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Evaluating the Clustering Protocols for Mobile Sink Based Wireless Sensor Networks

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Abstract: Wireless sensor networks (WSNs) are becoming popular in real life applications. Because of the top features of the resource-constrained and battery-aware sensors, in WSNs energy utilization has found to be always a major interesting subject of research. WSNs compose battery-powered nodes, which are linked to the beds base station to for many actions or task. As sensor nodes are battery-powered i.e. can be dead after the consumption of the battery that is also called duration of WSNs. So utilizing the energy in well-organized way, may end in prolonging the duration of the WSNs. Sensor nodes possess a negative characteristic of limited energy, which pulls back the network from exploiting its peak capabilities. Hence, it is essential to gather and transfer the data in a optimized way which reduces the vitality dissipation. In this paper, a survey on various mobile sink based clustering protocols is presented. From the survey, it has been concluded that none of the technique performs effectively in all fields.

Keywords: WSN, Clustering, LEACH , LEACH Clustering , Rendezvous, Artificial bee colony

1. INTRODUCTION

Wireless Sensor network [1] composed of many small-distributed sensor nodes offering the reliable monitoring in various environments such as for instance military and civil application. In WSN every sensor node contains specific hardware receiving hardware, memory, processing unit, required. With the aid of networking tiny sensor nodes, it becomes easy to get the information about physical phenomena which was quite difficult with conventional methods. These node process data and send it base station called as sink. For communication of data between nodes and sink many routing technologies are used initially, such as direct communication and multihop data transmission. But due to limited battery life of nodes this techniques were not so effective because early death of some node in both techniques were fail to achieve in the network suitability periods.

2. ENERGY CONSERVATION AS A CRITICAL ISSUE

Energy is quite critical issue in WSN, due to limited energy in sensor nodes, so to conserve energy clustering technique was introduced; in which out of a large number of nodes few nodes become cluster head and they manage the whole network. Cluster head is a node which can be accountable for maintain cluster, collect data from nodes in the cluster and communicating with sink. By utilizing clustering methodology it has been observed that there is massive amount energy that has been saved. In static clustering method some rules were followed to elect a bunch head, once a bunch is formed and cluster head is elected, the cluster was statically operated until the head node dead. Because cluster head node do have more responsibility so rapid decline in energy in the Cluster head node. The death time was head node was too early in static clustering technique. So there is a need required the Wenzimen proposed a protocol centered on adaptive clustering technique he named it LEACH.

LEACH means *Low Energy Adaptive Clustering Hierarchy*. This technique has proposed dynamically method to form cluster and selection of cluster head node. In this process a probability P is taken that was the percentage of node to be elected as cluster head. For communication of data there exist numerous rounds. Atlanta divorce attorneys round there exist two phases 1) Setup Phase 2) steady Phase.

In the setup phase the cluster head election and cluster formation two main activities were taken place. In Cluster head Election process every node is randomly assigned with a wallet value between 0, 1, for each round a network threshold T (n) was calculated with the formula T (n) = P/ 1-P(r mod 1/P) in this T (n) may be the threshold of network, P may be the probability percentage of cluster head and r is the existing round number. Node having pocket value.

In this way every round of LEACH works. There is a repair time of each round, once a node become cluster head it cannot be elected as cluster Head for next 1/P rounds. So this way all nodes having equal possibility to be elected as cluster head. Now all nodes randomly and almost chosen as cluster head and upsurge in network sustainability period. LEACH have proposed the quite effective model to truly save energy, it was further enhanced by taking various parameters. The focus is primarily enhanced the network lifetime that is vital because of limited battery in sensor nodes.

Therefore, to improve the network entire life, Network stability period and minimize the vitality consumption, large amount of research work has been carried out. To reach these objectives reduction in energy consumption is vital issue; so different strategies have already been put on address energy consumption factor. More concentration has been done on choice of cluster head election, so different researchers have proposed various ways to elect cluster head. In certain strategies, distance from the bottom station has been taken into consideration, somewhere residual energy has been considered as main factor. Therefore, these parameters have already been along with leach protocol to achieve better results.

