual energy and connectivity.

TYPES OF CLUSTERING

WSN has multiple modes ofclustering that are based on multiple attributes. Fig (3) describes the proposed study that is comparative in nature and focuses on the classification of clustering that are based on intracluster or intercluster communication between clusters of nodes in WSNs

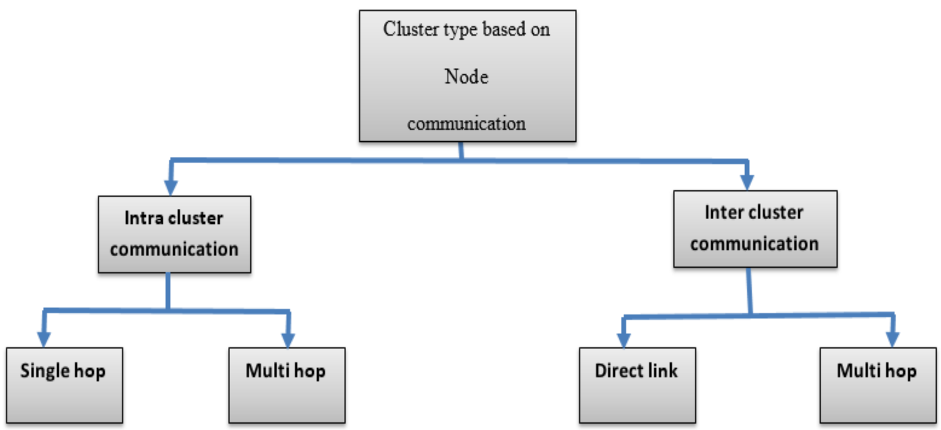

Fig.3. Classification of Clustering in WSN

Intracluster connection pertains to the exchange of information among members belonging to a cluster. Typically, this form of communication takes place via singlehop or multihops from the members to the cluster head. On the other hand, intercluster communication refers to the interaction between cluster within a networks. This interaction facilitates the transmission of clusters data to the external environment through the clusters head[11],[12]. This transmit can be accomplished through a singlehop to the (BS) or through multiplehop between the cluster heads and the (BS). Figure 4 illustrates the scenario of singlehop versus multihop communication in wireless sensor networks (WSN). In the case where data can be easily added to the cluster head and communicated solely through other cluster heads via singlehop network to the sink [13,14], the network exhibits a straightforward structure. However, if the transmission of data to the cluster head requires more than one hop, the network is deemed to be multihop. In this case, the data obtained must be authenticated by the sensor nodes [15-17] . Table 1 shows the communications strategy between cluster, which is utilized to classify the clustering protocols for WSNs.

