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Energy Efficient Routing Algorithms: A Survey

Jaspreet Kaur[1] and R C Gangwa[2]

[1]*CSE Department, Punjab Technical University*
[2]*Department of Computer Science and Engineering*
Jalandhar (Punjab), India
BCET Gurdaspur (Punjab.), India
jaspreetwarraich@gmail.com
rcg65dec@iitr.ernet.in

Abstract

Energy and bandwidth of the sensors in wireless sensor networks are highly valuable resources so must be used efficiently. Data aggregation on base station via entity nodes is the starting point of overflow of the information, which effect utmost power utilization. To reduce such obstacle, new data aggregation technique has been proposed called ERA which has improved the act of the wireless sensor network through the use of group-based data aggregation but still a lot improvement can be made. This term paper presents a review on various energy algorithms within clustering. And it has been found that none of the technique performs effectively in all fields. The major task of this survey is to find out the drawbacks in existing techniques and ERA. So this paper makes conclusion along with the future scope to overcome these problems.

Keywords: WSNs, ERA, Clusters, energy efficient, LEACH

I. Introduction

Wireless sensor networks hold hundreds to a huge number of low-power multi procedure sensor nodes, working in an unattended atmosphere with restricted computational and sensing capabilities. These nodes include wireless transceivers to make sure that message and networking are enabled. In addition, the network possesses self-organizing facility. Preferably, individual nodes should be battery powered by a lengthy life span and should price extremely little. A solution characteristic of such networks is that their nodes are unmetered and unattended. As a result, they've restricted and non-replenish able power resources. Therefore, energy efficiency is a vital design thought for these networks to prolong the network life span.

The paper's remaining part is structured as given: Part II explains clustering in wireless sensor network. Part III specifies cluster head formation. Part IV gives literature review. Part V gaps in literature. Finally Part VI presents conclusion and future scope.

II. Clustering in WSN

Clustering is a significant mechanism in large multi-hop wireless sensor networks for obtaining scalability, reducing energy consumption and achieving better network performance. The majority of the research has dedicated to energy-efficient solutions, but has not thoroughly analyzed the network performance, e.g. with regards to data collection rate and time. In wireless sensor network clustering has shown to be a highly effective approach for managing the network in a related hierarchy. Clustering handles tasks of the couple of sensor nodes in such a way sensor in cluster are similar to 1 another. In this the sensor nodes with less distance are next to cluster head. Probably the most appropriate task of clustering is to get the knowledge from target region and then send it to BS in

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order to save energy and money effectively. In this manner the network amount of wireless sensor network is improved and enhanced.

- ***Formation of cluster***

In WSNs, antenna nodes utilize the limited energy, the ability of nodes for the process of computation, communication, and storeroom is bound, but as per their requirement it demands WSN protocols to stock up energy with the aim of enhancing the network life span .So for this purpose an energy-efficient procedure LEACH has been taken into account which employs a hierarchical clustering made devoted to facts expected by the base station. The base station occasionally changes both cluster member and cluster head to stock up energy.

The cluster head gathers and then aggregate facts from sensors in a distinctive cluster and convey facts to the base station. By revolving the CH arbitrarily, energy utilization is estimated to be equally dispersed. On the other hand, LEACH selects the way so many CH at once or arbitrarily chooses the CHs not near to the base station without taking into account the left over power of nodes. Consequently, various CHs deplete their energy before time therefore falling the duration of sensor network. The CH election in LEACH has various gaps such as for instance,

- ✓ There are many huge and tiny clusters exist in the sensor network at the same moment.
- ✓ Awkward CH chosen methods as the nodes have dissimilar energy.
- ✓ Nodes which are CMs diminish their energy after CH was dead. The algorithm doesn't consider the location of nodes.
- ✓ CH node will rapidly fail if it ignores left over energy, geographic site and other facts.

III. Cluster Head Selection Algorithms

A. ERA for CH selection

In ERA, cluster head choice is just same as that of Low Energy Adaptive Clustering Hierarchy. The only difference is of cluster formation that have link between CH and other nodes. When the cluster head is chosen based on Low Energy Adaptive Clustering Hierarchy, and then cluster head makes estimate of their left over energy and conveys these facts to any or the entire other nodes. Left over energy of cluster head is evaluated by subtracting the left over energy of cluster head in present circle from the energy that is needed for transferring information to BS. Extra usual nodes evaluate their left over energy by subtracting their left over energy of cluster head in present circle from the energy that is needed for transferring information to every cluster head. Later than they Keeps Company with particular cluster head according to the summation of utmost energy remainder pathway. As a result it enhances the network life period by equaling the power usage of the network. In LEACH, usual nodes decide their CH based on shortest space; as a result of this there would have been a probability for vanishing cluster head in advance. The comparison of LEACH with ERA tells that ERA improved and enhanced the network duration by balancing the power usage of nodes. ERA ensures best possible cluster head election, enhanced network duration but it usually does not give attention on certainty of sensor network.

