ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

A Survey: Clustering Routing Algorithms for Isolated Nodes Using Wireless sensor network.

K Kalaivani*, and G Indhumathi.

Dept. of Embedded System, Sathyabama University, Chennai, Tamil Nadu, India.

ABSTRACT

Energy efficiency is one of the main thing for designing the protocols or gateways for WSNs. A wireless sensor network consists of a large number of sensors in an environment to sense, collect and transmit data to sink at long distance. The data collected by each sensor is communicated to the base station and it forwards the data to the end user. Clustering is introduced to WSN and it is an effective approach to provide better data aggregation and scalability. It also conserves the limited energy resources of the sensors and the analysis of clustering algorithms is classified based on the cluster formation parameters and cluster head (CH) selection .It mainly depends on the Lifetime with limited power source of nodes. So, energy consumption is important in WSNs. In this paper, we have discussed on features of Wireless Sensor Networks, and Clustering routing algorithms and more precisely on Energy Efficient routing protocols for prolonging the lifetime in Wireless Sensor Networks.

Keywords: Wireless Sensor Network, Clustering algorithms, Energy Efficiency, Lifetime.

Corresponding author

ISSN: 0975-8585

INTRODUCTION

WSN is a collection of sensor nodes to sense the physical characteristics of the world large number of small low-cost, low power and equipped with sensing, processing ability, data gathering, and limited storage space. WSN provides the place to the sensor nodes for sensing and Monitoring the network area in that wireless sensor network are dependents on battery power. WSN is used in sensitive and crucial applications. In order to monitor an Environment. Applications such as chemical detection, environmental monitoring, emergency response, Health-care services, vehicular movements, volcanic earthquake timing, surveillance missions, military and weather forecasting. Energy is an important issue in the design of WSN and depends on portable energy sources like batteries .Saving the energy of the sensor node is the big thing because every sensor node has its own separate non replaceable battery with limited lifetime and it cannot be recharged during sensing the data. So Energy efficiency is essential for wireless sensor network. In this, the different energy efficient clustering routing techniques are proposed to improve the lifetime of the network. Clustering is an important role for conserving the energy and for increasing the network lifetimes. It examine how the clustering is an essential part of the organized structure, they are

Sensor Node: A sensor node is the component of a WSN. It can take on multiple actions in a network, such as sensing, data storage, data processing, and routing.

Clusters: Clusters is the essential part for WSN. These networks require a simplify task for a communication.

Cluster heads: Cluster heads is a leader of a cluster. It required to organize activities in the cluster and the tasks include data-aggregation and communication schedule of a cluster.

Base Station: The base station is at the upper stage of the hierarchical WSN. It provides the communication link between the sensor network and the end-user.

End User: In a network the data can be used for a wide-range of applications. A particular application may make use of the network data over the internet.

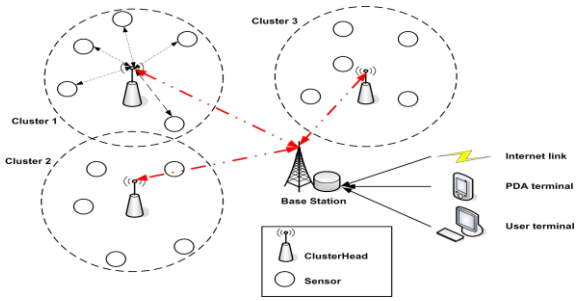

Fig: 1 Block Diagram of WSN

Moreover these parameters of various clustering protocols are discussed in this paper:

i. Number of clusters (cluster count): In clustering algorithms the CH selection and formation process lead naturally to a number of clusters. In some approaches, the set of CHs are predetermined and the numbers of clusters are preset. The amount of clusters is generally a critical parameter to the efficiency of the total routing protocol.

ii. Intra/Inter cluster communication: In some clustering approaches the communication between designated CH and a sensor is assumed to be direct. However, multi-hop intra-cluster communication is often required, i.e., when the communication range of the sensor nodes is limited.

iii. Cluster formation methodology: In some approaches, clustering is performed in a distributed manner without coordination and in few earlier approaches a centralized (or hybrid) and distributed approach is followed

iv. **Cluster-head selection**: The CH of the clusters in some proposed algorithms can be pre-assigned. Generally however in homogeneous environments, the CHs are picked from the deployed set of nodes.

v. Algorithm complexity: In these algorithms the fast termination of the executed protocol is one of the primary design goals, and the time complexity or convergence rate of cluster formation procedures proposed is constant.
vi. Multiple levels: A multi-level cluster hierarchy is introduced to achieve even better energy distribution and total energy consumption. The improvements offered by multi-level clustering can be further studied, especially it has a large networks and inter-CH communication efficiency is of high importance.
vii. **Overlapping:** Several protocols give high importance on the idea of node overlapping within different clusters.

