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Hybrid Artificial Bee Colony and rendezvous nodes based leach protocol for Mobile Sink based WSNs

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ABSTRACT: - Wireless sensor networks are composed of a large number of disposable wireless sensors that collect information about their surrounding environment and transmit them to the end user. Because these sensors do not have rechargeable batteries, increasing their lifetime is important and various methods have been proposed to increase the lifetime of the sensor nodes in a network. Most of these methods are based on clustering or routing algorithms.This paper has focused on evaluating the performance of rendezvous nodes based LEACH protocol. Nevertheless the rendezvous nodes based LEACH outperforms over the LEACH with regards to the stability period, but has inadequate network lifetime i.e. the final node become dead too early than LEACH. To overcome a constraint an improvement will undoubtedly be done in the rendezvous nodes based LEACH by using the artificial bee colony based routing algorithm. The general goal is to get the effectiveness of the rendezvous nodes based LEACH when artificial bee colony based inter cluster data aggregation is applied on it. The comparison has clearly shown the effectiveness of the proposed technique.

KEYWORDS: - WSN, Clustering, LEACH, LEACH Clustering , Rendezvous, **Artificial bee colony**.

INTRODUCTION

A **wireless sensor network (WSN)** (sometimes called a **wireless sensor and actor network (WSAN)**) are spatially distributed autonomous sensors to *monitor* physical or environmental conditions, such as for instance temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more contemporary networks are bi-directional, also enabling control of sensor activity. The development of wireless sensor networks was motivated by military applications such as for instance battlefield surveillance; today such networks are found in many industrial and consumer applications, such as for instance industrial process monitoring and control, machine health monitoring, and so on.

The WSN is made of "nodes" – from several too many hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver by having an internal antenna or connection to an additional antenna, a microcontroller, an electric circuit for interfacing with the sensors and a power source, usually a battery or an embedded type of harvesting. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The price of sensor nodes is similarly variable, which range from several to a huge selection of dollars, depending on the complexity of the average person sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as for instance energy, memory, computational speed and communications bandwidth. The topology of the WSNs can differ from an easy star network to a sophisticated multi-hop network. The propagation technique involving the hops of the network could be routing or flooding.

An alarm network 1 is definitely an infrastructure composed of sensing (measuring), computing, and communication element that an administrator the capacity to instrument, observe, and answer evens and phenomena in a specified environment. The administrator typically is just a civil, governmental, commercial, or industrial entity. The environmental surroundings can be the physical world, a biological system, or an information technology (IT) framework. Networked sensor systems have emerged by observers as an important technology, which will experience major deployment in the next few years for a plethora of applications, not minimal being national security. The concept of wireless sensor networks is based on easy equation: Sensing + CPU+ Radio =1000s of potential application. The moment people understand the

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capabilities of a wireless sensor network, hundreds of applications spring to mind. It seems like a straightforward mix of today's technology.

LEACH

[13] Propose a low-energy adaptive clustering hierarchy (LEACH), for WSN. It is really a protocol architecture where in fact, the ideas of power-efficient cluster based routing and media access control has been combined alongside application-specific data aggregation to be able to gain high performance. It is distributed and it assumes that most the sensor nodes have sufficient energy to reach the base station if required that is every sensor node gets the potential to become cluster head and carry out fusion of data. It is also assumed by LEACH that most the sensor nodes have data to transmit at regular intervals. The entire sensor nodes have the same level of power capacity in every round of election in LEACH that is based on the supposition that being a bunch head grades in equal power utilization for every single and every node. In LEACH, the organization of nodes is performed into clusters for the fusion of data. The fused data is transmitted from various sensors in the cluster to the sink with a selected node called cluster head after performing aggregation of data. Cluster head is more energetic than the rest of the sensor nodes in the cluster. It will help in reducing the total amount of data provided for the sink. The fusion of data is performed at the cluster heads at regular intervals. LEACH involves both necessary phases: the set-up phase and the steady phase. In set-up phase, organization of clusters is performed and in steady phase, transmission of data from sensor nodes to cluster head and from cluster visit base station takes place.

SELECTION OF CLUSTER HEAD

LEACH performs its operations in rounds. Guess that during each and every round, you can find k amounts of clusters. In case sensor nodes start with same energy, aim is always to distribute the ability load equally among all of the sensor nodes within the wireless sensor network. This is performed to ensure that no exceedingly utilized sensor nodes can be found that will expire of power before the other nodes. Initially at the starting of round r+1 that begins at instant t, each and every sensor node s elects itself to become cluster head with probability (t). (t) is selected such that because of this round, the amount of cluster heads expected is k. So, if N amount of nodes in the sensor network occurs,

$$E\,[\#CH] = \sum_{s=1}^{N} P_s(t) * 1 = k \qquad (3)$$

It should be ensured that the sensor nodes become cluster heads the equal quantity of times. In on average N/k rounds, it requires each and every node to become a cluster head exactly once. Possibility of each sensor node of becoming a branch head.

$$,P_s(t) = \begin{cases} \frac{k}{N - k*(r\,mod\frac{N}{k})} : H_s(t) = 1 \\ 0 : H_s(t) = 0 \end{cases} \qquad (4)$$

If =1, then node s has not been a bunch head in the recent r mod (N/k) rounds. Moreover, if, then node s is a huge CH (cluster head).