B. LEACH-C Algorithm

In LEACH, CH election based on present accurate position of the node and left behind energy. During association period, every one node transmits its present position and left over energy to BS. BS estimates the standard energy from the gathered energy facts. Then it comes to know that what nodes vitality is more than average vitality; and those nodes are going to be elected as CH. Later than election, BS coveys the note next to elected

CH‘s ID to the entire nodes. If node’s ID is matched with the ID containing in the note becomes cluster head. In Low Energy Adaptive Clustering Hierarchy –Centralized, cluster heads are detached during the network as it is based on position & left over energy. Now, here the thing is, BS is in charge of evaluating normal vitality; in case if any of the node fails to stay in contact with BS because of distant space from BS then the winning chance of cluster head election is very low. It also takes into account the energy amount of network even though not targets certainty of sensor network.

C. Energy aware routing algorithm for WSN

This work has focused on a brand new energy-aware routing algorithm, called ERA for a group based wireless sensor network that addresses the aforementioned issues. In our approach, most of the sensor nodes are organized into distinct clusters. To choose CHs, each node starts the operation to become a CH by initiating a time wait which depends upon its remaining energy. To make clusters, nodes join CHs by considering their residual energy and distance. Then, a directed virtual backbone (DVB) of CHs fixed at the sink is constructed using most of the CHs to facilitate the routing of the data. In data routing, each CH forwards the info packets to next hop CHs such way that their energy consumption may be balanced. Experiments are performed on planned algorithm, ERA. Comparisons based on consequences have been made with presented routing algorithms such as for example EEPA (energy-efficient and power-aware) and EADC (energy-aware distributed clustering) and also with this previous works such as for example BDCP (back off-based distributed clustering protocol) and EMRA (energy-aware multi-level routing algorithm). The outcomes demonstrate the potency of the proposed algorithm with regards to network life time, energy consumption, power imbalance factor, and data aggregation.

IV. Literature Survey

T. Amgoth [1] proposed energy aware routing algorithm for cluster based WSNs. The algorithm was centered on a intellectual strategy of cluster head (CH) selection, remaining energy of the CHs and the intra-cluster space for cluster creation. To produce easy data routing, a bound for practical stamina of CHs was constructed that has been fixed at the drop. The proposed algorithm was also proven to balance energy using the CHs during data routing process. They proved that the algorithm achieved stable message and linear time complexity. They tested the planned algorithm widely. The brand new results revealed that the algorithm outperforms other existing algorithms when it comes to network life time, energy utilization and other parameters. L.Mahajan [2] proposed a brand new self-motivated plan for electing the perfect CH in Stable Election Protocol. This proposed method had chosen a node as CH if it had best energy among the entire presented nodes in specific cluster. The greatest energy was that which was considered at running time of the WSN. The proposed approach considered several types of nodes and then separated these nodes amongst usual, middle and advance nodes. Dead time of initial node tells the network stability time and end node dead tells the whole network life span. The most important emphasis was to improve the first node and last node died time. The proposed algorithm was also compared with different identified protocols like Low Energy Adaptive Clustering Hierarchy, Extended-Low Energy Adaptive Clustering Hierarchy, Stable Election Protocol and Extended-Stable Election Protocol. Comparisons of planned algorithm with presented algorithm are better with respect to packets provided for CHs, when the first node and the entire node become dead i.e. network life span. V. Hoang [3] presented a story CH election plan to give network life span and consistency by taking obstacle-aware criteria into consideration. This plan allowed electing the most appropriate antenna node to become CH. Recreation results showed important results by falling 93% of missing packets in the network, hence improving the network output around 53%. Furthermore, their result extended the network lifetime to 11%.J.Yadav [4]