In this paper, we describe a number of well-known clustering routing algorithms for WSNs which has been proposed by researchers and so far. Rest of the paper presented as: Challenging issues of wireless sensor networks are discussed in section II. The section III describes limitations of wsn. The section IV describes features of wsn with appropriate approaches. In section V, it describes the design physiology.

CHALLENGING ISSUES OF WSNS

Wireless Sensor Networks present challenges in terms of implementation. The sensor nodes of WSN have energy to process, limited storage space, and communicate bandwidth. An efficient way to prolong the network lifetime through efficient energy utilization, so network lifetime is the important characteristics used for evaluating the performance of each and every sensor network. This performance evaluation arises many issues; WSN faces several challenging issues as follows:

Critical use issues: There are various critical issues such as:

- ***Accuracy****:* Collected data may trust and secure processing depends on the accuracy
- ***Timeliness****:* Gathered data may be time specified or specify by the time period.

Survivability issues: Survivability is the ability of a routing to achieve its target with limited power. These issues are mainly:

- ***Scalability:*** Networks should be scalable, and they should be able to adapt to changes in topology and node density.
- ***Distribution of the storage load*****:** Sensing data maintained by the nodes and can be left, if these nodes make the network to be dead.
- ***Heterogeneity of devices****:* In this nodes are heterogeneous. Heterogeneity is an important impact on the network activities and its result is compared to Homogeneous nodes.

Resources consumption issues: Energy efficient approaches address the resource constraints of wireless sensor networks. Some of the resources consumptions are:

- ***Bandwidth consumption***: Bandwidth will not be same for all over the lifetime of the network.
- ***Energy consumption***: Nodes are battery powered one and there are few behavior to consumed energy like data processing, data transmission activities and data sensing consumed the power of the battery. There are five solutions to Balance the energy consumption. They are, Deployment optimization, Mobile Sink and Mobile relay Nodes, topology control, Data aggregation, Energy balance routing.

LIMITATIONS OF WSN

There are several limitations are used in WSNs for clustering schemes they are:

• **Network Lifetime**: The limitation of energy on nodes results in a limited network lifetime. Proper clustering attempt to reduce the energy usage, and increase network lifetime.

• **Limited Abilities**: The physical size and small amount of stored energy in a node limits many abilities of nodes in terms of processing and communication abilities.

• **Limited Energy**: Wireless sensor nodes are off-grid i.e., they have limited energy, this energy will be vital to determining the range of suitable applications for networks. The energy in sensor nodes must be considered as a proper clustering and it can reduce the overall energy usage in a network.

• **Application Dependency**: Given application will rely heavily on cluster organization. While designing a clustering algorithm, application robustness must be Consider as a good clustering.

FEATURES OF WSNS

Wireless sensor network have different features for designing energy efficient routing algorithms. These features can be used and compare with different protocols and algorithms, they are as follows:

• **WSNs vs. Ad-hoc Networks:** WSNs is a kind of adhoc Network. It is cooperation based and infrastructure-less based networks. Sensor nodes are more limited in capabilities and are deployed more with ad-hoc networks.

• **Location-aware vs. Location-unaware Sensors:** Nodes can be a location-aware or location-unaware. Location-aware nodes know their position of the network using GPS-capable antenna; location-unaware sensors do not know their position. Distributed algorithms can be used for location-unaware, whereas centralized algorithms can be used for location-aware sensors.

• **Data Gathering:** The sensor nodes have processing ability in WSN. It can carry out simple data gathering procedures and transmit only the required processed data to the next sensor.

• **Homogeneous vs. Heterogeneous Sensors:** WSNs can be categorized as either heterogeneous or homogeny networks. Homogeneous networks have similar processing and communication abilities and in Heterogeneous networks, the battery processing, communication and capabilities of sensor nodes can vary. In particular, their hardware design can be varied.

• **Scalability:** Scalable algorithms are a wide range of energy efficient. WSNs consist of a large number of sensors spread over a wide geographical area and this node is in the order of hundreds to millions depending on their applications. Designing scalable routing protocols is crucial for a wide range of WSNs. Single-hop algorithms are more scalable than multi-hop algorithms.