To achieve network stability notion of heterogeneity has been proposed and sometime extra spare node addition methodology has been proposed. As we have seen in LEACH after the first node dies the network stability certainly decreased, so spare nodes recover this problem. Therefore, work has been done to improve network stability. So main focused was the by implementing different parameters illumination of those node to be cluster head, their energy reduced rapidly extremely fast, so premature death of some node in network, this thing affect the network stability. Like randomize collection of a cluster of a node as cluster head, which suited at edge of network i.e. very far from base station. So energy consumption of these nodes very rapidly and due to this network stability time reduced. So to overcome these kind of problems cluster head selection has been made very wisely, many improved techniques has been proposed to elect an improved cluster head by considering different parameters. So in last decade many new improved techniques have now been proposed, they have increased the network stability and lifetime.

3. LITERATURE REVIEW

S. Mottaghia and M. Zahabi [1] proposed an algorithm that combines the use of the LEACH clustering algorithm, MS and rendezvous points (RP). 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. The low energy adaptive clustering hierarchy algorithm is an efficient clustering algorithm where nodes within a cluster send their data to a local cluster head. Some researchers recommend a mobile sink (MS) as a way to reduce energy consumption and a rendezvous node (RN) to act as a store point for the MS. Simulation results show that this method is more efficient than LEACH in terms of energy consumption, particularly in large regions. Ahlawat, A. and Malik, V. [2] present a new version of leach protocol called Improved VLEACH, which aims to increase network lifetime. In this paper, we first completely analyzed the typical clustering Routing Protocol-LEACH and its deficiencies and proposed improved v-leach. The work to be done in improved v-leach protocol on selection of vice cluster head. The Vice Cluster head is that alternate head that will work only when the cluster head will die. The process of vice cluster head selection on the basis of three factors i.e. Minimum distance, maximum residual energy, and minimum energy. The proposed approach will improve the network life as never the cluster head will die. As a cluster head will die it will be replaced by it's vice Cluster head. After a number of simulations, it was found that the new version of improved v-LEACH outperforms the original version of leach protocol by increasing the network life time 49.37%. Elbhiri et al. (2013) [3] have explained the spectral clustering methods. Spectral Classification for Robust Clustering in Wireless Sensor Networks (SCRC-WSN) named algorithm has been proposed. Spectral partitioning method has used the graph theory techniques for separate the network in a fixed optimal amount of clusters. Optimal amount of clusters and changing dynamically the cluster head election probability has been very efficient to improve the performance. A centralized approach has been used calculate the nodes residual energy. Effectuation of node density on the robustness of the algorithm has been studied that has resulted less energy consumption and increase in lifetime. Beiranavand et al. (2013) [4] have proposed a enhancement in LEACH named I-LEACH, An Improvement has been done by considering basically three factors; Residual Energy in nodes, Distance from base station and quantity of neighboring nodes. A node has been considered as head node if it has optimum value for discussed three factors i.e. have significantly more residual energy as compare to average energy of network, more neighbors than average neighbors for a node calculated in network and node having less distance from base station as comparison to node's average distance from BS in network. Decrease in energy consumption and prolongation in network life time has been observed. Lu et al. (2013) [5] have already been concentrated mainly on the nodes those are far from base station and have already been elected as cluster head, these node's energy has been fallen very rapidly, so overcome it a fresh model has been proposed by which three factors have already been discussed i.e. energy of each node at particular instance of time, quantity of time a node has been selected as cluster head and distance

