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A Survey on Clustering Method for Improved Wireless Sensor Network

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Abstract - ***There are several application have been developed with need of self organization for network. To fulfill this requirement need of wireless sensor network in such applications. To manage network efficiently clustering is used. Lots of works have been done in field of wireless sensor networks (WSNs) in last few years. These researches have boost potential of WSNs in applications such as security monitoring, disaster management, military area, border protection and health monitoring systems. Such applications are required to be remotely deployed sensor nodes in huge numbers and to operate autonomously. So there need to scalability, nodes are often collected into disjoint clusters. This paper, presents a categorization and common organization of available clustering proposal. This work analysis various clustering algorithms used for WSNs and give a review with focusing on their objectives features, etc.***

Key Words: *WSNs, Monitoring System, Clustering techniques, Comparative Analysis.*

1. INTRODUCTION

Structures, as well as bridges, buildings, dams, pipelines, aircraft, ships, among others, are complicated built systems that guarantee society's economic and industrial prosperity. To style structures that are safe for public use, standardized building codes and style methodologies are created. Sadly, structures are typically subjected to harsh loading situations and severe environmental conditions not anticipated throughout style that may lead to semi permanent structural deterioration. For instance, recent unstable events, earthquakes, reveal civil structure vulnerability to break and failure throughout natural catastrophes. to style safer and additional sturdy structures, the engineering community is sharply following novel sensing technologies Associate in analytical ways that may be wont to speedily determine the onset of structural injury in an instrumented structural system. Known as structural health watching (SHM), this new paradigm offers Associate in Nursing auto-mated methodology for trailing the health of a structure by combining injury detection algorithms with structural watching systems.

Wireless communication technology, wireless sensing element networks (WSNs) are becoming additional and additional well-liked for numerous application areas, like military information gathering, disaster management, security applications, environment observation, medical and health, industrial automation, etc.. In general, a WSN consists of Associate in Nursing large vary of very little sensing element nodes distributed over Associate in Nursing large house with one or further powerful sinks or base stations (BSs) grouping data from these sensing element nodes [1]. All sensing element nodes have restricted power give and have the capabilities of information sensing, process and wireless communication. Wireless networks play an important role within the communication systems today. Wireless networks are being progressively employed in the communication among devices of the foremost varied sorts and sizes. User quality, affordability, flexibility and simple use are few of the many reasons for creating them terribly appealing to new applications and additional users every day. During this work, we have a tendency to take into account solely wireless networks capable of operational while not the support of any mounted infrastructure. We have a tendency to conjointly take into account the final case of multi-hop networks. Additional exactly, we'll take into account wireless circumstantial networks additionally as wireless sensing element networks. the range of the applications supported by wireless circumstantial and sensing element networks make a case for the success of this kind of network. These applications concern as numerous domains as environmental watching, life protection, emergency rescue, home watching, target trailing, exploration mission in hostile environments, etc. However, the foremost crucial demand for adopting such net-works is energy potency. Indeed, some nodes are battery operated and battery replacement will be tough, overpriced or perhaps not possible. The goal of

communication protocol designers is then to maximize the time period of such networks.

2. PROBLEM IDENTIFICATION

The design of routing protocols for WSNs is difficult as a result of many network constraints. WSNs suffer from the constraints of many network resources, for instance, energy, bandwidth, central process unit, and storage [2, 3]. The planning challenges in sensing element networks involve the subsequent main aspects [2, 3, 4]-

- Limited energy capability
- Sensor locations
- Limited hardware resources
- Massive and random node preparation
- Network characteristics and unreliable environment:
- Data Aggregation
- Diverse sensing application necessities
- Scalability

3. RELATED WORK

In flat networks, every node usually plays constant role and sensing element nodes collaborate along to perform the sensing task. Attributable to the massive range of such nodes, it's not possible to assign a world symbol to every node. This thought has light-emitting diode to information central routing [5], wherever the bachelor's degree sends queries to bound regions and waits for information from the sensors placed within the elect regions.