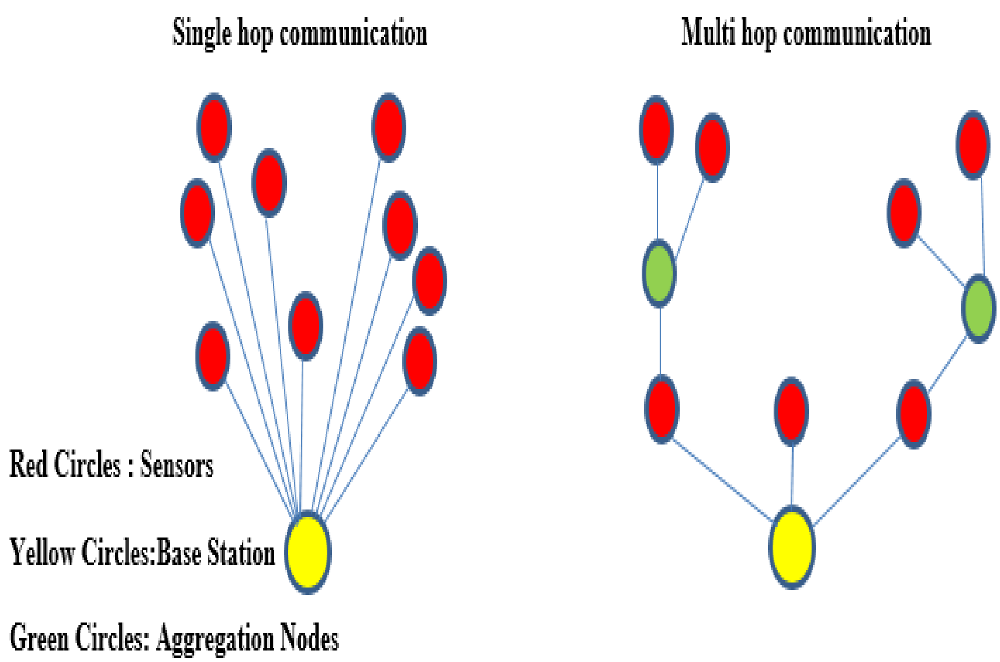

Fig.4. Singlehop Vs Multihop Communication

TABLE 1. Cluster based protocol based on their communications plan

Cluster Character-tics	**Cluster Communication**															
	Intra-Clustercommunication								**Inter-Custercommunication**							
	Single Hop				**Multi Hop**				**Directlink**				**Multihop**			
Protocol Name	LEACH	LEACH-C	HEED	PRODUCE	HSR	C4SD	NDBC	TBC		DWEHC	DEBC	DEEC	UCR	ECLCM	ECBDA	DCLB
Node Deployment	Random	Random	Random	Random	Random	Random	Random	Random	Random	Random	Random	Random	Random	Random	Random	Random
Heterogeneity (Y/N)	N	N	N	N	Y	Y	Y	N	N	N	Y	Y	N	N	N	N
Location Awareness (Y/N)	N	N	N	Y	Y	Y	N	Y	N	N	N	N	N	N	N	Y

Cluster head Mobility		FIXE	FIXE	FIXE	FIXE	FIXE	FIXE	FIXE		FIXE	FIXE	FIXE	FIXE	FIXED	FIXE	FIXE
Cluster count	VARIAB	VARIABLE	VARIABLE	VARIABLE	VARIABLE	VARIABLE	FIXED	VARIABLE	VARIABLE	VARIABLE	VARIABLE	VARIABLE	VARIABLE	VARIABLE	VARIABLE	VARIABLE
CH - Selection	PURE	PURE-PROBABILITY	PURE-PROBABILITY	DISTANCE	DISTANCE	WEIGHTED-PROBABILITY	NEIGHBOR	NEIGHBOR&DISTANCE	WEIGHTED	WEIGHTED-PROBABILITY	WEIGHTED-PROBABILITY	WEIGHTED-PROBABILITY	PURE&EIGHTED	PURE-PROBABILITY	WEIGHTED-PROBABILITY	NERIGHBOR&LOCATION

Message - count	N	N	N	Y	Y	N	Y	N	N	N	N	N	N	N	N	Y
Clustering-Method	DISTRIBUT	CENTRALIZED	DISTRIBUTED	DISTRIBUT	DISTRIBUTED	DISTRIBUTED	DISTRIBUTED	DISTRIBUTED	DISTRIBUTED	DISTRIBUTED	DISTRIBUTED	DISTRIBUTED	DISTRIBUTED	DISTRIBUTED	DISTRIBUTED	DISTRIBUTED

WSN CLUSTERING PROTOCOL BASED ON SINGLE HOP (INTRA CLUSTER) COMMUNICCATION

Low Energy Adaptive Cluster Head (LEACH)

The protocol cluster for wireless sensor networks, initially proposed in [18], [19], has gained popularity. This protocol entails the division of sensors into distinct groups, where certain nodes are selected as cluster heads through a random selection process that takes place every round. Due to the distributed nature of the LEACH algorithm, the number of clusters is not predetermined. The algorithm's distributed nature allows each node to select a number randomly and designate itself as a cluster head. The utilization of a random number generator guarantees an equal distribution of numbers among the cluster head collection.

Low Energy Adaptive Cluster Head centralized (LEACH-C)

In the present protocol, the nodes' position and energy level are conveyed to the sink utilizing a centralized methodology. The selection of cluster heads is done in a random manner, leading to a decrease in the total number of cluster heads. However, due to the challenging task of relaying information from nodes located far away from the base station, this protocols may not be suitable for larger network [20],[21]. Furthermore, later the location of the cluster heads is subject to rotation, the provision of information in a timely manner becomes unfeasible.