involving the node and base station. By considering these parameters threshold have already been changed to improve the network life time. NEWLEACH name protocol has been proposed which has introduced a fresh concept named optimum factor by considering the rest of the energy of nodes, times of a node to be chosen as a bunch head node and the distances between nodes and base station. Enhancement in Network lifetime and even distribution of dead nodes has been showed that approach contained balanced energy model. Yektaparast et al. (2012) [6] have proposed a technique where they've divided the clusters into equal parts, called as cell. Every cluster divided into 7 cells. Each cell has contained a cell head which can be accountable for direct communication with Custer Head. Cell head has aggregated the native member's information because cell and Speak with Cluster Head, and prevent sensors unnecessary redundant information to Cluster Head. An improvement even offers been done in computation of the threshold value for a cluster-head selection Formula. Node residual energy has been Considerate during cluster-head cell-head selection process that's accountable for maintaining the balanced energy consumption of the sensor network. Approach has been significantly improved the network lifetime and optimized the power consumption. Chen and Wang (2012) [7] have explained a better model in WSN which has been predicated on heterogeneous energy of nodes for same initial energy and multiple hop data transmission among cluster heads is proposed. New threshold has been introduced on the basis of current energy and average energy of the node to cluster head election probability and provide reliability that higher residual energy have greater probability to become cluster heads than that with the lower residual energy. Problem of quantity of cluster heads reduces with the increase of the number of rounds. Confirmation has been supplied with the approach that nodes with higher residual energy have greater probability to become cluster heads than that with the lower residual energy. Extension in the network lifetime and guarantees a well distributed energy consumption model been demonstrated. Peng et al. (2011) [8] have proposed a brand new technique by which adaptive clustering hierarchy algorithm has been proposed to meet up QOS (Quality of Services) requirements. Modification has been done in basic LEACH and a greater protocol has elaborated by which improvement has been occurred in the vitality efficiency and other QOS parameters by excluding the node with improper geographic location to function as the cluster heads. The optimum measuring range of head nodes has been designed to become a criterion of cluster head selection, and every cluster heads has been elected in line with the node density threshold, which can be defined by the node distribution situation process and communication among nodes. An Improvement has been shown in the network lifetime and the communication quality by selecting the Cluster head in the area of proper node density. Achieve accomplishment if you find uneven distribution of nodes. Babaie et al. (2010)[9] have proposed a novel method to pick a group Head. LEACH protocol has set threshold value to 0 for next 1/p rounds when a node has been selected as a group head. This technique optimized LEACH method, by adjusting threshold considering some factors. Proposed algorithm has settled the threshold of every node correspondingly to how many live and dead nodes in each round, so the probability for more nodes has been established to become cluster head. Energy factor has taken into consideration in this technique, During Cluster Head selection phase and no-cluster-head selecting node as its cluster head, while data transmitting procedure is the same as LEACH. This algorithm considered how many live and dead nodes in each round to calculation the threshold value. Probability of choose the cluster-head has been increasing after rounds. Consideration of amount of live and dead nodes in each round has been to calculate the Threshold. It figured the proposed method can reduce the low energy level sensor nodes to be selected as cluster heads, and create the energy Balance of network load. Moreover, Results have already been achieved better network lifetime in WSN. Therefore, the technique to change the threshold may be a successful way to resolve the problem of network energy consumption as this technique explained. Melese and Gao (2010) [10] have explained the vitality use of sensor nodes in Wireless sensor network. Main effort has been done for balancing the vitality consumption across the network so that survival time of most nodes can increase. Optimization of the energy consumption has been focused by taking consumed energy as an important factor for criteria cluster head selection. Energy consumption factor have contributed more effectively in increase network entire life of WSN as opposed to residual energy. By considering energy consumption, new formula has been proposed to calculate threshold value. To be able to optimize energy consumption and increase network entire life, it is required to balance energy among nodes has been summarized. Extension in the LEACH formula has been done on the cornerstone of an element that includes the consumed energy of every nodes of WSN, An increase in network entire life has been observed. Major impact has been noticed in the cases when long distances occurred between the base station and the nodes. Remarkable improvement has been concluded for cluster head selection. Bakr and Lilien (2010) [11] have made focus mainly on extending the WSN lifetime. Lifetime has been extended by making WSNs redundant by the addition of spare nodes. The passive (switched off) spares has been made wanted to become active (be switched on) whenever any active WSN node energy exhausted. A brand new proposed LEACH-SM (LEACH Spare Management) has modified the prominent LEACH protocol by enhancing it insurance firms an efficient management of spares. Addition of the spare selection phase has been done in LEACH; this functionality has been named as spare management features in LEACH-SM. During Spare Selection phase, each node has been decided in parallel whether it could be become an active primary node, or a passive spare node. The nodes decided spares go asleep, whilst the WSN as the whole has been