centered on analytical categorization of numerous proposed Cluster Head selection schemes. Through this analysis, it could be concluded that more work could be done on single Cluster Head selection in one process to improve the energy efficiency of a network. New parameters like awareness and accessibility of node could be taken into account to elect single CH and to improve stability. L. Bhasker [5] wished-for a cluster-based data aggregation in wireless sensor network. Originally the CHs were elected based on the node connection, which work as a data aggregator. In this algorithm each moment a cluster element preferred to throw out the information to aggregator, a data encryption method were utilized that offered correctness, privacy and reliability. Consequences showed that the planned system decreased the energy utilization, ensured facts protection and compact the broadcast operating cost. P. Ghaffariyan [6] investigated the usefulness of data aggregation by targeting on following troubles: first how to obtain superior cluster-based routing algorithms to achieve the least sum of energy utilization for aggregating information, and second analyzing and utilizing some aggregation methods which were used in unlike applications. After that they pretend two aggregation methods of Differential and Integrated Data compression which showed vital improvements in to enhance network life span. Experimental consequences revealed Differential Data Compression performs superior in enhancing the network life span. A.Ruperee [7] planned technique compact packet size by processing the information at the node itself using Delta Modulation. In the planned method offered facts importance was weighed against earlier facts importance, and if offered information cost was superior than the earlier information cost, yield was one if not yield was zero. It reduced the overall amount of packet and power utilization. The planned method used delta modulation to reduce how big the packet size. It had been experimental with cluster size, the minor energy utilization is 28 percent as well as for unequal cluster is 34 percent. With slight energy utilization, the duration of the network could be enlarged. Nitesh [8] presented an algorithm for relay node placement for wireless sensor networks resulting into an absolutely covered and connected network. Given the locations of the sensor nodes, it absolutely was to put minimum amount of relay nodes with minimum communication cost so that all the sensor nodes of the WSN were covered and most of the relay nodes were linked to communicate with the bottom station directly or via other relay nodes. AV.Karthick [9] proposed A Multi Queue Scheduling (MQS) algorithm to reduce the expense of both reservation and on-demand plans utilizing the global scheduler. The proposed methodology depicted the idea of clustering the jobs centered on burst time. They planned MQS method given extra significance to pick job dynamically to be able to attain the very best cloud scheduling problem.The queuing method had increased the satisfaction of an individual and utilized the free unused space of resources for increased performance. A .Jeong [10] planned the latest cluster based routing protocol, MPDA not just escalates the exactness of dimension however in addition provides energy efficiently in wsn. It has feature that may be distinguished every data aggregation phase according to uniqueness of every cluster. With this it's probable to bank the power and boost the correctness of dimension. For performance evaluation, they compared MPDA with LEACH through Matlab. As a result, MPDA surpasses LEACH with regards to a pair of errors and energy utilization. B. Abu Bakr [11] planned the Low-Energy Adaptive Clustering Hierarchy-SM procedure, which modified Low-Energy Adaptive Clustering Hierarchy procedure by giving an ideal spared election and energy-saving supervision of spares. Additionally they provided a technique for estimating wireless sensor network predictable life. The most crucial featured of Low-Energy Adaptive Clustering Hierarchy-SM included parallelism in running its constituent protocols, scalability, and reduced conduction of unnecessary data to CH. M. Tripathi [12] provided a summary of Low-Energy Adaptive Clustering Hierarchy, mainly trendy clustered routing protocol of wireless sensor network and how Low-Energy Adaptive Clustering Hierarchy could be compromised by Black and Gray outlet enemy. They had also conducted their