Hybrid Energy -Efficient Distributed (HEED)

The proposal in the HEED protocol suggests the usage of residual capacity nodes degrees or density as the primary factor in establishing clusters. This is done in order to attain a state of equilibrium in power distribution, as opposed to the LEACH protocol[22]. The protocol employs an algorithm that systematically selects cluster heads based on two fundamental factors .The initial parameter refers to the energy level of each individual node, whereas the subsequent parameter, concerning the density of clusters or the level of the nodes, encompasses the intracluster contact [23], [25]. In terms of probabilistic language, the primary parameters establish the original group leader, while the secondary parameters dictate the distribution of connections. HEED does not

PRODUCE

The distributed clustering algorithm [26] is employed to organize the network through the clustering of dissimilar sizes. The computation of this algorithm is accomplished by utilizing localized probabilities and stochastic geometry-based multihop routing. In this particular study of algorithms, it has been observed that clusters that are located at a greater distance from the Sink exhibit a prominent characteristic of having larger cluster sizes. On the contrary, clusters that are situated in closer proximity to the Base Station (BS) tend to have smaller cluster sizes. Each individual rank within the system is attributed a distinct probability value for the purpose of selecting the cluster head. As a result of the noticeable variation in cluster count, the proposed protocol effectively generates clusters of dissimilar sizes.

CLUSTERING PROTOCOLS BASED ON MULTI HOP(INTRACLUSTER) COMMUNICATION

Hierarchical Source Routing (HSR)

The active routing Protocols for Heterogeneous Sensors Networks proposed in [27],[30] employs a limited numbers of powerful high-end sensor along with a large number of low-end sensors. In this particular scenario, each sensor node remains stationary and is aware of its own location. During the process of clusters formation, the nodes select the cluster head based on signals power. The data is then transmit to the BS through multi-hop transmission by the Cluster Heads. However, it should be noted that the suggested approach is static in nature, thus rendering it unsuitable for scenarios requiring extensive coverage.

Cluster Based Service Discovery (C4SD)

A hierarchical structure of clusters is used to facilitate Dissemination of data information. This is employed by the service discovery protocol based on clusters that has been proposed for WSNs with heterogeneity. [31].Each node in the protocol has unique hardware and weights. If a nodes is highly influential, it should be elected as the cluster leader. These nodes are used to register services within the cluster[32-33]. The service finder only accesses directory nodes, resulting in low discovery overhead.

National Data Buoy Center (NDBC)

Sanjeev Kumar Gupta and his colleagues [34] propose the classification of nodes based on their grade as an extension to the lifespan of heterogeneous WSN (NDBC). In this particular investigation, the authors effectively employ two distinct classifications of sensor nodes, namely advanced nodes and normal nodes.The advanced nodes possess a higher energy capacity compared to the regular nodes.The selection of cluster heads is determined by the energy and network node degree of the advanced nodes. To facilitate the selection of cluster heads, the authors employ NDBC to minimize the communication costs among the sensor nodes.

Traffic Based Clustering (TBC)

The WSN methodologies endorse clustering techniques that are centered around traffic, as outlined in [35] and [37]. These methodologies aim to establish a framework that takes into account both the traffic flow and the density of sensors within a given region of interest .The authors recommend constructing network topologies in different areas covered by the entire network based on node density. This avoids bottlenecks and extends the life of the networks by properly distributing traffic. The proposed protocols shows that the power of distant sensors node decays more slowly than that of nearby sensor nodes.

CLUSTERING PROTOCOLS BASED ON DIRECT LINK (INTER CLUSTER COMMUNICATION

Stale Election Protocol (SEP)

Heterogeneity arises from the implementation of an Outdated Mechanism for Selecting Wireless Nodes, leading to the introduction of variability within the network [38]. This mechanism enhances the network's stability by designating the initial node as inactive after a certain duration, referred to as the stability period. The mechanism determines the probability of selecting a specific member from the clusters based on the remaining energy of other members within the cluster. To the existing LEACH protocol, the authors incorporated an additional step considering the aspect of diversity. However, the cluster identification process of this method exhibits inconsistency, and the duration of instability is not optimal.

Distributed weight-dependent energy efficient hierarchical clustering (DWEHC)

The suggested distributed protocols aim to enhance energy efficiency in hierarchical clusters based on weight-dependent criteria [39].Is intended to maximize the efficiency of energy consumption while also producing a balanced distribution of cluster sizes and improving the internal design of clusters. Every sensor node calculates the weight of the sensor after placing the other nodes in their designated position. The clusters head will be recognized as the most significant nodes in the vicinity, the remaining member will be considered. The protocol is lacking in terms of the stability time, as it relies on a large amount of energy in order to find friends.