Since information is being requested through queries, attribute-based naming is important to specify the properties of information. a number of routing protocols during this class are: SPIN [6], Directed Diffusion [7], Rumor Routing [8] and EBRP [9].

Hierarchical or cluster-based routing, are well-known techniques with special blessings associated with measurability and economical communication. As such, the conception of stratified routing is additionally used to perform energy-efficient routing in WSNs. in an exceedingly stratified design, higher energy nodes will be wont to method and send the data whereas low energy nodes will be wont to perform the sensing within the proximity of the target. a number of routing protocols during this cluster are: LEACH [10], PEGASIS [11], adolescent [12] and APTEEN [13].

Paper [14] proposes a load-balanced cluster formula for WSNs on the idea of their distance and density distribution, creating it basically totally different from the previous cluster algorithms. This methodology a balanced cluster formula with distributed self-organization for WSNs of non-uniform distribution, taking under consideration optimum configuration of clusters. This methodology formula will kind additional stable and cheap cluster structure, and conjointly improve the network life cycle considerably.

WCA [15] may be a classical formula supported node degree, the amount of single-hop neighbors. The election of cluster head depends upon the factors of node degree, send-receive energy and residual energy. Meantime the dimensions of cluster (the communication consumes massive amounts of energy once cluster is simply too large) is proscribed so as to avoid wasting energy. In distinction, the WCA cluster formula is additional comprehensive than the antecedently projected algorithms, and a few experiments show that the performance is additional superior. To boot, the most downside of WCA is that it must acquire the burden of the node and need every node to avoid wasting all the data of nodes before initializing network, therefore excessive amounts of computing and communications might cause excessive consumption in cluster directly. Within the method of aggregating and forwarding, the overhead may make to excessive energy consumption and fast death of cluster head node, acquisition instability within the topology.

K-clustering [16] formula will represent most k-hop non-overlapping clusters with partial networks topology data instead of the complete topology. At constant time, it may also save energy to prolong network survival time. Moreover, thanks to dynamic topology changes, it's of significance finding out cluster supported native data. Nonetheless, it doesn't take into account cluster size and should kind unbalanced cluster. For instance, some clusters contain tremendous range of nodes, which ends up in overlarge overhead of put down communication.

Different improved K-clustering algorithms are come back up with in turn to repair this downside. A representative formula is projected by designer and Chu [17] with exploitation hops jointly of the constraint parameters. During this formula, the node is elective as cluster head at random, and therefore the distance between cluster members and cluster head doesn't exceed k hops. The formula is more practical in limiting information forwarding distance, however it still doesn't solve unbalanced cluster (excessive cluster nodes). Additionally, during this formula, solely the basis of subtree is aware of that cluster it belongs to, whereas different nodes don't have this data. If the cluster head or the basis of sub-tree node fails, it might be inefficient and unfavorable to cluster once more.

ESAC [18] formula combines the benefits of the on top of projected algorithms, and it improves cluster performance by overcoming their shortcomings. This formula uses the tactic of scheming weight in choosing cluster head. the burden of every node is calculated looking forward to the mix of 2 parameters: residual energy and quality. The cluster size ranges between 2 thresholds (Thresh-high), and therefore the distance between every cluster node and its cluster head is not any quite 2-hop. This differs from

LEACH, and therefore the formula builds the balanceable and sleek cluster network by considering the k-density, residual energy and quality therefore on avoid mounted cluster head project, which can ends up in excessive energy consumption of cluster head. the method of electing cluster head is re-launched in an exceedingly bound amount (service period). It calculates the burden of {every} node in every stage of cluster head building so as to make sure the foremost acceptable node to become cluster head and limit the dimensions of cluster o.k.. once a cluster head dies or is affected to different cluster, the upkeep method is triggered. the method is analogous thereto of building cluster launched by a random member of the previous cluster, and is proscribed solely to the members losing their cluster head. during this manner it will avoid the previous 'chain loop' downside existed in cluster formula, and has very little impact on the topology. However, the structure of 2-hop clusters isn't appropriate for all circumstances. In some cases, we'd like to represent clusters quite 2-hop.

