Research Article **ISSN: 2395 – 5597**

International Journal of Engineering and Robot Technology

Journal home page: www.ijerobot.com

A SURVEY ON ENERGY EFFICIENT CLUSTERING ALGORITHMS IN MOBILE WIRELESS SENSOR NETWORKS

D. Rajesh*[1] and D. Giji Kiruba[2]

[1*]Department of Computer Science Engineering, Satyam College of Engineering and Technology, Tamilnadu, India.
[2]Department of Electrical and Electronics Engineering, Government Polytechnic College, Nagercoil, Tamilnadu, India.

ABSTRACT

To maximize community lifetime in Wireless Sensor Networks (WSNs) the paths for statistics switch are decided on in the sort of way that the entire electricity fed on alongside the direction is minimized. To guide high scalability and better information aggregation, sensor nodes are frequently grouped into disjoint, non overlapping subsets known as clusters. Clusters create hierarchical WSNs which contain green utilization of constrained sources of sensor nodes and accordingly extends network lifetime. The goal of this paper is to provide a kingdom of the art survey on clustering algorithms stated within the literature of WSNs. Our paper affords a taxonomy of power efficient clustering algorithms in WSNs. And also gift timeline and description of LEACH and Its descendant in WSNs.

KEYWORDS

Wireless sensor networks, Clustering, Energy efficient clustering, LEACH, Network lifetime, Energy efficient algorithms and Energy efficient routing.

Author for Correspondence:

Rajesh D,
Department of Computer Science Engineering,
Satyam College of Engineering and Technology,
Tamilnadu, India.

Email: rajeshd936@gmail.com

INTRODUCTION

Energy usage is an vital issue in the design of WSNs which commonly depends on transportable energy sources like batteries for electricity. MWSNs is massive scale networks of small embedded gadgets, every with sensing, computation and communication skills. They were widely mentioned in recent year[1-3]. Micro-Electro-Mechanical System (MEMS) sensor era has facilitated the development of smart sensors, these clever sensors nodes are small devices with limited electricity, processing and computation

resources. Smart sensors are energy restrained devices that have one or more sensors, memory unit, processor, strength deliver and actuator[4]. In WSNs, sensor nodes have restricted in time period of processing strength, verbal exchange bandwidth, and storage area which required very green resource utilization. In MNWSNs the sensor nodes are frequently grouped into individual disjoint units known as a cluster, clustering is utilized in MWSNs, as it gives community scalability, resource sharing and efficient use of restricted resources that offers community topology stability and strength saving attributes. Clustering schemes offer decreased communique overheads, and green aid allocations for this reason reducing the overall energy intake and lowering the interferences amongst sensor nodes. A massive range of clusters will congest the region with small size clusters and a completely small number of clusters will exhaust the cluster head with huge quantity of messages transmitted from cluster members. LEACH protocol is hierarchical routing primarily based on clustering and discover the most advantageous range of clusters in WSNs so that it will store strength and enhance community lifetime.

Given the importance of clustering for WSNs, relaxation of the paper is prepared in following shape; Section II affords the Challenges and boundaries of wi-fi sensor networks. Section III provides an outline of hierarchical routing in WSNs. Section IV offers a survey on state-of-artwork of clustering algorithms reported in the literature and section V offers the conclusion of the paper.

CHALLENGES AND DEMERITS OF MOBILE WIRELESS SENSOR NETWORKS

In MWSN sensor nodes have confined processing energy, communication bandwidth, and storage area. This gives rise to new and particular demanding situations in data control and statistics processing. In-community facts processing strategies, together with statistics aggregation, multicast and broadcast want to be evolved. Network lifetime is the important thing traits used for comparing the overall performance of any sensor community[5]. A life of the network is determined through residual electricity of the system, consequently essential and most vital challenge in WSN is the green use of power sources. Literature shows the strength efficiency is added in WSNs the usage of any of the subsequent mechanisms: Energy conservation mechanism, Power conservation mechanism, Energy harvesting mechanism and Energy green routing.

The aim Energy conscious routing in MWSNs is to find out and preserve routes in MWSNs. Routing demanding situations close to MWSNs[6].