$(N - k * r)$Could be the expected amount of sensor nodes that have been not cluster heads in the original r rounds. It is expected that all nodes have now been a cluster head after N/k rounds once and they could try this job in coming that group of rounds. The expression indicates the eligible nodes to become a cluster head at time t.

$$E\,[\sum_{s=1}^{N} H_s(t)] = \left(N - k * (r\,mod\frac{N}{k})\right) \qquad (5)$$

After each N/k rounds, at all nodes the vitality are roughly equivalent to at least one another. With the aid of (4) and (5), the amount of cluster heads expected per round is

$$E\,[\#CH] = \sum_{s=1}^{N} P_s(t) * 1 = \left(N - k * (r\,mod\frac{N}{k})\right) * \frac{k}{N - k*(r\,mod\frac{N}{k})} = k \qquad (6)$$

This probability becoming a cluster head requires that sensor nodes begin with same quantity of power and have information to transmit during each round. Just in case it is assumed that sensor, nodes have dissimilar number of power, then those nodes having higher power than others should become cluster heads more amount of times. To make this happen, the probability becoming a cluster head is placed as a function of power degree of an alarm node relative to the aggregate power left behind in the sensor network. So,

$$P_s(t) = min\left\{\frac{E_s(t)}{E_{total}(t)} k, 1\right\} \qquad (7)$$

Where$E_s(t)$ = the current power of node s and

$$E_{total}(t) = \sum_{s=1}^{N} E_s(t) \qquad (8)$$

With assistance from these probabilities, the bigger power nodes will become cluster heads than lower power nodes. The total amount of cluster head nodes expected is

$$E\,[\#CH] = \sum_{s=1}^{N} P_s(t) * 1 = \left(\frac{E_1(t)}{E_{total}} + \cdots \ldots \ldots \ldots + \frac{E_N(t)}{E_{total}}\right) k = k \qquad (9)$$

Once the sensor nodes start with same energy, (4) approximate the equation (7).

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TECHNIQUES TO AGGREGATE DATA

Tree based data aggregation

In this method, an aggregation tree [1] is constructed that is actually a minimum spanning tree and data is aggregated. Here, consider sensor nodes as leaf nodes and the bottom station as the main node. Fig 1delineates the principle utilized by the tree based data aggregation method. The data flow is from the leaf nodes to the main node. Data is aggregated at the main node

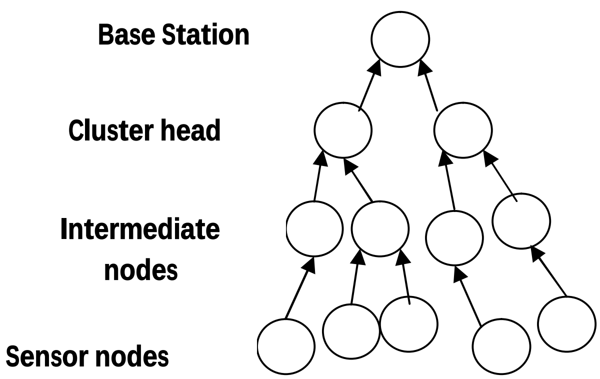

Fig 1. Tree based data aggregation

Multipath data aggregation

In this process, each and every node has the capability to send data [1] to its neighboring nodes. Aggregation of data is performed at the intermediate nodes between sources to sink. In the event of node failures, this process discovers alternative paths to be able to ensure the transmission of data packets within an occasion interval. Fig 2. Shows this approach.

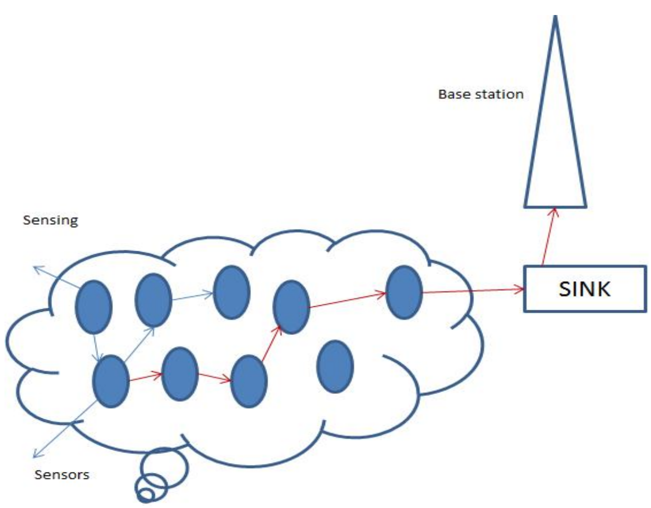

Fig 2. Multipath data aggregation [17]

Cluster based data aggregation

In this process, the network is divided into various clusters. The sensor nodes themselves form a group [1] and these sensor nodes elect a node as a bunch head [1].The sensor nodes transmit the sensed data to the cluster head, where aggregation of data is performed, and then data is delivered to the sink. Fig 3. Explains this method.