maintained the mandatory above-threshold target coverage. (The spares have awakened once the probability that any primary node exhausted its energy reaches a predefined value.) Identification of spares alone has been increased energy efficiency for WSNs as proved, Decentralized Energy-efficient Spare Selection Technique has been within spare selection phase by spare manger. Decline in the duration of the active interval for cluster heads has been observed, considered as a part effect. Reduction energy consumption by cluster heads has been observed mainly. Katiyar et al. (2010) [12] have discussed about the unnecessary energy consumption due to the formation tiny and big cluster at same. To overcome this problem a new protocol has been proposed named FZ-LEACH (Far Zone LEACH). Formations of Far Zones have already been done to overcome the situation of uneven cluster formation. Far-Zone has been explained as a small grouping of sensor nodes which are positioned at locations where their energies are less when compared to a threshold. A noticeable difference in the performance has been observed when it comes to Energy dissipation rate and network lifetime. Tao et al. (2010) [13] have represented a hierarchy based protocol in Wireless Sensor Network. A new energy-efficient protocol has been discussed by employing the cluster member energy threshold factor to restrict the synthesis of very big and the little clusters at the same time. Conceptualization of energy rating mechanism has been done in order to avoid uneven energy distribution; calculated energy even offers been also taken into consideration to minimize the power consumption of cluster members. An enhancement has been done by taking the consideration of three factors: Unbalanced Clusters, Uneven Energy Distribution and Unnecessary Energy Consumption when Cluster Head is dead. Hierarchical or multi-hop routing approach has been used to get data from the cluster head nodes to the BS. Cluster heads have programmed this kind of way which they form a multi-hop backbone for transmitting data among cluster heads until they reach the BS. An Algorithm has been concluded a notably advances the network lifetime. Liu et al. (2010) [14] this paper have explained at new methodology where reduced total of energy load among all the nodes has been presented a better algorithm LEACH-D predicated on LEACH. The combined ideas of adjusting the threshold function concerning the nodes, a fixed radius of the clustering and a multi-hop communication mechanism on the list of cluster heads to fairly share system lifetime energy load among all the nodes has been discussed. A noticeable difference has been done mainly on following aspects, Connectivity density in the worthiness of threshold which has taken the density of distribution of node into account, so that it increases the possibility of a node which have a high connectivity density to be always a head node. Second, in the clustering stage, the cluster head node decides its cluster radius according for their distance from the bottom station and their education of connectivity. With this process head node's energy, consumption have reduced. Non-Cluster Head nodes have to select to become listed on a bunch according to the energy of head node and the exact distance to the cluster head node; in the communication phase, cluster head node runs on the multi-hop steady-state transmitting data to the bottom station. Lowering of the entire network energy consumption has been observed, and found suited to the small wireless sensor network effectively. Sun et al. (2009)[15] has proposed a technique in which some implementation did to basic LEACH, named as ILEACH.ILEACH has on the basis of the characteristic of limited energy of wireless sensor networks to prolong the lifetime of the Whole networks. Consideration of Nodes for cluster head selection has been done on the cornerstone of residual energy. The constraint threshold of distance has used to optimize cluster scheme. Construction of the routing tree has been proposed on the cornerstone of Cluster heads' weight. A tree based routing has been done in which a cluster head is elected as root node and the criteria for selecting root node is usually to be nearer to the base station and owing enough energy. An improved performance in both network whole life and cluster head election has been drawing out as a conclusion. Heinzelman et al. (2000) [16] has proposed the initial Leach protocol ever. Wireless distributed micro sensor systems that provide the consistent observing the areas for military and civil applications have already been explained. It has additionally explained that the communication protocols, which have done the effective improvement on the general energy dissipation of WSN. Direct transmission, multihop routing, and static clustering have already been considerate far better in sensor networks, So LEACH (Low-Energy Adaptive Clustering Hierarchy), a clustering-based protocol has been proposed that have developed non randomized scheme for cluster-heads. Localized coordination has exploited scalability and robustness in the networks, and data fusion has reduced the total amount of data to the beds base station. A high quantity of Energy reduction has been achieved as weighed against conventional routing protocols.

4. COMPARISON TABLE

Table 1 represents the comparison table of various techniques.

Table 1: Comparison Table

REF NO.	*AUTHORS*	*YEARS*	*TECHNIQUES*	*FEATURES*	*LIMITATIONS*
[1]	Mottaghi, Saeid, and Mohammad Reza Zahabi	2015	clustering or routing algorithms	increase the lifetime of the sensor nodes in a network.	The artificial bee colony to improve rendezvous nodes based LEACH has been