HIERARCHICAL ROUTING IN MWSNS

The foremost target of hierarchical routing or cluster based routing is to efficaciously maintain the power usage of sensor nodes via concerning them in multi-hop verbal exchange inside a particular cluster. Cluster formation is normally based totally at the power reserve of sensors and sensors proximity to the Cluster Head (CHs). Clustering performs an essential position for energy saving in WSNs. With clustering in MWSNs, strength intake, life of the community and scalability may be progressed. Because best cluster head node in line with cluster is needed to carry out routing assignment and the alternative sensor nodes just ahead their facts to cluster head. In MWSNs the sensor nodes are resource constrained which means that they have got confined power, transmit electricity, memory, and computational talents. Energy consumed through the sensor nodes for speaking facts from sensor nodes to the bottom station is the crucial reason of energy depletion in sensor nodes.

Pros and Cons of clustering in MWSNs

The pros of Clustering are that it enables bandwidth reuse accordingly can improve the gadget ability[7]. Due to the reality that inside a cluster, all the normal nodes ship their records to the CHs so energy saving is finished by using absence of flooding, more than one routes, or routing loops. Due to the reality that clustering allows green useful resource allocation and consequently help in higher designing of power control and other gain is because of the truth that any changes of nodes behavior inside a cluster affect only that cluster but now not the entire community, so that it will therefore be strong to those modifications. There are also numerous cons of present clustering schemes in WSNs like inside the

choice of the cluster heads, a few set of rules selects cluster heads most effective consistent with the ID quantity or residual electricity of the sensor nodes. Science all of the information in sensor network are despatched to the bottom station, the traffic close to the bottom station is higher. The sensor nodes in those regions will consequently run out energy in advance. The base station will then be isolated and as a result, the residual strength stored inside the other sensor nodes might be wasted. Another drawback is the electricity is wasted by means of flooding in course discovery and duplicated transmission of data by multiple routes from the supply to the vacation spot[7].

SOME CLUSTERING ALGORITHMS IN MWSNS

CACC: Clustering Algorithm based on Cell Combination[8]

In this paper creator proposed a clustering algorithm which based on cell aggregate for the networks. Sensor nodes are distributed densely and the electricity of sensor nodes is always limited. In this clustering algorithm, the monitoring vicinity is divided into hexagonal cells by using considering the geographic vicinity information of nodes. Each cluster includes as a minimum seven hexagon cells. Nodes with the equal cluster identification form a cluster and the cluster head in each cluster is elected from the central cellular of every cluster. The shape of the cells don't forget nearly circular which will enhance channel reuse and power performance.

VAP-E: Energy-Efficient Clustering -Virtual Area Partition[9]

In this authors proposed an electricity green clustering algorithm which based on digital place partition in heterogeneous networks environment in which the maximal transmission electricity of every node can be extraordinary. Authors located that VAP-E can stability the load between clusters, decorate the power performance of sensor nodes, lengthen the lifetime of networks, and improve the performance of communications. Authors also evaluate this algorithm with appreciate to LEACH and LEACH-E and observed that VAP-E can beautify the stableness length and network existence time with the same simulation condition. Authors proposed a clustering algorithm which uses a blended weight feature and tries to divide the sensor nodes so that a minimal range of clusters with maximum wide variety of sensor nodes in each cluster can be performed. The weight features at each sensor node, which is a aggregate of various parameters such as: residual strength, variety of neighbors and transmission electricity. Basically CFL clustering set of rules is designed for localization in WSNs. It is unable to paintings when the distribution of sensor nodes are not true.

Hausdroff Clustering[10]

Authors taken into consideration that, as soon as cluster formations take location it's final equal throughout the community lifetime. This set of rules maximizes the lifetime of each cluster with a view to growth the life time of the machine. Cluster life time may be more suitable by means of rotating the function of cluster heads (CHs) many of the nodes within the cluster. Cluster heads choice essentially based on the residual power of the sensor nodes and it also used the proximity of friends as a secondary criterion for boosting strength efficiency and further lengthen the community lifetime. The Hausdroff clustering set of rules is similarly applicable for each uniform and nonuniform sensor node preliminary electricity distribution.