• **Proactive vs. Reactive Networks:** Sensor networks can be classified into proactive and reactive networks based on their final targets. The proactive networks monitor the area and deliver the sensed data to the sink. The reactive networks are well suited for real-time applications.

• **Single-hop vs. Multi-hop Networks:** It is based on the number of hops from sensors to sink, In WSN; it can be divided into single-hop and multi-hop networks. In single-hop networks, sensors directly deliver the sensed data to the sink. In multi-hop networks, sensors transmit the sensed data to the sink using intermediate nodes. In multi-hop, nodes operate in the main paths for other nodes and thus, energy might drain quicker than others.

DESIGN PHILOSOPHY

Design goals for traditional networking provide than a basis for the design in WSN. Clustering algorithms play a vital role for a given implementation. There are several attributes they are,

• **Cost of Clustering:** Clustering plays a vital role for organizing the sensor network topology for Communication and processing tasks needed for the creation and maintenance of the Clustering topology.

• **Selection of Cluster heads and Clusters:** The clustering concept offers marvelous benefits for wsn. When designing a particular application, designers must carefully examine the formation of clusters in the network. Depending upon the application, certain requirements of nodes in a cluster and its physical size play an important role in its operation.

• **Real-Time Operation:** Lifetime of data is a fundamental concept for designing Wsn. Receiving data is sufficient for analysis, but delay is not an important issue. The time required for cluster recovery mechanisms must also be taken into account.

• **Synchronization:** Wireless Sensor Networks is the limited energy capacity of nodes. Slotted transmission schemes such as TDMA, allow nodes to schedule sleep intervals to minimize the energy. Such schemes require synchronization to setup and maintain the transmission Schedule. It will have a considerable effect on network lifetime and the overall network performance.

• **Data Aggregation:** Wireless sensor networks are the ability for data aggregation to occur in the network. Data aggregation allows the differentiation between sensed data and useful data. The power required for processing tasks is substantially less than the communication Tasks. Many clustering schemes Provide data aggregation capabilities, and as such, the requirement for data aggregation.

• **Repair Mechanisms:** It often to node mobility, interference and node death. All of the situations can result in link failure, the mechanisms in place for link recovery and reliable data communication.

• **Quality of Service (QoS):** The overall QoS network requirements in Wsn are more. Many of these requirements are application dependant such as acceptable delay and packet loss tolerance, Implementations can vary widely in terms of the metrics.

PERFORMANCE PARAMETERS

1) Node Density

Many algorithms are perceptive to node density. Hop-count based algorithms require high node density so only the number of hops approximation of the distance is correct. When designing or analyzing an algorithm, it is important to consider the algorithm in terms of node density.

2) Cost

Normally the cost of an algorithm includes computation cost hardware cost, and communication cost. Hardware Cost includes the node density, reference nodes and measurement equipment. Communication cost consists of two parts communication between nodes, inter-node communication and Base Station (BS) or Central Server. Unfortunately this communication cost consumes more energy as compared to inter-node communication or computation cost.

3) Beacon Nodes

Beacon nodes are nodes which know their coordinates by the use of additional hardware such as a GPS receiver. It has a strong effect on the localization. Drawback of using beacon nodes is hardware cost, because GPS receivers are very expensive. Benefit of using beacon nodes is it can easily get global coordinates.

4) Accuracy

Accuracy is most essential part of Localization algorithm in WSN and it is deployed to perform monitoring tasks such as search, rescue, and disaster relief, target tracking etc. Localization algorithm should give exact location.

DISTRIBUTED CLUSTERING ALGORITHMS

Distributed clustering algorithms can be used for location-unaware sensors, these sensors are not aware of the network position and all of the routing decisions. A number of well known distributed routing clustering algorithms for WSNs are as follows:

ISSN: 0975-8585

1) Low Energy Adaptive Clustering Hierarchy (LEACH)

One of the most well-known clustering algorithms for WSNs is LEACH. It is energy based approach for WSN and it is a popular algorithm because of its clarity and efficiency. LEACH is one of the hierarchical routing protocols which is used in WSN to increase the life time of a network and it performs self-organizing and re-clustering functions for every round Initially Cluster Head (CH) is selected which collects the data of the cluster member and add own data. So, LEACH suffered from energy dissipation problem and no appropriate CH selection approach. It introduces the rotation theory. In LEACH algorithm, the lifetime is divided into a number of rounds. Each round contains stable phases and set-up. In the set-up phase, the CHs are elected and the clusters are shaped. In the LEACH algorithm, the CHs aggregate the collected data in order to decrease the amount of transmitting data and the consequent energy cost. LEACH shows in Fig. 2

i) Sink represented by triangle.
ii) Cluster head represented by rectangle.
iii) Member nodes represented by oval.