4. CLUSTERING ALGORITHMS FOR WSNS

4.1 Energy economical stratified cluster (EEHC)

Paper [19] projected EEHC; a distributed, irregular cluster formula for WSNs with the target of maximizing the network time period. CHs collected the sensors' readings in their individual clusters are send a collective report back to the base-station. Their technique relies on 2 stages; initial and extended. Within the initial stage, conjointly known as single-level cluster, every sensing element node announces itself as a CH with chance p to the neighboring nodes among its communication varies. These CHs are named because the volunteer CHs. All nods that are among k hops vary of a CH receive this announcement either by direct communication or by forwarding. Any node that receives such announcements and isn't itself a CH becomes the member of the nearest cluster. Forced CHs are nodes that are neither CHs nor belong to a cluster. If the announcement doesn't reach to a node among a planned measure t that's calculated supported the length for a packet to achieve a node that's k hops away, the node can become a forced CH assumptive that it's not among k hops of all volunteer CHs.

4.2 Low Energy reconciling cluster Hierarchy (LEACH)

LEACH is one amongst the foremost well-liked cluster algorithms for WSNs [20]. It forms clusters supported the received signal strength and uses the CH nodes as routers to the base-station. All {the information|the info|the information} process like data fusion and aggregation ar native to the cluster. LEACH forms clusters by employing a distributed formula, wherever nodes create autonomous choices with none centralized management. at the start a node decides to be a CH with a chance p and broadcasts its call. every non- CH node determines its cluster by selecting the CH that may be reached exploitation the smallest amount communication energy. The role of being a CH is turned sporadically among the nodes of the cluster so as to balance the load. The rotation is performed by obtaining every node to decide on a random range "T" between zero and one.

4.3 Hybrid Energy-Efficient Distributed cluster (HEED)

HEED [21] may be a distributed cluster theme during which CH nodes are picked from the deployed sensors. HEED considers a hybrid of energy and communication price once choosing CHs. not like LEACH, it doesn't choose cell-head nodes at random. Solely sensors that have a high residual energy will become cell-head nodes. HEED has 3 main characteristics:

- The chance that 2 nodes among every other's transmission vary turning into CHs is tiny. Unlike
- LEACH, this implies that CHs are well distributed within the network.
- Energy consumption isn't assumed to be uniform for all the nodes.
- For a given sensor's transmission vary, the chance of CH choice will be adjusted to make sure inter-CH property.

4.4 Distributed Weight-Based Energy-Efficient stratified cluster (DWEHC)

Paper [22] has projected DWEHC to realize additional aggressive goals than those of HEED. Basically, generating balanced cluster sizes and optimizing the intra-cluster topology. DWEHC yield in an exceedingly distributed manner and has O(1) time complexness. every sensing element calculates its weight when locating the neighboring nodes in its space. the burden may be a function of the sensor's energy reserve and therefore the proximity to the neighbors. in an exceedingly neighborhood, the node with largest weight would be no appointive as a CH and therefore the remaining nodes become members. At this stage the nodes ar thought of as first-level members since they need an on the spot link to the CH. A node increasingly adjusts such membership so as to succeed in a CH victimization the smallest {amount} amount of energy. Basically, a node checks with its non-CH neighbors to search out out their lowest value for reaching a CH. Given the node's data of the gap to its neighbors, it will assess whether or not it's higher to remain a first-level member or become a second-level one; reaching the CH over a two-hop path. it's price noting that by doing

therefore the node might switch to a CH apart from its original one. the method continues till nodes settles on the foremost energy economical intra-cluster topology. To limit the quantity of levels, each cluster is assigned a variety among that member nodes ought to lay.

4.5 Attribute-based cluster

In this paper [23] have planned a replacement cluster technique for WSNs. DREEM-ME uses static cluster and most energy primarily based CH choice. Multi-hop route is employed for the CHs at long distance to sink. smart issue concerning DREEM-ME is that the network field is split equally into circles and sectors to scale back the gap between CHs and SB. In simulations this technique compared leads to terms of achieving optimum variety of CHs in every spherical and CH choice technique of technique provided higher results than its counterparts, in terms of network lifespan, stability amount, space coverage and turnout.