Distributed Energy Efficient Clustering (DEEC)

In [40], a set of hierarchical clustering algorithms has been developed specifically for heterogeneous wireless sensor networks. The DEEC (Distributed Energy-Efficient Clustering) cluster heads are selected based on a probabilistic approach, which takes into account the ratio between the residual energy of each node and the average energy level across the entire network. In order to address the multi-level heterogeneity, the algorithms thoroughly examine two layers of heterogeneous nodes to obtain a comprehensive solution. DEEC proficiently ascertains the most suitable value for the persistency of the network, thereby establishing the standard energy distribution for each individual node within a specified iteration. Significantly, this approach permits a fluctuating cluster quantity, leading to clusters of varying magnitudes.

Distributed energy balance clustering (DEBC)

A collection of cluster head creates a distributed wireless sensors network [41]. In DEBC, clusters are formed based on radio based probabilities of node residual power and the average power of the network [42]. Cluster heads are more likely to be high-performance initial and remaining nodes. This protocol is derived from the LEACH and SEP protocols by considering two levels of diversity. The first extension is to include multihop diversity.

CLUSTERING PROTOCOLS BASED ON MULTIHOP (INTERCLUSTER COMMUNICATION)

Unequal Cluster-based Routing (UCR)

In order to circumvent the hotspot problem in wireless sensor networks, a protocol based on unequal clusters is adopted for routing [43]. It is a competitive algorithm that selects cluster heads based on local information (such as the remaining energy of nearby nodes). Cluster heads closer to the base station have smaller cluster sizes, so the cluster heads have lower energy costs for processing internal data and want more energy to carry external traffic routed within the cluster. This protocol completes the process of selecting cluster heads based on a variable number of clusters in two steps. This takes time and results in uneven cluster sizes.

Energy Consumption & Lifetime analysis in Clustered Multi-hop (ECLCM)

A probabilistic cluster energy model is proposed to estimate the energy consumption of multihop[44],[46] .wireless sensor networks. Each sensor node selects itself as a cluster head with a certain probability; it does not communicate any information with other nodes. For communication between all nodes, TDMA scheduling is used, which is ordered by the cluster head or sink node. If the shortest path length to a sensor node is greater than or equal to 2, the node is randomly selected. This continues until each node is elected or designated as the head of the cluster. TDMA schemes are organized by cluster heads or sink nodes so that all nodes can connect to them. Data conflicts should also be avoided. Due to the different number of clusters, the proposed protocol results in unequal cluster sizes. The phenomenon of multiple frequency hopping is the cause of network gaps in base stations.

Energy Efficient Cluster Based Data Aggregation (ECBDA)

ECBDA was proposed in [47] as a cluster-based solution to extend network lifetime. A member in each cluster elects a cluster head based on its remaining energy and the connection cost in the process of electing a cluster head. During maintenance, the remaining energy of the cluster is adjusted at each iteration. If the remaining energy falls below the necessary threshold, a fresh leader is chosen from within the same cluster. The suggested protocol leads to the formation of a compact cluster, thereby enabling more efficient transmission from the cluster head to the base station.

Distributed Clustering with Load Balancing (DCLB)

Distributed load balancing cluster scheduling in the communications between cluster was proposed in order to form clusters with efficient design and balance the load in [48]. In regards to energy efficiency and load distribution, the size (span) of the cluster is of paramount importance to the contact between multiple hop cluster heads. It avoids the failure of energy and ensures the cluster has a uniform load, because at every step in theclustering process it inspects the volume of data. Because of the differing number of clusters that are variable, the proposed protocol produces clusters that are unequally large.