LEACH provides a balancing of energy usage by random rotation of clusterheads. The role of a CH is rotated periodically in the nodes in order to balance the load. The rotation is performed by getting each node to choose a random number ‘‘T’’ between 0 and 1. A node becomes a CH for the current rotation, if the number is less than the following threshold then,

$$T(n) = sf(n) \times \frac{p}{1 - (\frac{cHeads}{numNodes})}$$

Where p is the desired percentage of CH nodes, r is the current round number, and G is the set of nodes. Data-fusion can be performed as in LEACH for communication. A cluster is still scheduled using TDMA time-slots.

LEACH routing protocol makes WSN scalable and robust and it reduces the energy dissipation by following features they are, reducing the number of transmission, reducing the date to transmit through compression technique, Increase the life time of all nodes in Fig. 2.

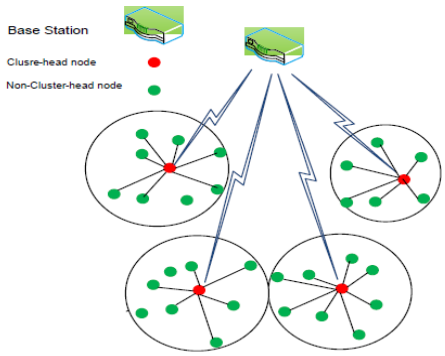

Fig. 1. LEACH

Fig: 2 Block diagram of LEACH

There are different types of protocols are used in LEACH; some of them are as follows:

a) S-LEACH

In Solar-aware Distributed LEACH (SLEACH) some nodes are used by solar power and that nodes act as CHs which mainly depend upon the solar status. Both LEACH and LEACH-C are extended by SLEACH. In Solar aware Distributed LEACH, CH is given to solar driven nodes. The probability of solar-driven nodes is higher than battery driven nodes.

ISSN: 0975-8585

$$T(n) = sf(n) \times \frac{p}{1 - (\frac{cHeads}{numNodes})}$$

Where, sf(n) is equal to 4, P denotes the percentage of optimal CHs. CH specifies the number of CHs.

b) M-LEACH

Multi-hop leach is comes from the LEACH, When network length is increased then distance between CH and BS is increased extremely. This scenario is not suitable for LEACH routing protocol because BS is at single-hop to CH. In this case, energy dissipation of CH is not reasonable. Multi-hop LEACH is another type of LEACH routing protocol to increase energy efficiency of WSN. It is also complete distributed clustering based routing protocol. Multi-Hop LEACH allows two types of communication one is inter-cluster and another one is intra-cluster. Multi-Hop LEACH selects the best path with a minimum hop-count between the first CH and BS.

c) LEACH-F

It is one of the improved versions of LEACH protocol. It includes fixed number of clusters and rotating cluster heads. The clusters are formed once and it fixed within the cluster, the CH position rotates among the nodes. There is no set-up overhead in the LEACH, since clusters are formed only one time in the beginning of each round and it does not allow any new nodes.

d) E-LEACH

Energy-LEACH protocol improves the Cluster Head selection procedure. LEACH is improved by the energy-LEACH. Residual energy of node is taken as a main which decides the nodes for CH. The main operation of E LEACH is divided into rounds. In the initial round cluster head is formed randomly. In the next rounds, the residual energy of each node is different and it is considered for the selection of the CHs. each node is different and this node will have high residual energy.

e) V-LEACH

V-LEACH is an enhancement in LEACH Protocol in order to reduce energy consumption. The main concept of V-LEACH is to have a CH in the cluster, which takes the role of the CH when another CH dies. It is possible for cluster nodes that the data will always reach the BS.

f) H-LEACH

Hierarchical LEACH (H-LEACH) is considering the concept of energy conservation by minimizing or reducing the communication distance between the nodes. During initial phases the same clustering approach is used as LEACH and by further clustering is used as the cluster heads, one of the cluster head is selected which acts as the Master Cluster Head (MCH) to forward the data to the base station. So, only one of the MCH is involved to transmit all the compressed data to the base station, when the MCH is dead, central point of failure situation may occur.

