

# Study on Different Topology Manipulation Algorithms in Wireless Sensor Network

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**Abstract**— Wireless sensor network (WSN) comprises of spatially distributed autonomous sensors to screen physical or environmental conditions and to agreeably go their information through the network to a principle area. One of the critical necessities of a WSN is the efficiency of vitality, which expands the life time of the network. At the same time there are some different variables like Load Balancing, congestion control, coverage, Energy Efficiency, mobility and so on. A few methods have been proposed via scientists to accomplish these objectives that can help in giving a decent topology control. In the piece, a few systems which are accessible by utilizing improvement and transformative strategies that give a multi target arrangement are examined. In this paper, we compare different algorithms' execution in view of a few parameters intended for every target and the outcomes are analyzed.

**Keywords**- Topology control; Wireless sensor networks; QOS.

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## I. INTRODUCTION

WSNs measure environmental conditions like temperature, sound, contamination levels, stickiness, wind pace and course, weight, and so forth. A WSN comprises of huge number of sensor hubs. The sensor hub gear incorporates a radio handset alongside a receiving wire, a microcontroller, an interfacing electronic circuit, and a vitality source, normally a battery. Sensor hubs can sense the target zone and gather the data and sent it to the dynamic hub. This transmitted information is then exhibited to the framework through Gateway connection. The fundamental Limitation in the WSN is the force shortage since these sensor hubs are worked on the little batteries. In numerous applications It is incomprehensible for to supplant the sensor hub when their vitality is depleted.

Topology control is the one of the approach to achieve energy conservation and to extend the lifetime of the wireless sensor network without degrading the network performance such as coverage, and connectivity. The topology control protocols primarily concern on energy conservation. Topology control process consists of two main phases First one is topology construction and the second one is topology maintenance. In topology construction main goal is building a topology to connect the network nodes based on topological property. The network topology can be dense or sparse.

The topology maintenance mechanisms are classified in three one is static, second is dynamic and the third one is hybrid approaches.

Static topology maintenance techniques calculate all different topologies during the first topology construction process. Dynamic topology maintenance techniques calculate a new reduced topology "on the fly", triggering the topology construction mechanism when necessary. Hybrid topology maintenance techniques use both, static and dynamic techniques. Hybrid techniques calculate all different reduced topologies during the first topology construction phase (static approach) but if the coming topology cannot be established because the sink has no connectivity with the nodes (dead topology), the mechanism finds a new topology on the fly

(dynamic approach). Energy-efficient topology control technique for wireless sensor network are classified in four groups: power-adjustment approach, power-mode approach, clustering approach, and hybrid approach. The coverage problem is one of the most fundamental issues in wireless sensor networks, which directly affects the capability and efficiency of the sensor network

In this paper, the next section covers the measurement of parameters, and the third section covers the literature survey the fourth section shows the comparison among the approaches and finally the fifth one explains the conclusion we derived from the comparison.

## II. MEASUREMENT OF THE PARAMETER

### A. Coverage

WSN consist of so many sensor nodes. This sensor node senses the target area and sent the information to sink node. A sensor node in the WSN is said to be covered if its Euclidean distance to sensor is within the sensing radius of the other sensor node. In most sensor network literature, every sensor node is assumed to have a fixed sensing accuracy and sensing. (The Coverage Problem in a Wireless Sensor Network Chi-Fu Huang Yu- Chee Tseng)

Given a set of sensor nodes  $S = \{s_1, s_2, s_3, s_4, \dots\}$  in a two dimensional area say  $A$ . Each sensor node  $S_i$  Where  $i = 1, \dots, n$  is located at coordinate position  $(x, y)$  inside  $A$  and has a sensing range of  $r_i$ . that is it can communicate any object within this area. A location in  $A$  is said to be covered by  $s_i$  if its within  $s_i$ 's sensing range. A location in  $A$  is said to be  $j$ -covered if it is within at least  $j$  sensors' sensing ranges.

