A Brief Review on Energy Based Clustering in Wireless Sensor Networks

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Abstract-Now-a-days, WSN is considered as one of the developing innovation since it extraordinarily helps individuals by offering sensing, processing and communication capacities and empower people to have a nearly collaboration with the earth wherever they go. Wireless Sensor Networks WSNs are unique networks comprise of gadgets (sensor nodes) in expansive numbers and spatial dispersion. They have different sensing capacity and collaborate to achieve regular assignment. Clustering is a standout amongst the best techniques used to take care of the issue of energy utilization in WSNs. Here, every one of its hubs incorporate handling capacity, products sorts of memory, RF handset, power source and further it even suit an assortment of actuators and sensors.

Keywords-Wireless Sensor Network, density, Energy clustering, data Aggregation.

I. INTRODUCTION

Wireless Sensor Network (WSN) is a fast growing and stirring research area which has attracted considerable research attention. These networks are widely used in various applications such as industrial, medical, military and home networks. Simply these networks are a new class of distributed systems which is an essential part of physical space they inhabit. Generally the wireless sensor devices are considered as the battery-operated device and have an ability of sensing physical quantities. Apart from sensing, this network is capable of data storage, wireless communication and partial amount of computation and signal processing.

WSN mainly includes a huge number of wireless-capable sensor devices that works collaboratively in order to attain a common objective. This network will either include one or more base stations (or sinks) that gathers information from all sensor devices. Moreover, these sinks are the interface by which WSN interacts with outside world. Within this network there are numerous techniques to transfer the data from one sensor node to another. In-network aggregation is one of the important techniques in WSN, which process the data at intermediate nodes and routing the information through the network.

Basically the sensor network comprises sensor field, where the sensor devices or nodes are scattered in this field. Here, each of these nodes will have the capability to gather information and then route information back to sink and end users. With the help of multi-hop infrastructure and less architecture the information is routed back to the final user through sink as shown in figure 1.

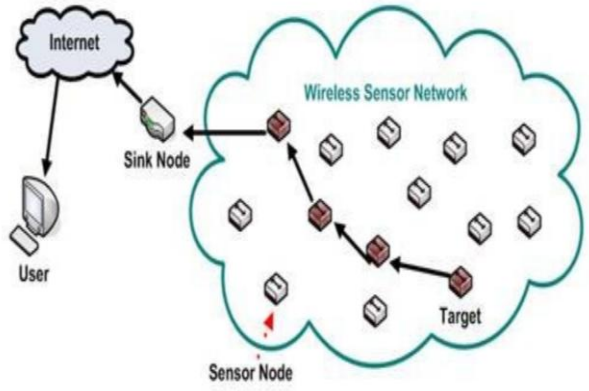

Fig.1 Wireless Sensor Network.

Here in this network the sink send commands or queries to other sensor node in sensing region, on other hand sensor node collaborate to achieve the sensing task and send sensed information to sink. In the meantime, sink even serve as gateway to outside networks. Further sink gathers information from sensor nodes, and executes simple processing on collected information and then sends relevant data to end user through internet whoever made request to make use of the information. Each of the sensor nodes makes use of single-hop long-distance transmission to send information to sink.

Data Aggregation

It is just a process of aggregating the sensor information through aggregation approaches. This technique was mainly utilized to resolve both overlap and implosion problem in data centric routing. In data aggregation the sensor network is generally supposed as reverse multicast tree. Here, sink request the sensor nodes to study ambient condition of phenomena. In this process, generally the information that is coming from several sensor nodes are aggregated in such a way that they are about same attribute of phenomenon once it reach the same routing node on way back to sink.

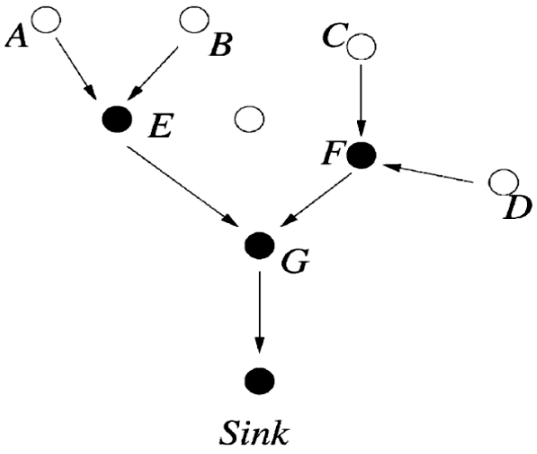

Fig. 1.2 An example of data aggregation.