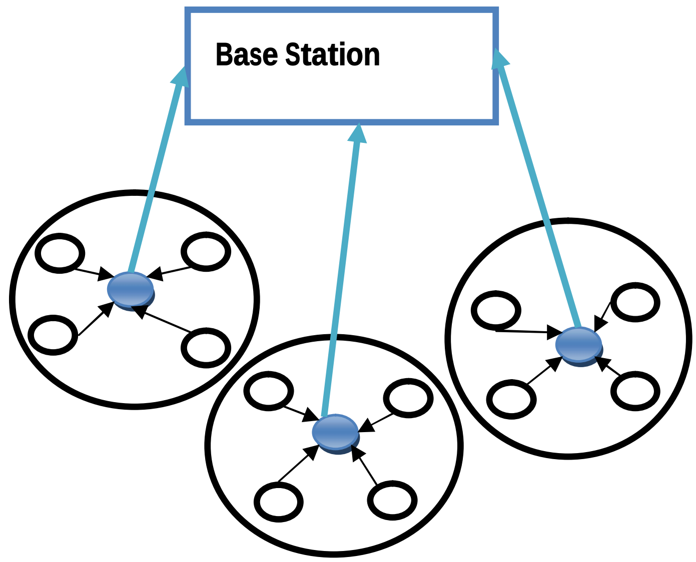

Fig 5. Cluster based data aggregation

Hybrid data aggregation

This approach is a mix of three other methods: tree based, multipath and cluster based data aggregation [1].

V. Centralized data aggregation

All the sensor nodes transmit their data to the best choice or cluster head [1] with the help of shortest path where data is aggregated. Fig5. Demonstrates this method.

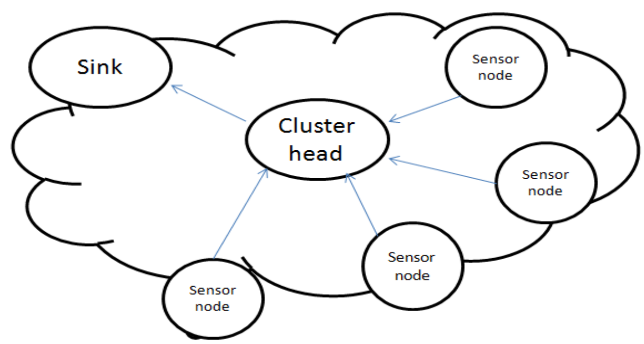

Fig5. Centralized data aggregation [

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In-network data aggregation

Here, various data packets are aggregated because they are transmitted [1] by the sensor network rather than transmitting individual data packets. Fig7. Explains the principle of this approach.

CLUSTER BASED DATA AGGREGATION

Clustering helps in reducing power consumption and collision. Inside our work, we will discuss two kinds of protocols: homogeneous WSN protocols and heterogeneous WSN protocols.

A. Homogeneous wireless sensor network

If the sensor nodes present in the network have the equal level of energy, then the network is called homogeneous sensor network.

(1) Low energy adaptive clustering hierarchy

13] Propose a low-energy adaptive clustering hierarchy (LEACH), for WSN. In LEACH, the corporation of nodes is performed into clusters for the fusion of data. The fused data is transmitted from various sensors in the cluster to the sink by way of a selected node called cluster head after performing aggregation of data. Cluster head is more energetic than all of those other sensor nodes in the cluster. This helps in reducing the amount of data sent to the sink. The fusion of data is performed at the cluster heads at regular intervals. LEACH involves both necessary phases: the set-up phase and the steady phase. In set-up phase, organization of clusters is performed and in steady phase, transmission of data from sensor nodes to cluster head and from cluster check out base station takes place. In LEACH, an optimal percentage of sensor nodes are taken that has to become cluster heads in each and every round. It is assumed that nodes are uniformly distributed in space. LEACH ensures that each and every and every node will prove to become a cluster head exactly once every 1/ rounds, and these rounds are called eph of the clustered network.