g) TL-LEACH

Two-level hierarchy (TL-LEACH) is an extension of the LEACH protocol. It uses adaptive, self-configuring and randomized cluster formation. Localized control for data transfers is used to achieve the energy and latency efficiency. A CH collects the data from the member nodes, it uses an integral part of the CHs that lies between the CH and the Base Station. In this two types is used top CHs called primary cluster heads and secondary cluster heads represents the second level and this LEACH algorithm consists of four phases they are cluster setup phase, schedule creation phase , advertisement phase and data transmission phase. In this LEACH CH sends the data to the base station in one hop.

2) Threshold sensitive Energy Efficient sensor Network (TEEN)

It is an algorithm which is used to design the re-active networks and it is a hierarchical protocol. TEEN protocol hybrids this technique with a data-centric approach. The nodes sense their environment regularly and contionusly, since the data transmission is less and also the energy consumption is less than that the proactive network. For time-critical applications, a reactive network is more suitable event and reported to the sink and it proposes an efficient approach in terms of energy and suitable real time applications, and it is not suitable for regular data gathering applications. It provides a trade-off between the energy consumption and accuracy applications. This protocol uses 2-tier clustering topology and two thresholds. In order to trade-off between data accuracy, energy efficiency and response time, a communication protocol TEEN has been proposed. In TEEN two types of threshold is used hard threshold and soft threshold. The Adaptive Threshold sensitive Energy Efficient sensor Network protocol (APTEEN) is an extension or advanced method to TEEN and it targets also both reactive and proactive networks. TEEN gives the best performance and analysis while decreases the number of transmissions.

Benefits of the Scheme: Both hard and soft threshold values can be adjusted in order control the number of transmissions and TEEN is not a good choice for periodic applications. The main drawbacks of TEEN and APTEEN is the overhead and complexity of clusters in multiple levels.

3) Hybrid Energy-Efficient Distributed (HEED)

It is another clustering algorithm which offers uniform distribution of Cluster Head over the network. HEED considers the sensors of residual energy. In HEED two sensors are used as a neighbor sensor and they are within the power range. It is a multi-hop clustering algorithm for Wsn on efficient clustering by a selection of clusterheads based on the distance. The main objectives of HEED is to

- To Minimize the control overhead of the network.
- Distribute the energy consumption to prolong the network lifetime.
- To minimize the energy during the clusterhead selection phase.

The clusterheads are determined based on two important parameters in wsn, they are:

1) The residual energy of the node is used to choose the initial set of clusterheads.

2) Intra-Cluster Communication Cost is used to

Determine the cluster to join. The intra-cluster communication cost is measured by using the Average Minimum Reachability Power (AMRP). HEED has three main characteristics they are:

- The probability of two nodes within each transmission range becoming CHs is small.
- Energy consumption is not assumed to be uniform for all the nodes.
- From a given sensor's transmission range, the probability of CH selection can be adjusted to ensure inter-CH connectivity.

4) Stable Election Protocol (SEP)

It is a clustering algorithm which is designed for heterogeneous network. This will assume a percentage of sensors and that sensors are powerful sensors and equipped with more battery power. In SEP, the powerful sensors have more chance to be elected as CHs. In SEP the ordinary sensors have a smaller chance to elect as the CHs. These algorithms extend the stable-phase of the network and depending on the percentage and the initial energy of the powerful and super nodes.

5) Bayesian algorithm

It is energy efficiency Optimization routing protocol which uses the Bayesian game theory. Here, the network life time is divided into three steps including: In the initial step, the sink broadcasts the initial information to all of the sensors, and in the CHs election step, each sensor will broadcasts an amount of its

information such as its residual energy, Then, Each sensor forms a routing protocol table containing its routing information. In this algorithm, the average amount of a hop from the sensors to the sink is considered as a real-time property and this algorithm shows a high reliability. However, this algorithm does not seem efficient energy enough again. If the sink is distant away from the network edge due to the large amount of message passing between sensors.