CLUSTER HEADS SELECTION MODEL

In general, a Wireless Sensor Networks (WSNs) consist of a specified number of sensor nodes, denoted as Nn, which are connected to a solitary base station [49, 50, 51, 52, 53, 54]. All the nodes within the WSN are immobile and possess indistinguishable capabilities. The transfer of data within the WSNs is facilitated by these nodes within their respective radio range. A cluster node can fulfill two primary functions: serving as a cluster head and functioning as an active sensor. The WSN model encompasses various aspects such as radio communication, sensor placement, data sensing, energy consumption, and topology. The placement of sensors within an application area can be either manual or random. In all instances of WSN, the Base station (BS) has the ability to directly communicate with all the sensors. The framework of the cluster head, along with the communication of sensors to the centralized base station, is illustrated in Figure 5. The base station, referred to as BS, plays a crucial role within the WSN, however ,The utilization of clustering technology finds wide applicability in the context of selecting the cluster head of the Wireless Sensor Network (WSN) due to its significant enhancement of the network's lifespan. Clustering plays a crucial role in the formation of clusters by grouping the nodes and selecting the number of cluster head (N_C) for each cluster .Within the WSN, the sensor nodes identify their respective cluster head based on proximity. The main goal of every sensor is to gather information from the allocated region, transfer it to the cluster head, and then forward it to the base station through the cluster head-based routing mechanism. The perfect cluster head is a sensor node within the corresponding cluster of sensor nodes that is capable of efficiently transmitting the data of all the sensor nodes while conserving the maximum energy of every sensor node within the cluster.

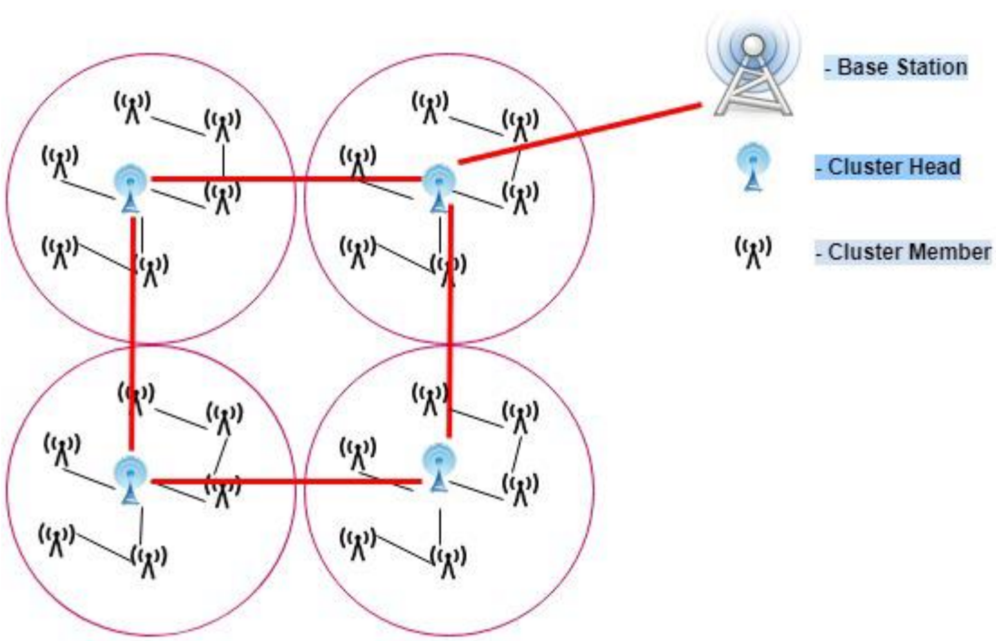

Fig (5) Clusters head with sensor communications to the centralized (BS)

CLUSTER HEAD SELECTION ALGORITHM

The CHs will disseminate a promotional message to member nodes by employing the CSMA MAC protocol. The member nodes, upon receipt of the advertisement message, proceed to locate their nearby CH in order to establish a cluster, the determination of which is based on the strength of the received signal. Once the setup phase concludes, each member node once again notifies the CH of its presence within the cluster using the CSMA MAC protocol. Subsequent to the receipt of the member node's request message, the CH assigns a TDMA schedule to the member nodes, the basis of which is the quantity of nodes within the cluster. During the phase of steady state, the transmission of data from each member node occurs within the timeslot allocated to it. This ensures that there is no collision between the transmitted data .