HSA: Harmony Search Algorithms[11]

This is music primarily based metaherustic optimization algorithm which has similarities with a track improvisation process in which musician retain to polish the pitches for you to attain better concord. By which it optimizing the energy intake and minimizing intra-cluster distance of the network. In this the base station computes and allocates nodes into clusters consistent with the statistics in their residual power and place. The operation has two levels: clustering setup and records transmission. This set of rules affords improvement in term of strength consumption and community lifestyles time over LEACH protocol. With a small community diameter, strength consumption of the network is nearly same whilst the use of special clustering protocols.

Max-Min D-Cluster Algorithm[6]

Authors proposed a clustering set of rules in which no nodes are greater than d-hops far from the cluster head. The cluster head selection strategy developed, with the aid of having each sensor node provoke a 2d round of flooding, from which results are taken into consideration. In order to pick out the cluster head nodes, comply with a set of rule wherein 1st d round known as flummox, used to propagate biggest node IDs and after of completion of this round second d spherical begin which is known as flagmen. This algorithm is applicable best whilst two assumptions are made: all nodes that continue to exist the flood max choose themselves cluster heads. During flooding, no node ID will propagate further than d-hops from originating node. This set of rules provides load balancing among the cluster heads.

Four.6 PDCH: Pegasis Algorithm Improving Based on Double Cluster Head[12]

Authors proposed an set of rules based on hierarchical chain topology and this set of rules the use of bottom stage cluster head and tremendous degree cluster head to improve the burden balance. In the hierarchical shape, base station (BS) is the middle of a circle. The BS will predefine the wide variety of tiers and every node's distance to BS determined the extent which it belongs to. Every node receives the signal from the BS, then consistent with the signal electricity to locate the gap to BS. PDCH outperform to PEGASIS set of rules and it is also useful for huge networks.

GROUP[13]

GROUP clustering algorithms primarily based on clustering set of rules that offers scalable and green packet routing for massive-scale WSNs. Only some components of general number of sensor nodes participate in formation of cluster heads (CHs). In this, cluster heads are arranged in a grid manner and number one sink (One of the sink), dynamically and randomly builds the cluster grid. Greed Seed (GS) is a node within a given radius from the number one sink. Any queries from sink to nodes are propagated from greed seed to its cluster heads and so on.

EECS: Energy Efficient Clustering Schemes[14]

Authors proposed an algorithm wherein cluster formation isn't the same as LEACH protocol. In LEACH protocol cluster formation takes area on the idea of a minimal distance of nodes to their corresponding cluster head. In EECS, dynamic sizing of clusters takes area which is based on cluster distance from the base station. The consequences are an algorithm that addresses the trouble that clusters at a more distance from the sink requires more power for transmission than those which can be nearer. Ultimately it affords same distribution of electricity within the networks, resulting in network lifetime. Thus fundamental gain of this set of rules is the full connectivity can be achieved for an extended length. So we are able to say it offers reliable sensing capabilities at a larger range of networks for a longer time frame. It presents a 35 percentage development in network lifestyles time over LEACH set of rules.

PEGASIS: Power-Efficient Gathering in Sensor Information System[15]

By this author proposed set of rules PEGASIS that is a chain based protocol provide improvement over LEACH algorithms. In PEGASIS, every node communicates simplest with a near neighbor and takes turns transmitting to the base station, therefore lowering the quantity of electricity spent in line with round. Using greedy algorithm, the nodes might be organized to form a sequence, after that BS can compute this chain and broadcast it to all of the sensor nodes. Energy saving in PEGASIS over LEACH takes location via many stages: First, inside the nearby records gathering, the distances that most of the sensor nodes transmit are a lot less compared to transmitting to a cluster-head in LEACH. Second, handiest one node transmits to the BS in every round of communication. PEGASIS outperforms LEACH by limiting the wide variety of transmissions, disposing of the overhead of dynamic.