In order to get a clear idea on data aggregation let us consider seven sensor nodes 'A', 'B', 'C', 'D', 'E', 'F', 'G' and a sink node. Initially, sensor node 'E' aggregates the information from both 'A' and 'B' sensor nodes. In the same way node 'F' aggregates data from 'C' and 'D' sensor nodes. According to, data aggregation is professed as the set of automated methods of merging the information which comes from several sensor nodes into set of meaningful data. In other way this process is also called as data fusion. Based on this point, 'G' node gathers information from 'E' and 'F' and finally sends the data to sink node.

Density and Energy Clustering in Wireless Sensor Networks

In clustering, the sensor nodes are partitioned into different clusters. Each cluster is managed by a node referred as cluster head (CH) and other nodes are referred as cluster nodes. Cluster nodes do not communicate directly with the sink node. They have to pass the collected data to the cluster head. Cluster head will aggregate the data, received from cluster nodes and transmits it to the base station. Thus minimizes the energy consumption and number of messages communicated to base station. Also number of active nodes in communication is reduced. Ultimate result of clustering the sensor nodes is prolonged network lifetime.

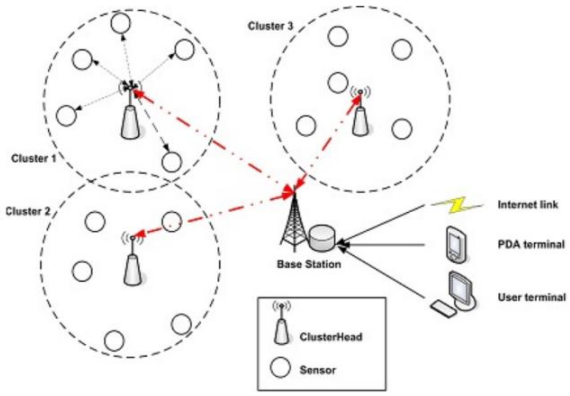

Fig. 1.3 Clustered Sensor Network.

Sensor Node: It is the core component of wireless sensor network. It has the capability of sensing, processing, routing, etc.

Cluster Head: The Cluster head (CH) is considered as a leader for that specific cluster. And it is responsible for different activities carried out in the cluster, such as data aggregation, data transmission to base station, scheduling in the cluster, etc.

Base Station: Base station is considered as a main data collection node for the entire sensor network. It is the bridge (via communication link) between the sensor network and the end user. Normally this node is considered as a node with no power constraints.

Cluster: It is the organizational unit of the network, created to simplify the communication in the sensor network.

During clustering, the sensor nodes of a WSN are isolated into diverse virtual groups. They are apportioned geologically nearby into the same cluster as per some set of guidelines. In clustering, sensor nodes work either as a cluster- head or a member node. A CH serves as a local coordinator for its cluster, by performing data aggregation and inter-cluster transmission. The CHs can combine the data and send it to the server as a solitary packet, thus diminishing the overhead from packet headers.

II. LITERATURE SURVEY

Sr. No.	Title	Author	Year	Approach
1	Density, distance and energy based clustering algorithm for data aggregation in wireless sensor networks	H. Lin, R. Xie and L. Wei	2017	In this paper, author proposes high event density area centered clustering based routing (HEDACR) for efficient energy consumption in WSN. HEDACR forms a high density tree based cluster centered at the high event density area.
2	Preserving data and key privacy in Data Aggregation	V. Akila and T. Sheela	2017	In this paper, author proposes a new approach to attain data and key privacy protection in data