It must be ensured that the sensor nodes become cluster heads with probability. On the average, nodes have come out to be cluster heads per round per eph. The sensor nodes that have already become cluster heads in the present round cannot become cluster heads in the exact same eph. G may be the set of sensor nodes that have not become cluster heads within the last rounds of the eph and the likelihood of the sensor nodes belonging to G increases after each round in the exact same eph for maintaining a well-balanced number of cluster heads per round. The decision regarding cluster head is made in the commencement of each round independently selecting a random number between 0 and 1. If this random value is less compared to threshold then the node ends up becoming a cluster head in the present round. The threshold is distributed by:

$$T(s)=\begin{cases}\frac{1}{1-p_o*(r \bmod \frac{1}{p_o})} : if\ s \in G \\ 0 : otherwise\end{cases} \quad (3)$$

Where r is the round number. The election probability of sensor nodes belonging to G to become cluster heads increments in each round in the same eph and becomes similar to 1 in the last round of the eph. It should be noted that a time interval is defined where all the cluster members have to send their data to the cluster head once.

(2) LEACH-Centralized (LEACH-C)

No guarantee emerges by LEACH in regards to the placement and amount of cluster heads. Due to clusters adaptive nature, in confirmed round obtaining an undesirable set-up of clustering will not greatly hamper the entire performance. Although, in order to form clusters utilizing a central control algorithms may create good clusters by dispersing the cluster heads throughout the entire network. It's the basis for LEACH- Centralized (LEACH-C). LEACH-C [13] is really a protocol utilizing a centralized clustering algorithm and the steady-state protocol is same as that of LEACH.

phase with this protocol is equivalent to that of LEACH.

(3) Hybrid energy-efficient distributed clustering approach

[16] propose a cross, energy-efficient distributed clustering approach (HEED), for WSNs. The key objective of this process is the formation of efficient clusters to maximize the network lifetime. Due to this reason, the choice of cluster head is completed based on the remainder power of every and every node. Intracluster communication cost can be viewed as a secondary parameter for increasing power efficiency and lifetime of network.

Three main characteristics of HEED are:

- The likelihood of two nodes turning out to be cluster heads within one another transmission range is

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less, which means that cluster heads are well distributed in the whole network.

- Power utilization is not assumed uniform for all the sensor nodes.
- To be able to ensure inter cluster head connectivity, the likelihood of selecting cluster head could be adjusted for the transmission array of certain sensor.

In HEED, each sensor nodes lies within one cluster and can directly communicate {with its using its having its} cluster head.

The algorithm has three phases:

1. Initial phase: An original percentage of cluster heads among most of the sensor nodes is placed first. For limiting, the first cluster head announcement to the other sensor nodes, this value, is used. Each and every sensor node sets its likelihood of turning out to become a cluster head,, as follows:

$$CH_p = C_p * \frac{E_{res}}{E_{max}} , \quad (4)$$

Where E_{res} = present power in the node,

E_{max} = maximum power corresponding to a fully charged battery.

CH_p is not allowed to fall below threshold value that is chosen to be inversely proportional to E_{max}.

2. Repetition phase: Every sensor node goes through various iterations until it finds the cluster head, which it could send to with the smallest amount of transmission power. If no hearing is performed, the sensor node elects itself to become a cluster head and transmits an announcement message to its neighbors. Value is doubled by each sensor and node visits next iteration. It ceases executing the phase when hence, you will find two forms of status that a node could announce:

(i) Tentative status: the nodes ends up to be always a tentative cluster head if its $CH_p < 1$.

(ii) Final status: the nodes permanently ends up to be always a cluster head if $CH_p = 1$.

3. Final phase: One last decision is produced by each sensor on its status. It either selects the least power cluster head or makes itself cluster head.

(4) Stable Cluster Head Election (SCHE) Protocol

It is based on LEACH design that utilizes clustering [18] procedure. Its objective would be to decrease the power utilization of each and every sensor node and thus reducing the general power dissipation of the entire network. It is really a source driven protocol based on well-timed reporting. Hence, the sensor node will constantly have some information to pass to the base station. In addition, it makes utilization of data aggregation in order to avoid information overload.

It provides n analytical framework to achieve the stable probability for a node to be always a cluster-head to cut back power consumption. It is important to apply appropriate cluster head election solution to diminish power consumption of each and every sensor node that finally results in minimized power dissipation. This protocol was proposed where this method was applied by getting the optimum value of possibility for a sensor node to come out to be always a cluster head and consumes appreciably a lot less of power when compared to LEACH. Additionally it minimizes utilization by reducing distance between head of cluster and sink.

(5) Distributed Weight-Based Energy-Efficient Hierarchical Clustering (DWEHC)

For achieving more aggressive goals as compared to HEED, Distributed Weight-Based Energy-Efficient Hierarchical Clustering (DWEHC) is proposed by [17]. Balanced cluster sizes are generated and the intra-cluster topology is optimized. This process proceeds in a distributed way and has time complexity of after locating the neighboring nodes in its area, each sensor node computes its weight. The sensor node having the biggest weight would be elected as cluster head and all other nodes become members. Here, the nodes are called first level cluster members as they have direct connection with the cluster head. Using the least power for reaching a group head, a warning node progressively adjusts. Given that each node knows the exact distance to its neighbors, it can consider whether it is better to call home as a first-level member or come out to be a second-level one, reaching the cluster head over a two-hop path. By doing so, the sensor node may switch to a group head besides its original one. The method proceeds until nodes settles on the absolute most power efficient intra-cluster topology. To bound how many levels, each and every cluster is assigned a set within which cluster member nodes should set.