experiments on diff erent size networks. They accomplished that eff ect of the attack increased with increased network size. Quantity of nodes in a group increased with increased network size. They experimental that the eff ect of the Gray outlet enemy was fewer as comapred to the Black outlet enemy. A.M. Akbar [13] planned and evaluated Advanced Low-Energy Adaptive Clustering Hierarchy which was unmoving clustering based varied routing procedure. The whole system was separated into fixed clusters and then each cluster split Advanced Low-Energy Adaptive Clustering Hierarchy procedure was useful. Their planned protocol was inborn from Low-Energy Adaptive Clustering Hierarchy with CH election criteria of Distributed Energy-Efficient Clustering. They enabled Advanced Low-Energy Adaptive Clustering Hierarchy in order to manage with the varied nature of nodes. Because of tiny fixed clusters, every node decreases it's transmitting note power as it had to cover up a little region. They performed experiments to test the competence of Advanced Low-Energy Adaptive Clustering Hierarchy. The experimental consequences showed that Advanced Low-Energy Adaptive Clustering Hierarchy was more suitable for heterogeneous WSNs. A.N. Javaid [14] planned Regional Energy Efficient Cluster Heads based on Maximum Energy routing procedure for Wireless Sensor Networks. The key intent behind this procedure was to enhance the network life span and specially the constancy of the network. In this, the node with utmost energy in a region becomes Cluster Head of that region for that specific round and the amount of the CHs in each round remains identical. Their system outperforms Low-Energy Adaptive Clustering Hierarchy which used probabilistic plan for the election of Cluster Heads in terms of network life span, constancy period, region coverage and output. N. S. N. Mohammad [15] planned a procedure for the uniqueness of a homogeneous Wireless Sensor Networks, Hybrid Energy Efficient Reactive protocol. In HEER, Cluster Head preference was based on the proportion of left over energy of node and normal energy of network. HEER minimized the strength utilization by first distributing weight to any or the entire tall energy nodes and after that lying on toward little energy nodes. Moreover, to save more energy, they introduced Hard Threshold and Soft Threshold. Lastly, experiments showed that their procedure had not only extended the network life span but also improved constancy period. B. Sherine M. Abd El-kader [16] studied the Quality of Service of an energy-efficient cluster-based routing procedure known as EAP when it comes to life span, wait, loss proportion, and output, and prepossessed a number of changes onto it to increase its act. The modified protocol offered better characteristics when it comes to packets loss, delay, and throughput, but slightly affected lifetime negatively. Simulation results revealed that the modified protocol significantly outperforms EAP when it comes to packet loss percentage by an average of 93.4%.N.N. Javaid [17] planned a new clustering method, Distributed Regional Energy Efficient Multi-hop routing protocol based on maximum energy for wsn which used for the CHs at cross country to sink. A valuable thing about Distributed Regional Energy Efficient Multi-hop –Maximum Energy was that network region separated into circles and sectors to decrease the space between Cluster Heads and Base Station. They made comparison of their consequences with Low Energy Adaptive Clustering Hierarchy and Low Energy Adaptive Clustering Hierarchy -Centralized in order to obtain best possible number of Cluster Heads in each round and Cluster Head election.They give better consequences when it comes to network life span, constancy phase, region coverage and output. T. N. Javaid [18] planned Energy Efficient Sleep Awake Aware clever direction-finding protocol for WSNs. Within their planned method they evaluated and improved positive problems like network strength, network life span and CH election method. Major focus was to improve CH election process. In Energy Efficient Sleep Awake Aware, Cluster Heads are chosen based on left over energy. In this node also switches among sleep and energetic modes in sort to reduce energy utilization. Simulation consequences indicated that their planned protocol efficiently enhanced the network parameters and can be fairly a useful approach for WSNs. Y.N. Javaid [19**]** planned new clustering method in routing

protocols, Location-aware Permanent Cluster Head and User Defined Location-aware Permanent Cluster Head .In these two protocols, network region was separated into two areas; equivalent numeral of nodes were randomly deployed in each area. In Location-aware Permanent Cluster Head, numbers of Cluster Heads were chosen by Low Energy Adaptive Clustering Hierarchy algorithm in first round. Yet in User Defined Location-aware Permanent Cluster Head, equal and best possible numbers of Cluster Heads were chosen in each area, throughout the network life span number of CHs were remained identical. Experimental consequences showed that stability phase and throughput of Location-aware Permanent Cluster Head was superior to LEACH, stability period and throughput of User Defined Location-aware Permanent Cluster Head was better than Location-aware Permanent Cluster Head.Q. M. B. Rasheed [20] planned Gateway based energy aware multi-hop routing protocol for Wireless Sensor Networks which was mainly based on entrance. They separated the antenna nodes into four different areas depending on location in the sensing field. They installed BS away of the sensing part and an entry node at the middle of the sensing section. In case the space of an antenna node from Base Station or entrance was considerably fewer than predefined space threshold, the node used direct communication. They separated the left over nodes into two identical areas whose space was away from entrance space. They chosen cluster heads in each region which were free of the other region. These CHs were chosen on the basis of a chance. They compared action of their protocol with LEACH. Presentation study, information comparison consequences showed with the aim of their planned procedure performed fine for energy utilization and network life span.

V. Gaps in Literature

The review has shown that the most of the existing technique has neglected the following issues.

1. The effect of the mobile sink in the most of the energy efficient protocols has been ignored.
2. The effect of lossless data compression has been neglected by the most of the researchers.
3. No optimization technique is considered for the effective route selection in ERA protocol.

VI. Conclusion and Future Scope

The survey in this paper found that most of the existing technique has neglected the following issues like the effects of the mobile sink in the most of the energy efficient protocols. Moreover the effect of lossless data compression has been neglected by the most of the researchers. Also no optimization technique is considered for the effective route selection in ERA protocol. Therefore to overcome these issues, a new TABU search based energy efficient routing algorithm may be proposed in near future to overcome these issues. Also the use of compressive sensing is ignored in majority of existing research thus we will use different compressive sensing techniques to boost the consequences more.

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