	for Wireless Sensor Networks			aggregation called Preserving Data and Key Privacy in Data Aggregation for Wireless Sensor Networks (PDKP).
3	Data Aggregation Scheme Based on Compressive Sensing in Wireless Sensor Network	B. Sun, C. Ma, X. Jin and Z. Ma	2016	The research and analysis show that the proposed algorithm has better performance in amount of data being transferred and energy consumption.
4	An energy-efficient and density -aware clustering for WSNs	A. A. Khamiss, S. Chai, B. Zhang, J. Luan and Q. Li	2014	In this paper, density-aware clustering algorithm that based on region density and uses fuzzy clustering technique in cluster formation is proposed .The cluster head selection method depends on intra and inter-communication distances in addition to residual energy. It is cluster-based, centralized, single-hop routing method.
5	An approach to improved energy efficient hybrid clustering in wireless sensor networks	A. Patra and S. Chouhan	2014	In this paper, author introduces a cluster head (CH) selection process and cluster formation algorithm by re-selection of CHs called Improved Energy Efficient Hybrid Clustering Scheme (IEEHCS).
6	Mobility aware reputation node ranking (MARNR) for efficient clustering at hot spots in wireless sensor networks (WSN	P. J. Balaji and S. Anandamurugan	2013	The proposed scheme is to present Mobility Aware cluster head selection in the hotspots of WSN. This calculates node reputation to have better cluster head. Ranking is made based on both node reputation and its mobility rate.
7	Design and implementation of high event density area centered clustering based routing	B. Jeon, B. Kang and S. Park	2012	In this paper, Author propose high event density area centered clustering based routing (HEDACR) for efficient energy consumption in WSN. HEDACR forms a high density tree based cluster centered at the high event density area.

H. Lin, R. Xie and L [1] Wireless sensor networks (WSNs) are wireless networks which consist of distributed sensor nodes monitoring physical and environmental conditions. Due to the energy limit of sensor nodes, prolonging lifetime of wireless sensor networks (WSNs) is a big challenge. In this paper, author propose a new clustering method called Density, Distance and Energy based Clustering (DDEC) to improve network performance. DDEC partitions the network into clusters with similar member number, so as to achieve load balancing. Then a cluster head is selected for each cluster based on three criteria: residual energy, distance and density, which achieves to minimize intra-communication cost and prolong cluster lifetime. In our performance analysis, author compare DDEC with another clustering method called DDCHS. The results show that DDEC outperforms DDCHS in terms of alive node number and energy consumption.

V. Akila and T. Sheela [2] Reliable and trustful data aggregation is needed for most application in Wireless Sensor Networks. In this paper, author propose a new approach to attain data and key privacy protection in data aggregation called Preserving Data and Key Privacy in Data Aggregation for Wireless Sensor Networks (PDKP).Existing privacy preserving protocol provide more computational and communicational overhead in the sensor nodes. It increases the consumption of energy among the nodes. In our scheme, the encrypted content of the data is shared without revealing the data and key to other nodes by using simple technique. It preserves the key and data from an adversary with less computational and communication overhead. The base station can identify the distrustful groups related to the set of group aggregates and the retransmission of data is performed only for the abnormal data sensing intermediate nodes. It preserves the various security issues such as data freshness, data integrity, data confidentiality in data aggregation. Our simulation result showed that implementation of PDKP reduces the communication overhead and increases energy efficiency.

B. Sun, C. Ma, X. Jin and Z. Ma [3] A layered efficient data aggregation scheme based on compressed domain is presented and implemented to overcome the problem of

excessively high amount of data transmission and excessive energy consumption in wireless sensor networks. Sensor networks are configured and their nodes are arranged in a hierarchy of multistage clusters. On this structure, collecting clusters in different levels perform the compressed sampling and transmit the compressed data to their parent clusters. Then the data fusion based on compressed domain is carried out by the parent collecting clusters and the data is continued to be sent to the upper layer, until the top cluster head node is reached, and the final data is recovered. The research and analysis show that the proposed algorithm has better performance in amount of data being transferred and energy consumption.

A. A. Khamiss, S. Chai, B. Zhang, J. Luan and Q. Li [4] Wireless Sensor Networks are sets of thousands or more of sensor nodes with very small size and limited energy, scattered over particular area to sense a certain physical phenomenon. Energy constraints are the most important challenge for these networks to work efficiently for long time. Most existing clustering algorithms are applied without considering the density of region. In this paper, density-aware clustering algorithm that based on region density and uses fuzzy clustering technique in cluster formation is proposed .The cluster head selection method depends on intra and inter-communication distances in addition to residual energy. It is cluster-based, centralized, single-hop routing method. The simulation results show that the algorithm can balance the energy load between nodes, reduce energy consumption and prolong the stability period and life time of network compared to traditional LEACH-C.