(6) Multi-Hop LEACH

When the diameter of network is enlarged beyond definite level, distance between cluster head and sink is enlarged extremely. [20] Propose multi-Hop LEACH. It is another extension of LEACH to be able to raise power efficiency of the wireless sensor network. It is also a distributed clustering based routing protocol. Same as LEACH, in Multi-Hop LEACH some sensor nodes elect themselves as cluster heads and remaining nodes associate themselves with elected cluster-head to be able to complete formation of cluster in set up phase.

4. ABC (Artificial bee colony):

In the ABC model, the colony includes three groups of bees: employed bees, onlookers and scouts. It is assumed that there is just one artificial employed bee for each food source. Quite simply, how many employed bees in the colony is add up to how many food sources across the hive. Employed bees go with their food source and get back to hive and dance with this area. The employed bee whose food source has been abandoned becomes a scout and starts to find finding a new food source. Onlookers watch the dances of employed bees and choose food sources according to dances. In ABC, a population based algorithm, the position of a food source represents a possible means to fix the optimization problem and the nectar quantity of a food source corresponds to the product quality (fitness) of the associated solution. The amount of the employed bees is added up to how many solutions in the population. At the first step, a randomly distributed initial population (food source positions) is generated. After initialization, the populace is put through repeat the cycles of the search processes of the employed, onlooker, and scout bees, respectively. An employed bee produces a modification on the origin position in her memory and discovers a fresh food source position. So long as the nectar quantity of the brand new one is higher than that of the last source, the bee memorizes the brand new source position and forgets the old one. Otherwise, she keeps the position of usually the one in her memory. After all employed bees complete the search process; they share the position information of the sources with the onlookers on the dance area. Each onlooker evaluates the nectar information obtained from all employed bees and then chooses a food source about the nectar levels of sources. As in case of the employed bee, she produces a modification on the origin position in her memory and checks its nectar amount. Providing that its nectar is higher than that of the last one, the bee memorizes the brand new position and forgets the old one. The sources abandoned are determined and new sources are randomly produced to be replaced with the abandoned ones by artificial scouts.

LITERATURE REVIEW

Nayebi, Abbas et al. (2011) [1] provides an analytic model to investigate the effect of mobility on a well-known cluster-based protocol, LEACH. The model evaluates data loss after construction of the clusters due to node mobility, which can be used to estimate a proper update interval to balance the energy and data loss ratio. Thus, the results can help the network designer to adjust the topology update interval given a value of acceptable data loss threshold. A practical approach to increase the mobility tolerance of the protocol is applying a buffer zone to the transmission ranges of the nodes. The model is extended in order to consider the effect of buffer zone. To validate the analytic evaluations, extensive simulations are conducted and correctness of the evaluations is tightly verified .Comeau, Frank et al. (2011) [2] analyses the effect of varying the parameter values used in the LEACH protocol. In particular, we study the effect of the bit rate and operational frequency on the free space factor, and the effect of the antenna heights on the multipath factor. Simulation results are presented. We show that the parameters normally used apply to a specific network only.