Table -1: Comparison of the Presented Clustering Algorithms

Clustering approaches	Convergence time	Node mobility	Cluster overlapping	Location awareness	Energy efficient	Failure recovery	Balanced clustering	Cluster stability
EEHC	Variable O(k1+k2+..+kh)	No	No	Required	Yes	N/A	OK	N/A
LEACH	Constant O(1)	Fixed BS	No	Not required	No	Yes	OK	Moderate
HEED	Constant O(1)	Stationary	No	Not required	Yes	N/A	Good	High
DWEHC	Constant O(1)	Stationary	No	Required	Yes	N/A	Very good	High
Attribute-based clustering	Constant O(1)	No	No	No Required	Yes	Yes	Very good	High

5. PROPOSED WORK

This section provide proposes new technique this works on each atmosphere homogeneous still as for heterogeneous network o.k.. This work primarily focus for minimize total network power consumption with quality service to boost stability of network and total network life time. Stability of network means that once 1st node died among any network it ought to be take long enough time to prevent operating for 1st node.

To accomplish mention objective here introduce the conception of node pairing. man nodes among any network are deploying random positions. Due this random node distribution some nodes are placed terribly close to one another with various to their distance. These nodes sense same info and transmit to base station however base station not want for redundant info there's further work load for same recurrent knowledge. Thence planned work removes this recurrent info by pairing nodes among minimum distance to every alternative compare to predefine threshold price. There also are some enhancements in cluster technique for choice cluster head (CH) with choice parameter remaining energy of nodes. Additional details are given as below. Once nodes are paired to every alternative in step with distance, just one of them is in operating state (ON state) at a same time and alternative node is in not operating state (OFF state) throughout that spherical. Thence just one node from 2 is used energy power whereas alternative saves its energy by non active mode.

On setup of any WSN network base station manages pairing method by locating position of all sensing element nodes by aggregation hi message from all nodes. Victimization geographical location position a base station to induce try for nearest node if exists. The closest node makes try as directed by base station according their distance position. Such 2 nodes get connected as try through their node IDs. Overall mechanism is given in algorithmic program three.

The sensing element network may be homogeneous or heterogeneous thus planned technique is planned by considering each sort of networks and effectively solves this issue by choosing cluster head higher energy node with higher choice chance. Cluster node should have higher energy power still as should have higher energy state than whole network average energy. The systematic algorithmic program may be given as algorithmic program two.

5.1 Proposed Algorithms

Algorithm 1: SensingRegionSelection()

This algorithm determines the region where clustering is required.

Input: Position of the sensor nodes and BS.

Output: Direct transmission region, Clustering region.

begin

1 for a given simulation time T do

2 BS broadcasts HELLO packets periodically.

3 if a sensor node listen HELLO packet then

4 Reply with residual energy.

5 if the RSSI of the received signal RSSIch

then

6 No need to form clusters.

7 else

8 Clustering occurs according to ClusterSelection()

end

Algorithm 2: ClusterSelection()

This algorithm grouped the sensor nodes into clusters.

Input: No. of Sensor nodes, Initial node energy, probability (p), No of rounds.

Output: Cluster heads, Clusters.

begin

1 if any node is alive then

2 follow nodePairing() to pair with closest neighbour.

3 follow nodeClassStatusSetup() to decide about the on nodes.

4 if Node Class = ON for any node then

5 for each round do

6 BS choose CHs following CHsetup()

7 if a node is Cluster Head then

8 Broadcasts its CH advertisement message

9 All non-CHs on nodes, sends joining request message to that CH, from which it received the highest RSSI.

10 Cluster head accepts the joining request.

11 Forms respective clusters.

End

Algorithm 3: NodePairing()

This algorithm coupled the nodes.

Input: No. of Sensor nodes, RSS

Output: Set of paired-node

begin

1 A Base station gets closest nodes by their location and find Closest Neighbor nodes.

2 The neighbors answer consistently.

3 The neighbor with the strongest RSSI is selected as the next node.

4 Node Status = PAIRED
5 Base station stored Node Paired ID

end

Algorithm 4 NodeClassStatusSetup()

This algorithm set the mode of node whether switch to off mode or on mode for this round.