A. Patra and S. Chouhan [5] In wireless sensor networks (WSNs), hierarchical clustering approach gives an efficient solution to achieve the goal of maximizing the network lifetime by minimizing energy utilization. In this paper, authors introduce a cluster head (CH) selection process and cluster formation algorithm by re-selection of CHs called Improved Energy Efficient Hybrid Clustering Scheme (IEEHCS). In the proposed scheme, energy efficient CHs are selected by a centralized algorithm based on remaining energy, node density and minimum separation distance to reduce the control message overheads. The key idea is that the CH role is repeated with the same settings or shifted to a eligible member nodes instead of re-clustering the whole network at every round. In this way, IEEHCS reduces the frequency of updating CHs, avoids unnecessary re-clustering in every round and saves significant amount of node energy. Simulation results demonstrate that IEEHCS effectively reduces the energy consumption and prolongs the network lifetime for first node death upto 45.39% and 11.36% over LEACH-C and EEHCS, respectively, in certain network settings.

P. J. Balaji and S. Anandamurugan [6] Wireless sensor network generate hotspots because of heavy traffic load at certain locations. Nodes in hotspots lose energy resources quickly and disrupt network services. The Cluster head (CH) gets more burdens in gathering and relaying information. Relay load on CH gets increased as distance to sink decrease. CH role is articulated across all nodes to balance traffic load and energy consumption. The existing work presented distributed energy efficient clustering algorithm that determine suitable cluster size based on the listed factors. Hop distance to data sink, Equalization of node lifetime, reduced energy consumption levels. This design energy efficient multi-hop data collection protocol is to calculate end to end energy consumption. The proposed scheme is to present Mobility Aware cluster head selection in the hotspots of WSN. This calculates node reputation to have better cluster head. Ranking is made based on both node reputation and its mobility rate. This also increases the clustering efficiency in terms of cooperativeness and mobility of sensor nodes. However, certain sensor nodes have high mobility. In addition certain nodes unwilling to serve the network, the proposal present Mobility Aware Reputation Node Ranking (MARNR) technique to improve the efficiency of clustering at hot spot regions. MARNR identifies the senor nodes mobility rate. Each node serving the region as cluster is identified from the cache. This ensures the node should have minimal mobility threshold and high cluster head rank probability. Simulation is carried out to evaluate performance of EC in terms of Network life time, Energy consumption, Mobility rate, CH ranking, Node reputation Count, Hot spot density, Cluster Size.

B. Jeon, B. Kang and S. Park [7] Energy consumption is the most important issue in a wireless sensor network (WSN). As the WSN scale increases, the required energy consumption and bandwidth are increased. In this paper, authors propose high event density area centered clustering based routing (HEDACR) for efficient energy consumption in WSN. HEDACR forms a high density tree based cluster centered at the high event density area. The main idea of HEDACR is to form a multi-hop short distance routing path and for all sensors to participate in the data transmission to diffuse energy consumption for data transmission. authors developed the environmental data gathering and aggregation sensor (EGAS) to realize HEDACR. authors experimented on HEDACR in a test bed. The result of experiment indicates that HEDACR reduces the energy consumption and extends the network lifetime as compared with LEACH using one-hop.

III. PROBLEM IDENTIFICATION

Wireless sensor networks are special kind of wireless networks due to its constraints and application specific characteristics. Consequently, WSNs pose different

research challenges. In a wireless communication system, cost and other application specific issues affect the communication properties of the system. For example, radio communication in WSN is considered as low power and short range contrasted with some other wireless communication system. The system performance characteristics vary considerably in WSN even though the same fundamental principles of the wireless communication network are used in WSN.

IV. CONCLUSION

WSN incorporates vast number of sensor nodes which exchange the information starting with one framework then onto the next framework without making utilization of any wires. All these sensor nodes in the network are asset limitation, so due to this reason the lifetime of the network is constrained. Subsequently, different analysts work various conventions or methodologies for expanding the lifetime of the wireless sensor networks. In this implies, the information aggregation idea has been presented in this study as it is one of the imperative techniques that upgrades the network lifetime. These sensor gadgets are restricted with battery power and constrained stockpiling limit. Along these lines, authors have to increase the lifetime of the network by actualizing techniques like in-network data aggregation techniques.

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