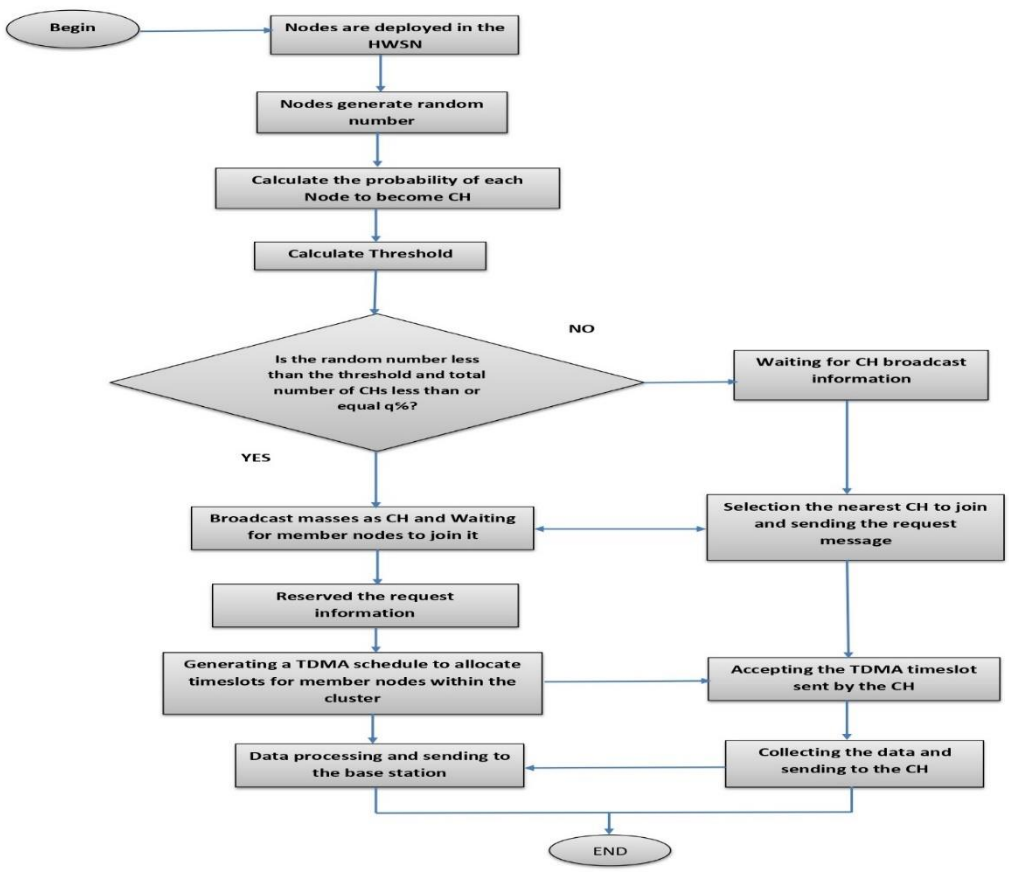

Fig6. Flowchart of Cluster Head Selection.

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Following the completion of data transmission from all nodes, the CH conducts data aggregation, eliminating redundancy and compressing the data to a practical extent, which allows for enhanced utilization of the available bandwidth. The details regarding the proposed protocols are described through the utilization of a flowchart, as depicted in Figure 6.

OPTIMAL CH SELECTION

The total number of active node is calculated for each iteration. The percentage of the total number that is selected as a CH is maximised. All nodes in the network that have the potential to become a CH are considered possible. Of the possible CHs, the percentage of active nodes that are assigned to the final set of CHs is at most q%. It is important to acknowledge that the restriction imposed on the number of CHs has a profound impact on various performance parameters, such as stability duration, node half-life, throughputs, and normalised residual energy. The node are normally classified into three levels of energy heterogeneity (normally nodes , intermediate nodes and advanced nodes) .The initial energy of intermediate nodes is between the energy levels of normal and advanced nodes .If m and b are the percentage of energy levels for the advanced and intermediate nodes respectively, also energy level of advanced nodes is α times higher than the normal node , energy level of intermediate nodes is β times higher than the normal nodes ,as well as α is related to β by β = α/2 then, the energy of nods can be related as follows :

$$E_N = E_0$$

$$E_I = E_0\ (1+\beta)$$

$$E_A = E_0\ (1+\alpha)$$

Where E_0 is the initial energy of node (its standard value 0.5J).

E_N, E_I and E_A represent the initial energy for normal, intermediate and advanced nodes respectively.

Tables 2 and 3 provide information on the settling time and half-life in rounds for (m = 0.2 and b = 0.3), respectively. In both scenarios, the quantity of CHs is subject to limitation, ranging from 5% to 30%, which includes the condition of "unlimited." The findings reveal that the resting time increases as the number of CHs escalates, and this trend persists until 20% of the live nodes are chosen as CHs. For (m = 0.2 and b = 0.3), as well as (m = 0.3 and b = 0.3), the maximum stability lengths are 1533 cycles and 1616 cycles, correspondingly. However, the settling time diminishes when the limit value reaches 30%, which encompasses the situation with no limit value. Conversely, the half-time is maximum [55].