					ignored.
[2]	Ahlawat, A. and Malik, V.	2013	Improved VLEACH	improve the network life as never the cluster head will die. As a cluster head will die it will be replaced by it's *vice Cluster*	Though the rendezvous nodes based LEACH outperforms over the LEACH in terms of the stability period, but has inadequate network lifetime i.e. the final node become dead too early than LEACH
[3]	Elbhiri, B., Fkihi, S. E., Saadane, A., Lasaad N., Jorio, A., Driss, Aboutajdine, E.R. and Morocco	2013	Spectral Classification for Robust Clustering in Wireless sensor Networks	*I*ncreases the lifetime of a whole network and presents more energy efficiency distribution compared to the Low-Energy Adaptive Clustering Hierarchy (LEACH)	The use of inter cluster data aggregation has additionally ignored.
[4]	Beiranvand, Z., Patooghy, A. and Fazeli M.	2013	routing algorithm	routing algorithm has been improved the WSN performance at least 65%, reduces the energy consumption of the WSN up to 62%, and improves the successfully delivered packet ratio by at least 56% as routing algorithms	The artificial bee colony to improve rendezvous nodes based LEACH has been ignored.
[5]	Lu, Y., Zhang D., Chen1 Y., Liu, X. and Zong P.	2013	LEACH routing protocol	The new prolong can prolong network's life time and balance energy consumption of nodes.	Though the rendezvous nodes based LEACH outperforms over the LEACH in terms of the stability period, but has inadequate network lifetime i.e. the final node become dead too early than LEACH
[6]	Yektaparast, A., Nabavi, F. H. and Sarmast, A.	2012	LEACH is a hierarchical clustering protocol	Energy consumption and network lifetime.	The use of inter cluster data aggregation has additionally ignored.
[7]	Chen, G., Zhang, X., Yu, J. and Wang, M.	2012	improved LEACH algorithm based on heterogeneous energy	extends the network lifetime	The artificial bee colony to improve rendezvous nodes based LEACH has been ignored.
[8]	Bakr, B. A. and Leszek, L	2011	LEACH-SM protocol	increases energy efficiency for WSNs	Though the rendezvous nodes based LEACH outperforms over the LEACH in terms of the

					stability period, but has inadequate network lifetime i.e. the final node become dead too early than LEACH
[9]	Melese, D. G., Xiong, H., and GAO Q.,	2010	Cluster Head Selection in Wireless Sensor Networks	Increase of network lifetime by about 47-575% can be achieved.	The use of inter cluster data aggregation has additionally ignored.
10]	Babaie, S., Agaalizadeh, S. and Golsorkhtabar, M.	2010	Threshold Based Hierarchical Clustering Method for Wireless Sensor Networks	Higher efficiency and can achieve better network lifetime and energy consumption.	The artificial bee colony to improve rendezvous nodes based LEACH has been ignored.
[11]	Katiyar, V., Chand, N., Gautam, G. C. and Kumar A.,.	2010	LEACH is a hierarchical clustering protocol	Energy consumption and network lifetime.	Though the rendezvous nodes based LEACH outperforms over the LEACH in terms of the stability period, but has inadequate network lifetime i.e. the final node become dead too early than LEACH
[12]	Tao, L., Xin, Z. Q. and Luqiao Z.,	2010	new energy-efficient LEACH-based protocol	energy consumption among nodes and can prolong network lifetime compared to LEACH.	The use of inter cluster data aggregation has additionally ignored.
[13]	Liu, Y., Luo, Z., Xu, K. and Chen, L.,	2009	improved algorithm LEACH-D	improve the network's lifetime effectively.	The artificial bee colony to improve rendezvous nodes based LEACH has been ignored.
[14]	Sun, J., Chen, W., Zhang, B., Liu, X. and GU, X	2009	clustering routing protocol	prolong the lifetime of the whole networks.	Though the rendezvous nodes based LEACH outperforms over the LEACH in terms of the stability period, but has inadequate network lifetime i.e. the final node become dead too early than LEACH
[15]	Heinzelman, W., Chandrakasan, A., and Balakrishnan, H	2000	communication protocols	reduction in energy dissipation	The use of inter cluster data aggregation has additionally ignored.

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CONCLUSION AND FUTURE SCOPE

In this paper, a survey various on various mobile sink based clustering techniques has been presented. From the survey it has been concluded that **the use of artificial bee colony to improve** rendezvous nodes based LEACH has been ignored. Moreover the rendezvous nodes based LEACH outperforms over the LEACH in terms of the stability period, but has inadequate network lifetime i.e. the final node become dead too early than LEACH. Also The use of the inter cluster data aggregation has additionally ignored in the majority of the existing literature. This work has not considered any evolutionary approach to enhance the results

further, so in near future we will propose a new technique, which will improve the intercluster data aggregation using artificial bee colony technique.

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