6) Power-Efficient Gathering Sensor Information Systems (PEGASIS)

This is an routing algorithm for WSNs. It is used to form a cluster and forms a chain from sensors to sink. Here the sensors are greedy algorithm in order to form a chain. All data are aggregated in one node and that node transmits the aggregated data to the sink. It needs multi-hop data to Transmit from sensors to the sink. This leads to a packet delay problem. Every sensor transmits its data to one of its neighbors. PEGASIS is a distributed algorithm with energy load distribution. Every single node needs to achieve the global topology. In PEGASIS, the locations of all nodes are random, which has the ability for positioning, data detection, data fusion and wireless communication. This is a chain based protocol which provides LEACH algorithms. Here each node communicates with a close neighbor and transmitting to the BS. Using greedy algorithm, the nodes will be organized to form a chain. After that BS can compute this chain and broadcast it to all the sensor nodes.

7) Energy-Efficient Multi-hop Hierarchical Routing (EMHR)

It is multi hop data transmission approach. And depends on energy levels to prolong the lifetime. Energy is the important side to extend the life of the node in the network. The cluster head is selected based on the maximum energy in the nodes. Single hop and multi hop network depends on the distance from one CH to the other CH end.

Suppose sink node has effective communication distance from the cluster head, then it directly transmits the data to the sink. The EMHR is more efficient and best than LEACH on the basis of unbalance energy depletion and prolong the life time.

8) Self Organizing Protocol (SOP)

It considers CH-to- CH multi-hop data to transmit from CHs to the sink for the energy dissipation in the network. In SOP, the clusters are shaped, and then CHs organize a multi-hop. Each sensor transmits their data into its CH directly and that will transmit its data to the Sink. SOP has more energy efficient than LEACH. It is designed to build the interconnection links between sensor nodes. A self organizing clustering protocol is based on persistent algorithm. It provides protocol and its protocol performance is comparing with simulation results with timer based approach. Although it has a higher message complexity due to extra messages, it need to generate inter-cluster links, then the new protocol have a better clustering performance and operates well in low node densities. Configuration is much faster in the network and the network size will be increased.

9) Adaptive algorithm

It is a distributed hierarchical Clustering algorithm which reimbursement from a message passing technique in order to shape equal clusters. In this algorithm, a number of messages are exchanged between numbers of sensors to find out their position across the Network. Then more number of equal clusters is shaped by choosing proper CH positions. This algorithm is compared with LEACH-C and LEACH in terms of the energy efficiency and to show the outperformance. Sometimes this will comes under the centralized algorithm. However, this algorithm includes a large amount of slide in the set-up phase due to the high volume of message passing.

CENTRALIZED CLUSTERING ALGORITHMS

Centralized clustering algorithms can be used for location aware sensors. It is aware of the network position and all the routing decisions can be made in central locations. In Centralized algorithms can be done in central server, and it resolves computational limitations of the nodes. Here nodes will communicate to BS, unfortunately the communication consumes more energy than computation. In this algorithm only Inter node

communication is used and it consumes less energy as compared to communication cost in centralized algorithm. A some of the well-known centralized routing algorithms for WSNs are as follows:

1) Centralized LEACH (LEACH-C)

It was proposed by the LEACH. Each sensor knows its position in the network and the position of CHs are selected in an optimum method. LEACH C showed up to 40% outperformance for energy efficiency.

2) Power Efficient and Adaptive Clustering Hierarchy (PEACH)

This is a centralized probabilistic multi-level algorithm. In this algorithm, each sensor can acquire the source and destination of packets. Based on this information, this algorithm can shape the clusters without a number of clusterheads such as advertising, joining, and synchronizing. PEACH reduces the message communication costs, improved the energy consumption and network lifetime.

3) Fuzzy Logic algorithms

It is a centralized algorithms proposed for WSNs. In these algorithms, CHs are selected in the sink by employing fuzzy logic theories. These algorithms use three factors; they are centrality, density, and residual energy. In the meantime these three factors are distance of sensors from the sink.

4) Weighted Clustering Algorithm (WCA)

This algorithm is a non-periodic procedure for CH selection. It is invoke on demand every time of a reconfiguration of the network's topology is necessary. A new election is invoked in every time and a sensor loses the connection with any of the CH, thus it will save the power. WCA is based on a grouping of metrics that take into account with several system parameters such as: the ideal node degree; transmission power; mobility; and the remaining energy of the nodes. Depending on the specific application, any or all of these parameters can be used as a metric to elect CHs. The election procedure is based upon a global parameter that is called combined weight.