Network lifetime results obtained using one set of parameters are not easily generalized Bara'a, A. Attea et al. (2012) [3] is to alleviate the undesirable behaviour of the EA when dealing with clustered routing problem in WSN by formulating a new fitness function that incorporates two clustering aspects, viz. cohesion and separation error. Simulation over 20 random heterogeneous WSNs shows that our evolutionary based clustered routing protocol (ERP) always prolongs the network lifetime, preserves more energy as compared to the results obtained using the current heuristics such as LEACH, SEP, and HCR protocols. Additionally, we found that ERP outperforms LEACH and HCR in prolonging the stability period, comparable to SEP performance for heterogeneous networks with 10% extra heterogeneity but requires further heterogeneous-aware modification in the presence of 20% of node heterogeneity. Geetha et al. (2013) [4] regard, many routing protocols have been proposed to optimize the efficiency of WSNs amidst of above mentioned severe resource constraints. Out of these, clustering algorithms have gained more importance, in increasing the lifetime of the WSN, because of their approach in cluster head selection and data aggregation. LEACH (distributed) is the first clustering routing protocol, which is proven to be better compared to other such algorithms. This paper elaborately compares two important clustering protocols, namely LEACH and LEACH-C (centralized), using NS2 tool for several chosen scenarios, and analysis of simulation results against chosen performance metrics with latency and network lifetime being major among them. The paper will be concluded by mentioning the observations made from analyses of results about these protocols. Lai, Wei Kuang et al. (2012) [5] presents a cluster-based routing protocol called "arranging cluster sizes and transmission ranges for wireless sensor networks (ACT)." The aim is to reduce the size of clusters near the base station (BS), as CHs closer to the BS need to relay more data. The proposed method allows every CH to consume approximately the same amount of energy so that the CHs near the BS do not exhaust their power so quickly. Furthermore, we separate the network topology into multiple hierarchical levels to prolong network lifetime. Simulation results show that our clustering mechanism effectively improves the network lifetime over LEACH (Low Energy Adaptive Clustering Hierarchy), BCDCP (Base Station Controlled Dynamic Clustering Protocol) and MR-LEACH (multi-hop routing with low energy adaptive clustering hierarchy). Liu, Zhixin, et al. (2012) [6] analyzing communication energy consumption of the clusters and the impact of node failures on coverage with different densities, we propose a DEECIC (Distributed Energy-Efficient Clustering with Improved Coverage) algorithm. DEECIC aims at clustering with the least number of cluster heads to cover the whole network and assigning a unique ID to each node based on local information. In addition, DEECIC periodically updates cluster heads according to the joint information of nodes' residual energy and distribution. The algorithm requires neither time synchronization nor knowledge of a node's geographic location. Simulation results show that the proposed algorithm can prolong the network lifetime and improve network coverage effectively. Yu, Jiguo, et al.[7] (2012) [8] a cluster-based routing protocol for wireless sensor networks with non-uniform node distribution is proposed, which includes an energy-aware clustering algorithm EADC and a cluster-based routing algorithm.

EADC uses competition range to construct clusters of even sizes. At the same time, the routing algorithm increases forwarding tasks of the nodes in scarcely covered areas by forcing cluster heads to choose nodes with higher energy and fewer member nodes as their next hops, and finally, achieves load balance among cluster heads. Theoretical analysis and simulation results show that our protocol can balance the energy consumption among nodes and increase the network lifetime significantly. Manzoor, Basit, et al. (2013) [9] Wireless Sensor Networks (WSNs) with their dynamic applications gained a tremendous attention of researchers. Constant monitoring of critical situations attracted researchers to utilize WSNs at vast platforms. The focus in WSNs is to enhance network lifetime as much as one could, for efficient and optimal utilization of resources.

Different approaches based upon clustering are proposed for optimum functionality. Network lifetime is always related with energy of sensor nodes deployed at remote areas for constant and fault tolerant monitoring. In this work, we propose Quadrature-LEACH (Q-LEACH) for homogenous networks, which enhances stability period, network lifetime and throughput quiet significantly. Chen, Tzung-Shi, et al. (2013) [10] presents a novel converge cast algorithm called, Virtual Circle Combined Straight Routing (VCCSR), which collects data in a wireless sensor network (WSN) using a mobile sink. Tree-based routing offers the shortest routes to deliver data, and it is a common scheme used by mobile sinks to collect data from sensors With VCCSR, the spanning tree does not need to be reconstructed when the mobile sink's location changes because the algorithm is able to update the location of the mobile sink, which then delivers this information to the cluster heads and adjusts the routing. Tyagi, Sudhanshu, et al. (2013)[11] research, proposals on WSNs have been developed keeping in view of minimization of energy during the process of extracting the essential data from the environment where SNs are deployed. The primary reason for this is the fact that the SNs are operated on battery which discharges quickly after each operation. the taxonomy of various clustering and routing Mahajan, Shilpa et al. (2014) [12] Metrics approach (CCWM) has been discussed that takes service parameters for enhancing performance of the overall network. In a clustering based approach, one of the main concerns is selection of appropriate cluster heads in the network and the formation of balanced clusters. The results of the proposed approach are compared through simulation with LEACH, WCA and IWCA. The proposed approach shows an improvement on an average over rounds by 51% over LEACH, 27% from WCA and 18.8% from IWCA in terms of lifetime and energy consumption. 2014 Production and hosting by Elsevier B.V. on behalf of Faculty of Computers and Information, Cairo University. Liu et al. (2010) [13] in this paper present a state-of-the-art and comprehensive survey on clustering approaches. We first begin with the objectives of clustering, clustering characteristics, and then

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present a classification on the clustering algorithms in WSNs. Then, we survey the proposed approaches in the past few years in a classified manner and compare them based on different metrics such as mobility, cluster count, cluster size, and algorithm complexity. Khediri, Salim EL, et al. (2014)[14] proposed to minimize the traffic into network. Clustering algorithms have been widely used to reduce energy consumption. C. Kuila, Pratyay et al. (2014) [15] presents Linear/Nonlinear Programming (LP/NLP) formulations of these problems followed by two proposed algorithms for the same based on particle swarm optimization (PSO). The routing algorithm is developed with an efficient particle encoding scheme and multi-objective fitness function.

PROPOSED METHODOLOGY

Figure 1 represents the flowchart of the proposed methodology.