Input: No. of Sensor nodes, Node residual energy.

Output: Off node, On node.

begin

1 Get N paired node sets in the network.

2 if node== PAIRED then

3 for each pair set do

4 Node broadcasts an Energy Msg message to its neighboring node.

5 Receiving Energy Msg from its neighbouring node, updates its own Neighbor Table.

6 if E(r) node > E(r) neighbour

then

7 Set Node Class = ON and Node Status=1

8 else

9 The node Broadcasts go To Off message to neighbours.

10 Node Class = OFF

11 Set Node Status== 0

12 Nodes receive their status update

13 for a pair do

14 if neighbor node is dead then

15 Another node of that pair On for remaining rounds.

16 else Node Class = ON for whole networklife time.

end

Algorithm 5 CHsetup()

This algorithm selects the powerful nodes as cluster head

Input: No. of Sensor nodes, Initial node energy, Node Residual Energy, Energy Consumption rate, No of rounds.

Output: Cluster heads.

begin

1 BS receives the status of the Eresi from all nodes.

2 Then based on this BS computes Eavg of the on nodes.

3 Broadcasts the Eavg

4 for each node having Eresi Eavg

do

5 Include in the set of eligible CHs

6 if a node finds its Eresi Eavg then

7 it sends a request message to find eligible neighbours

8 The 1-hop neighbour nodes closer to that node send a reply with their

Eecr of r-1.

9 The node which has min Eecr and with Eresi Eavg is selected as CH node.

End

6. CONCLUSION

Wireless sensing element networks (WSNs) have gotten major concentration over the last decade. massive numbers of application depends on WSNs like civil and military applications for inflated effectiveness, primarily in unfriendly and remote areas or rural areas. WSNs ar numerous necessary things wherever ancient techniques fail as demand for examples disaster management, border security, battle field inspections. These applications embody sizable amount of sensing element nodes ar expected, want careful structure and organization of the network. to satisfy these needs grouping nodes into clusters is become the foremost loved answer attributable to support measurability in WSNs. Main awareness has been paid to cluster techniques and algorithms got an oversized variety of researches done. This paper, review existing analysis work and offers comparison of latest schemes. This paper review previous work wiped out field of WSNs and offers categorization various attributes needed for economical WSNs style.

In this paper we've got bestowed Associate in Nursing increased weight primarily based cluster algorithmic program to boost upon their stability and to scale back re-affiliation of the nodes. This work focuses on reducing the instability caused by high-speed moving nodes, by taking relative quality of node and its neighbors into thought. Since WCA support stable cluster head election and therefore the disadvantage is re-affiliation of nodes that is reduced by quality prediction, it leads to stable cluster.

REFERENCES

[1] R. Mitra and D. Nandy. A survey on clustering techniques for wireless sensor network. Int. J. of Research in Computer Science, 2(4):51{57, 2012

[2] Jamal Al-Karaki, and Ahmed E. Kamal, “Routing Techniques in Wireless Sensor Networks: A Survey“, IEEE Communications Magazine, vol 11, no. 6, Dec. 2004, pp. 6-28.