TABLE 2 . Stability period and half lifetime for(m = 0.2, b = 0.3)Limit on numbers of CHs Stability period Half lifetime

	Stability	Half lifetime
No limit	1160	2655
30% CH	1549	2347
20% CH	1616	2420
10% CH	1445	2345
5% CH	554	2174

TABLE 3. Stability period and half lifetime for (m = 0.3, b = 0.3) Limit on numbers of CHs Stability period Half lifetime

	Stability	Half lifetime
	1208	2791
	1447	2465
	1533	2338
	1331	2270
	506	2200

For the "no limit" version of CHS, she continued to diminish the number of CHs while also making sure to select the most appropriate ones. Additionally, the system's throughput is measured for m = 0.2, b = 0.3 and m = 0.3, b = 0.3 in relation to the CHs maximum percentage as displayed in Fig.7. If the quantity of CHs is reduced, the transition of packets from CH to sink will also be reduced, as representation by Fig.5. The system has the greatest capacity for throughput when no limits are placed on the number of CHs, and the minimum capacity is achieved when 5% of the nodes are alive and selected as CHs. The results are clearly demonstrative of the fact that the throughputs is almost the same for "without limit", 30% and 20% of the live nodes that are selected as CH. As a result, a period of stability and throughput is observed in the trade-off between performance and stability. The quantity of CH should be limited in order to achieve a longer stability period, whereas the lack of limit in the selection of CHs is necessary in order to have a higher throughputs. Over all, we discovered that 20% of the live nodes were chosen as CH [56

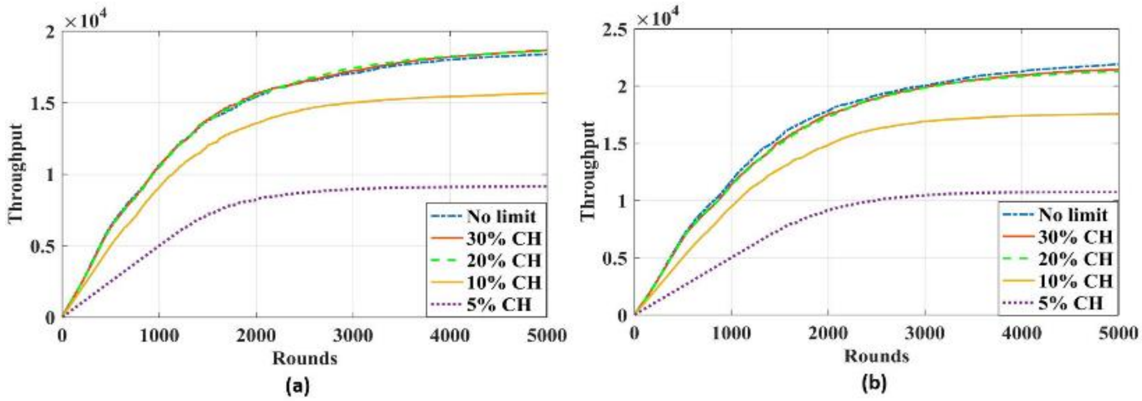

Fig (7). Numbers of packet sent from CHs to sink for (a) m = 0.2, b = 0.3 and (b) m = 0.3, b = 0.3

CONCLUSION

Heterogeneity can extend the networks lifetime and improve the reliability of wireless sensors network. Clustering successfully reduces energy consumption and improves reliability in wireless sensor networks. Many protocols are designed to operate in complex wireless sensor networks. Many new protocols for energy efficient heterogeneous networks are based on clustering approaches. This shows that it is useful to reduce the energy consumption of wireless network. Additionally, the protocol, how to select a cluster head, and how to optimize a cluster head (CH) using a flowchart are discussed .Through this study, we conclude that when the power level is 20% or more, the node is a candidate to be a cluster head. The network performance is high, in terms of better stability and high productivity, when the power level is more than 20%. This paper concludes that comparing different WSN protocols in terms of clustering helps researchers identify problems in their practical applications and make informed decisions in the future. Additionally, more specific parameters of cluster creation were considered in this investigation.

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