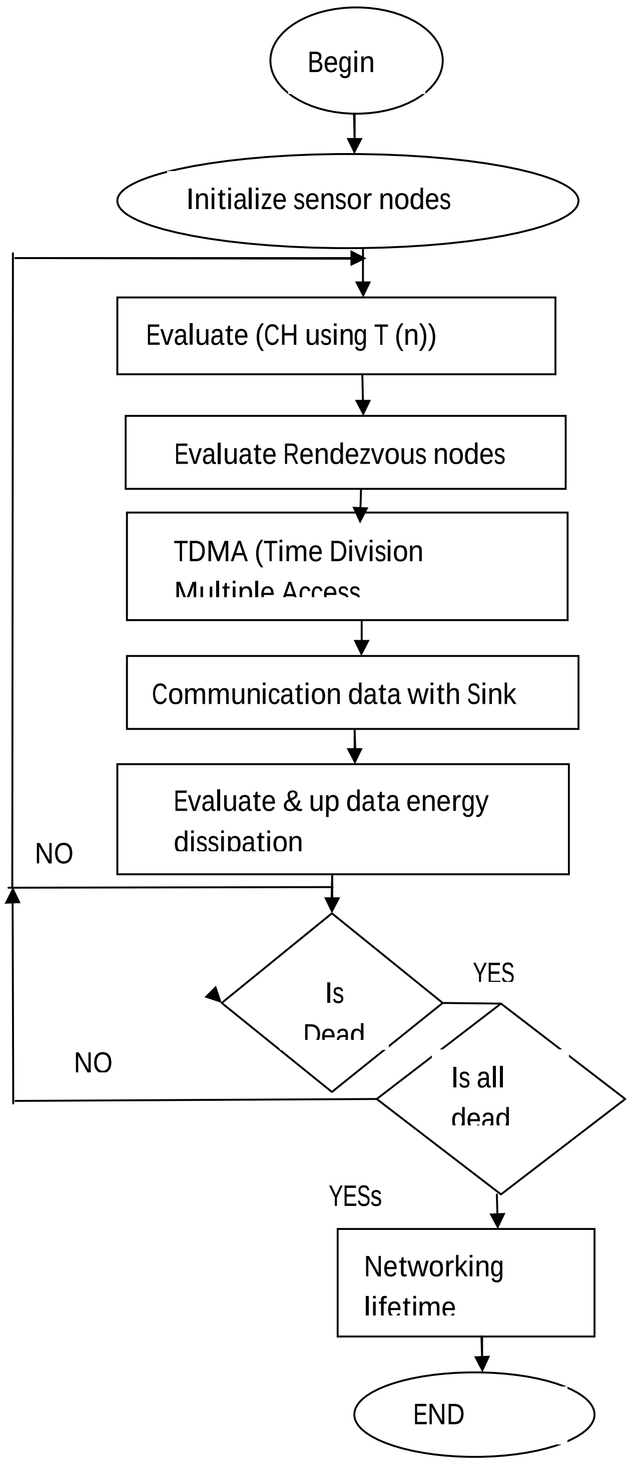

Fig 1: Flowchart of the proposed methodology

6. RESULTS AND DISCUSSIONS

FIRST NODE DEAD: - Table 1 shows the first node dead evaluation of the LEACH, rendezvous nodes and the proposed protocols. In the table, it is clearly shown that the proposed performs better as compared to the existing technique.

TABLE 1: FIRST NODE DEAD EVALUATION

NODE VALUE	LEACH	RZ	PROPOSED
100	133	218	242
120	137	219	235
140	143	228	244
160	150	220	223
180	144	221	230
200	147	209	240
220	132	221	244
240	137	224	252
260	125	208	231
280	142	221	232

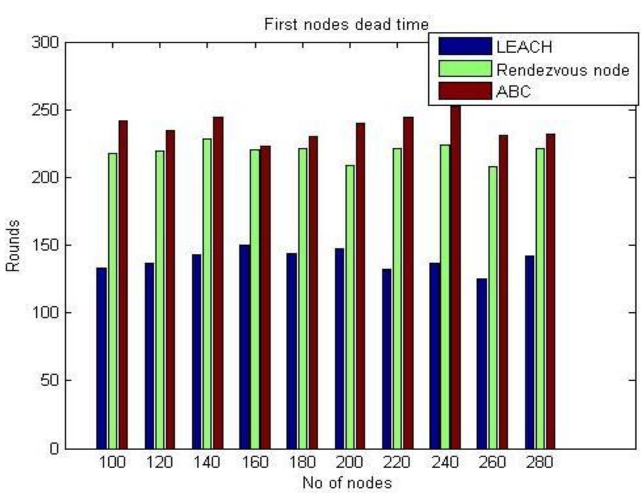

Fig 2 : FIRST NODE DEAD ANALYSIS

Fig. 2 is showing the comparison of LEACH, rendezvous nodes and the proposed technique with respect to total number of rounds in case of first dead node when the number of nodes are changed. X-axis is representing number of nodes. Y-axis is representing the number of rounds. It has been clearly shown that proposed outperforms over the existing technique.