EEUC: Energy Efficient Unequal Clustering[16]

This scheme is distance based scheme similar to EECS and it also required that each node has global identity along with its places and distances to the bottom station. Hotspot is the primary trouble in WSNs due to multi hopping that occurs whilst CHs in the direction of the sink have a tendency to die

quicker compare to any other node within the WSNS, due to the fact they relay lots extra visitors than far off nodes. This algorithms partition the all nodes into clusters of unequal length, and clusters towards the sink have smaller sizes than those farther far from the sink. Thus cluster heads (CHs) closer to the sink can conserved some energy for the inter-cluster records forwarding. Energy fed on by means of cluster heads in step with round in EEUC plenty lower than that of LEACH popular however similar to HEED protocol.

LEACH and Its Descendant

Low Energy Adaptive Clustering Hierarchical Protocol (LEACH) uses the subsequent strategies to obtain the layout goals: randomized, self-configuring and adaptive cluster formation, Local manage for data transfers and occasional-energy media access manipulate and alertness precise data processing. LEACH protocol has many rounds and every round has two phases, a setup section and steady country phase, in installation phase it gives cluster formation in adaptive way and inside the steady state section switch of statistics takes region. LEACH uses a TDMA or a CDMA MAC to reduce inter-cluster and intra cluster collisions. Cluster formation based totally on many properties along with the quantity and form of sensors, communication variety and geographical region.

The electricity intake of the information accrued through the sensors node to reach the sink will depend on the range of cluster heads and radio variety of various algorithms, because the electricity intake can be reduced through organizing the sensor nodes within the clusters[17].

MS-LEACH

In this paper the authors have analyzed the trouble of energy intake of the single-hop and multi-hop transmissions in a unmarried cluster. Finally essential cost of the cluster place size is determined. MS-Leach is based totally on the essential cost. Simulation results truly display that MS-Leach outperforms at maximum by way of two hundred% in term of network lifetime. It is proposed as destiny paintings its courting among multi-hop and single-hop transmissions might be analyzed in-depth in various protocols and new mechanisms of routing may be advanced[18].

Table No.1: Comparison of LEACH Protocols

S.No	LEACH and Its Descendant	Abbreviation	Year of Publication
1	LEACH[19]	Low energy adaptive clustering hierarchy	2002
2	LEACH-C[19]	Centralized - Low energy adaptive clustering hierarchy	2002
3	LEACH-F[20]	Fixed No. Of Cluster- Low energy adaptive clustering hierarchy	2002
4	LEACH-B[21]	Balanced- Low energy adaptive clustering hierarchy	2003
5	LEACH-ET[22]	Energy threshold- Low energy adaptive clustering hierarchy	2006
6	LEACH-E[23]	Energy- Low energy adaptive clustering hierarchy	2007
7	TL-LEACH[24]	Three Layer- Low energy adaptive clustering hierarchy	2007
8	TB- LEACH[17]	Time based- Low energy adaptive clustering hierarchy	2008
9	MS- LEACH[18]	Combination of multi-hop and single hop- Low energy adaptive	2009

CONCLUSION

Survey country-of-art of different clustering algorithms in Wi-Fi sensor networks together with LEACH and descendant pronounced within the literature of WSNs till today and provided the assessment of various LEACH descendant. We have observed that the a few electricity efficient algorithms increases the community lifetime Although every effort has been made to provide complete and correct state of the art survey on energy green clustering algorithms alongside LEACH and its descendant as relevant to WSNs.

ACKNOWLEDGEMENT

I have taken efforts in this research. However, it would not have been possible without the kind support and help of many individuals and organizations. I would like to extend my sincere thanks to all of them. I would like to express my gratitude towards my parents and member of Satyam College of Engineering and Technology for their kind cooperation and encouragement which help me in completion of this project. I would like to express my special gratitude and thanks to industry persons for giving me such attention and time. My thanks and appreciations also go to my colleague in developing the project and people who have willingly helped me out with their abilities.

CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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Please cite this article in press as: Rajesh D and Giji Kiruba D. A survey on energy efficient clustering algorithms in mobile Wireless sensor networks, *International Journal of Engineering and Robot Technology,* 5(2), 2018, 49-55.