5) PSO-C: Centralized-PSO

Authors proposed centralized-PSO algorithms, in which the nodes which have energy above average energy resource are elected as the cluster heads. In this authors also compare this algorithm with LEACH protocol and with LEACH-C. Simulation results show that PSO outperform to LEACH and LEACH-C in term of network life time and throughput etc. It also outperforms GA and K-means based clustering algorithms.

CONCLUSION

Wireless sensor networks have significant consideration more than the past decade because of the brisk advances in their technologies. In this survey paper, different energy efficient is available for each routing Algorithms is described and presented. Moreover, their strengths and limitations are also presented for all routing algorithms. In addition, different clustering energy efficient protocols and data collection protocols which are commonly been used in WSNs are presented in brief. The advantage and Techniques used in these protocols are highlighted. The comparisons of the protocols on different parameters will results provided by authors such as clustering approach, selection of cluster head etc. are described in this paper. It is observed that every abbreviation has its own advantages over others in terms of networks lifetime, battery life, data transmission and sensing techniques etc. It is difficult to single out any one that will be suitable in all environments.

RFERENCES

[1] F. Zhao and L. Guibas, Wireless Sensor Networks: An Information Processing Approach. Morgan Kaufmann, 2004.

[2] W. Heinzelman, A. Chandrakasan, and H. Balakrishnan, “An application-specific protocol architecture for wireless micro sensor networks,” IEEE Transaction on Wireless Communications, 2002, vol. 1, no. 4, pp. 660–670.

[3] Wen-Wen Huand, Min Yu, Li-Qiong Xiong and Jian Wen, “Energy- Efficient Hierarchical Routing protocol for Wireless Sensor Network,” IEEE Pacific-Asia Workshop on computational Intelligence and Industrial Application,2008,doi:10.1109/PACIIA.2008.79.

[4] Kennedy J, Eberhar R C. Particle Swarm Optimization. Proceedings of the IEEE International Conference on Neural Networks. Iscataway: IEEE Service Center,1995,pp1942-1948.

[5] Li-shan Kang, Yun Xie, etal, simulated annealing algorithm, Science Press, Beijing, 1994 (in Chinese).

[6] I. F. Akyildiz, S. Weilian, Y. Sankarasubramaniam, and E. Cayirci, “A Survey on Sensor Networks,” IEEE Communications Magazine, vol. 40, no. 8, pp. 102–114, 2002.

[7] M. Zanjireh, A. Kargarnejad, and M. Tayebi, “Virtual Enterprise Security: Importance, Challenges, and Solutions,” WSEAS Transactions on Information Science and Applications, vol. 4, no. 4, pp. 879–884, 2007.

[8] C. Perera, A. Zaslavsky, P. Christen, and D. Georgakopoulos, “Sensing as a Service Model for Smart Cities Supported by Internet of Things,” Transactions on Emerging Telecommunications Technologies, vol. 25, no. 1, pp. 81–93, 2014.

[9] C. Tselikis, S. Mitropoulos, N. Komninos, and C. Douligeris, “Degree- Based Clustering Algorithms for Wireless Ad Hoc Networks Under Attack,” IEEE Communications Letters, vol. 16, no. 5, pp. 619–621, 2012.

[10] W. R. Heinzelman, A. Chandrakasan, and H. Balakrishnan, “Energy- Efficient Communication Protocol for Wireless Micro sensor Networks,” in 33rd Annual Hawaii International Conference on System Sciences, 2000.

[11] M. Reddy, P. Jagadeeswara, S. Prakash, and P.Chenna Reddy, “Homogeneous and heterogeneous energy schemes for hierarchical cluster based routing protocols in WSN: A survey,” in Proc. 3rd Int. Conf. Trends Inf., Telecommun. Comput., vol. 150, Lecture Notes in Electrical Engineering, 2013, pp. 591–595.

[12] B. Li, H. Li, W.Wang, Z. Hu, and Q. Yin, “Energy-effective relay selection by utilizing spacial diversity for random wireless sensor networks,” IEEE Commun. Lett., vol. 17, no. 10, pp. 1972–1975, Oct. 2013.

[13] L. Xie and P. R. Kumar, “Multisource, multidestination, multirelay wireless networks,” IEEE Trans. Inf. Theory, vol. 53, no. 10, pp. 3586–3595, Oct. 2007.

[14] S. Pollin *et al.*, “Optimizing transmission and shutdown for energy efficient real-time packet scheduling in clustered *ad hoc* networks,” EURASIP J. Wireless Commun. Newt., vol. 2005, no. 5, pp. 698–711, Oct. 2005.