2. TENTH NODE DEAD: - Table 2 shows the tenth node dead evaluation of LEACH, rendezvous nodes and the proposed protocols. In the table, it is clearly shown that the proposed performs better as compared to the existing technique.

TABLE 2: HALF NODE DEAD EVALUATION

NODE VALUE	LEACH	RZ	PROPOSED
100	164	288	311
120	162	299	337
140	160	281	321
160	166	288	340
180	163	303	363
200	166	297	328
220	162	301	319
240	164	301	327
260	162	285	323
280	163	320	333

Fig. 3 is showing the comparison of LEACH, rendezvous nodes and the proposed technique with respect to total number of rounds in case of tenth dead node when the number of nodes are changed. X-axis is representing number of nodes. Y-axis is representing the number of rounds. It has been clearly shown that proposed outperforms over the existing technique.

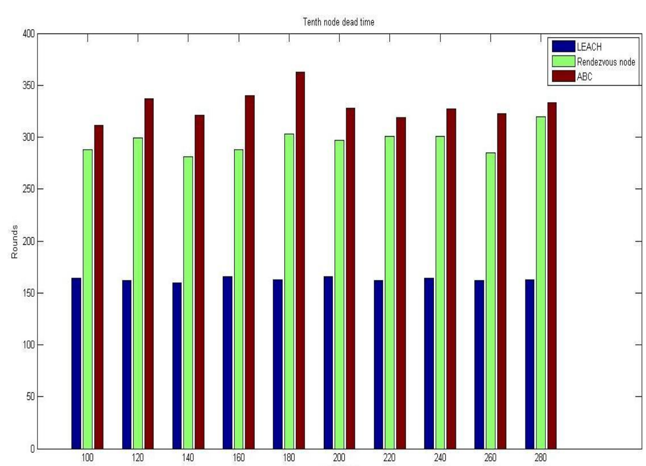

Fig 3: HALF NODE DEAD ANALYSIS

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3. ALL NODES DEAD: - Table 3 shows the all node dead evaluation of the LEACH, rendezvous nodes and the proposed protocols. In the table, it is clearly shown that the proposed performs better as compared to the existing technique.

TABLE 3: ALL NODE DEAD EVALUATION

NODE VALUE	LEACH	RZ	PROPOSED
100	333	721	729
120	353	724	729
140	325	726	730
160	322	726	733
180	356	727	730
200	325	729	730
220	327	730	732
240	323	727	732
260	339	730	731
280	379	732	734

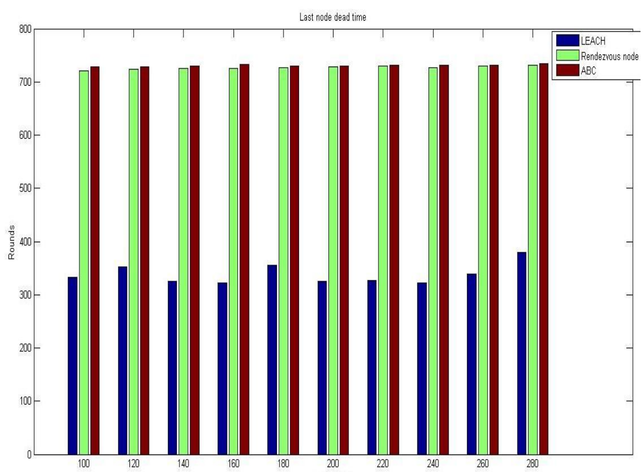

Fig 4: ALL NODE DEAD ANALYSIS

Fig. 4 is showing the comparison of LEACH, rendezvous nodes and the proposed technique with respect to total number of rounds in case of all dead node when the number of nodes are changed. X-axis is representing number of nodes. Y-axis is representing the number of rounds. It has been clearly shown that proposed outperforms over the existing technique.

CONCLUSION AND FUTURE SCOPE

This paper has focused on evaluating the performance of rendezvous nodes based LEACH protocol. Nevertheless the rendezvous nodes based LEACH outperforms over the LEACH with regards to the stability period, but has inadequate network lifetime i.e. the final node become dead too early than LEACH. To overcome a constraint an improvement will undoubtedly be done in the rendezvous nodes based LEACH by using the artificial bee colony based routing algorithm. The general goal is to get the effectiveness of the rendezvous nodes based LEACH when artificial bee colony based inter cluster data aggregation is applied on it. The proposed technique is designed and implemented in the MATLAB tool along with the help of data analysis toolbox support. The comparison has clearly shown the effectiveness of the proposed technique. This work has not considered the effect of the failures on the WSNs. So in near future we will evaluate various kind of failures and also the way to handle them in more efficient manner.

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