### B. Energy Efficient

An energy-efficient topology construction algorithm for wireless sensor networks Javad Akbari Torkestani [5].

$$E_{Tn} = \min_{v \in T_i} \left[ \frac{1}{\min_{n \in T_i} \{E_{nj}\}} \right] \quad (1)$$

where  $\min_{v \in T_i} \{E_{nj}\}$  represent the energy of degree constrained CDS  $T_i$  subject to the constrained  $d$  (degree

constraint) and ET is the energy of optimal degree constraint CDS Tn

### C. Congestion control

In WSN congestion occur in the situation first one is all the sensor node are distributed densely. Second one is the application produces high flow rate near the sink node. This congestion may cause packet loss which in turn reduce the throughput and thereby reduce the energy. So the congestion control in the WSN is very important.( Priority-based Congestion Control in Wireless Sensor Networks, Chonggang Wang1, Kazem Sohraby1, Victor Lawrence2, Bo Li3, Yueming Hu4)

Congestion degree can be calculated by

$$d(i) = tsi / tai \quad (2)$$

tai=mean packet inter-arrival and tsi=mean packet service times.

### D. Load Balancing

Load Balancing in WSN is the balance the load in each cluster Head.( PratyayKuil, SuneetK.Gupta, PrasantaK.Jana [11])

$$\text{Minimize } L = [\max Li \forall gi \in G] \quad (3)$$

Where Li is the load produced by each sensor node to the each gateway gi.

### E. Navigation

In the Wireless Sensor Network the Navigation is the position estimation of target object in the particular area. Selection and navigation of mobile sensor node sensing a sensor network (Atul Verma, Hemjit Sawant, Jindong Tan [1])

In this paper the navigational control input of the mobile sensor node is given by

$$Fi = \sum_{n=1}^{mi} kipij \quad (4)$$

Where ki is the kinetic energy of mobile sensor node pij is the position of the sensor node. Fin = virtual navigation force generated by static sensor nodes. Mi is the total number of static sensor node.

Wherever Times is specified, Times Roman or Times New Roman may be used. If neither is available on your word processor, please use the font closest in appearance to Times. Avoid using bit-mapped fonts if possible. True-Type 1 or Open Type fonts are preferred. Please embed symbol fonts, as well, for math, etc.

## III. SURVEY

### A. Energy Efficiency

- Ruiyun Yu [14] uses Energy-efficient dominating tree construction (EEDTC) algorithm we propose is different from those in the previous execution processes. In the previous related papers, the algorithm first constructs a dominating set which is then connected by the MST algorithm. The tree construction approaches in previous papers all have high message complexity, because every node is involved up to n times to collect information for combination decision. Either all nodes report to the root or the root broadcasts a query and gets response over the tree .EEDTC first constructs a MIS using k-hop neighbors' information, and meanwhile a forest consisting of some multi-hop trees is formed with a little extra overhead. Then it connects the forest using the shortest paths between some pairs of adjacent trees. EEDTC combines MIS

construction and forest formation together, and only a small proportion of nodes are involved to connect the forest, therefore it uses less messages than in other schemes. Moreover, it also has good time complexity. The previous algorithms used have high message complexity and time complexity, but in EEDTC algorithm they uses k-hop, by keeping k =1 then we can get has low message complexity and EEDTC performs well on energy consumption. The energy-aware ranking technique that is introduced can also balance energy consumption in the network, and hence reduce the probability of network failures caused by energy depletion of backbone nodes .Lower message complexity definitely leads to lower energy consumption. Moreover, EEDTC also has good performance on energy balance. So EEDTC is energy-efficient, and can greatly prolong the lifetime of wireless networks.

Algorithm:

Step1: The construction of the tree consist of two phase.

Step2: First phase is marking phase and second phase is connecting phase.

Step3: In the Marking phase construct a maximal independent set (MIS) and a forest composed of many trees which rooted at several initiator is generated at same time.

Step4: This MIS is a connected dominating set. In the connecting phase connect the forest to a single spanning tree, in which a subset node forms the dominating tree.

Step5: In the connecting phase use large number of Message because each steps all nodes in the related tree want to collect information for the next combination decision.

Step6: To avoid this message complexity we use spanning tree approach that is the forest will be connected only through communication along the shortest paths between pairs of adjacent trees, and nodes not in these paths will not be involved in the execution.