[3] Kemal Akkaya and Mohamed Younis, "A Survey on Routing Protocols for Wireless Sensor Networks", Ad hoc Networks, vol. 3, no. 3, May 2005, pp. 325-349.
[4] N. Bulusu, J. Heidemann, and D. Estrin, "GPS-less Low Cost Outdoor Localization for Very Small Devices", IEEE Personal Communication Magazine, vol. 7, no. 5, Oct. 2000, pp. 28-34.
[5] I.F. Akyildiz et al., Wireless sensor networks: a survey, Computer Networks 38 (2002) 393–422.
[6] W. Heinzelman, J. Kulik, H. Balakrishnan, Adaptive protocols for information dissemination in wireless sensor networks, in: Proceedings of ACM/IEEE International Conference on Mobile Computing and Networking MobiCom'99,Seattle, WA, 1999.
[7] C. Intanagonwiwat, R. Govindan, D. Estrin, Directed diffusion: a scalable and robust communication paradigm for sensor networks, in: Proceedings of ACMMobiCom'00, Boston, MA, 2000, pp. 56–67.
[8] D. Braginsky, D. Estrin, Rumor routing algorithm for sensor networks, in: Proceedings of the First Workshop on Sensor Networks and Applications(WSNA), Atlanta, GA, October 2002.
[9] S. Madiraju, C. Mallanda, R. Kannan, A. Durresi, S.S. Iyengar, EBRP: energy band based routing protocol for wireless sensor networks, Department of Computer Science, Louisiana State University, 298 Coates Hall, LA 70803, USA, 2004.
[10] W. Heinzelman, A. Chandrakasan,H. Balakrishnan, Energy-efficient communication protocol for wireless microsensor networks, in: Proceedings of the 33rd Hawaii International Conference on System Sciences (HICSS'00), January 2000.
[11] S. Lindsey, C.S. Raghavendra, PEGASIS: power efficient gathering in sensor information systems, in: Proceedings of the IEEE Aerospace Conference, Big Sky, Montana, March 2002.
[12] Manjeshwar, D.P. Agrawal, TEEN: a protocol for enhanced efficiency in wireless sensor networks, in: Proceedings of the 1st International Workshop on Parallel and Distributed Computing Issues in Wireless Networks and Mobile Computing, San Francisco, CA, April 2001.
[13] Manjeshwar, D.P. Agarwal, APTEEN: a hybrid protocol for efficient routing and comprehensive information retrieval in wireless sensor networks, in: Parallel and Distributed Processing Symposium. Proceedings International, IPDPS 2002, pp. 195–202.
[14] Ying Liao, Huan Qi, and Weiqun Li, "Load-Balanced Clustering Algorithm with Distributed Self-Organization for Wireless Sensor Networks", IEEE Sensors Journal, Vol. 13, No. 5, May 2013.
[15] M. Chatterjee, S. K. Das, and D. Turgut, "WCA: A weighted clustering algorithms for mobile ad hoc networks,"Cluster Comput., vol. 5, no. 2, pp. 193–204, 2002.
[16] Y. Fernandess and D. Malkhi, "K-clustering in wireless ad-hoc networks," inProc. 2nd ACM Workshop Principles Mobile Comput. Conf., Oct. 2002, pp. 31–37.
[17] H. C. Lin and Y. H. Chu, "A clustering technique for large multihop mobile wireless networks," inProc. 51st Int. Conf. Veh. Technol.,May 2000, pp. 1545–1549.
[18] M. Lehsaini, H. Guyennet, and M. Feham, "A novel cluster-based selforganization algorithm for wireless sensor networks," inProc. Int. Symp. Collabor. Technol. Syst. Conf., May 2008, pp. 19–26
[19] S. Bandyopadhyay, E. Coyle, An energy efficient hierarchical clustering algorithm for wireless sensor networks, in: Proceedings of the 22nd Annual Joint Conference of the IEEE Computer and Communications Societies (INFOCOM 2003), San Francisco, California, April 2003.
[20] W.B. Heinzelman, A.P. Chandrakasan, H. Balakrishnan, Application specific protocol architecture for wireless microsensor networks, IEEE Transactions on Wireless Networking (2002).
[21] O. Younis, S. Fahmy, HEED: A Hybrid, Energy-Efficient, Distributed clustering approach for Ad Hoc sensor networks, IEEE Transactions on Mobile Computing 3 (4) (2004) 366–379.
[22] P. Ding, J. Holliday, A. Celik, Distributed energy efficient hierarchical clustering for wireless sensor networks, in: Proceedings of the IEEE International Conference on Distributed Computing in Sensor Systems (DCOSS'05), Marina Del Rey, CA, June 2005.
[23] N. Amjad, N. Javaid, A. Haider, A. A. Awan, M. Rahman, "DREEM-ME: Distributed Regional Energy Efficient Multi-hop Routing Protocol based on Maximum Energy in WSNs", IEEE 2013.