In the paper Chi Lin [4] has measured the data aggregation based on ant colony optimization. Chi Lin [4] expand the ant colony algorithms by proposing a family of energy-efficient Data Aggregation Ant Colony Algorithms (DAACA for short), which contains Basic-DAACA (i.e. the Basic algorithm of DAACA), ES-DAACA (i.e. Elitist Strategy based DAACA), MM-DAACA (i.e. Max-Min based DAACA) and ACS-DAACA (i.e. Ant Colony System based DAACA). DAACA include three phases: 1) the initialization, 2) packets transmissions and 3) operations on pheromones. Initially, all the sensors are deployed randomly, and then they set up their routing tables in a self-organization manner. Chi Lin[4] consider each node as an artificial ant which is raised in ant colony optimization for solving the global optimization problem. The packets transmitted between nodes are considered as tools for updating or adjusting the pheromones. Each node estimates the remaining energy and the amount of pheromones to compute the probabilities for dynamically selecting the next hop. After certain rounds of transmissions, the adjustments of pheromones are performed, which originally combine the advantages of global and local adjustments for evaporating or depositing pheromones. Four different pheromones adjustment strategies are designed to achieve the global optimal in prolonging network lifetime.

Algorithm:

Step1: In this Algorithm the sensor node in the wireless sensor Network are considered as the artificial ant.  
Step2: Algorithm uses a Routing Table to record amount of pheromones in the link.  
Step3: When a node receives a packet it find the next node on the bases of information about pheromones, distance and the remaining Energy.  
Step4: Initially all nodes in the wsn build its own neighbor set and routing table by broadcasting its id and information of the location in the sensing range .  
Step5: After the initialization, Each node broadcast "hello" message to its neighbor. the node which are near to sink node will be recorded its routing table and the information in the table are initialized.  
Step6: Then the transmission of packet started and the source node sent the packet periodically to the sink node when a relay node got a packet it will calculate the probability of next hop based on the information about the distance, amount of pheromones estimated remaining energy.  
Step7: The transmission proceeds until the data are forwarded to the sink.  
Step8: After transmission each node broadcast its actual energy, using this neighbor node can update their own routing table information. Main objective of this is to, energy efficient transmission and prolonging the network life time.

*B. Coverage*

Bang Wang [2] has analyzed that the existing coverage control protocols can be classified into three groups based on whether the nodes' locations or distances are known. Bang Wang[2] has reviewed some representative coverage protocols for each group and proposed a new distance- and location-free coverage control protocol: Layered Diffusion based Coverage Control (LDCC). The LDCC protocol exploits hop count information, which is very easy to obtain in a WSN, to select active sensor nodes. Simulation results show that, among distance and location-free protocols, LDCC achieves a high coverage ratio with a lower number of selected active nodes. Although the location-based coverage control protocol (OGDC) performs best when there are no localization errors, its performance degrades fast when the location errors increase, and its performance is even worse than the proposed LDCC when the localization errors are above half of the sensing range. He has mainly focused on how to select active nodes by a coverage control protocol. Given that all nodes have the same initial energy and the energy consumption rate is the same across active nodes, a coverage control protocol that selects the least number of active nodes in each round normally leads to the longest network lifetime. But since the nodes' energies are often consumed at different rates due to their different roles in one round and different message overheads, an energy-aware coverage control protocol is needed. Thus, LDCC protocol achieves a high coverage ratio while incurring very low message overhead compared with other existing protocols.

Algorithm:

Step1: In this protocol each nodes have two state one ACIVE and SLEEP.  
Step2: Initially all nodes are in Active state and listen to the neighbors. And each sensor node has a timer which can be set or reset on different time period.

Step3: When the timer of the sensor node expires the it send a active message to the neighbor node.  
Step4: The coverage control starts when sensor node with a small hop count sends out an ACTIVE message to its neighbors upon expiration of its timer.  
Step5: After the sensor node receive the ACTIVE message from the neighbor node and set its state to sleep or set other timer depend on the hop count information in the ACTIVE message.  
Step6: if a sensor node got more than ACTIVE message from neighbor with same hop then it has to set its state as sleep.  
Step7: All nodes become active again and the above procedure repeats for selecting the active sensor nodes for the next round.

As Bang Wang[2] approach does not mentioned about the network lifetime maximization. Thus Jenn-Wei Lin[6] proposed a grid-based and distributed approach for providing large coverage for a motorized target in a hybrid sensor network. The large coverage is achieved by moving mobile sensor nodes in the network. To minimize total movement cost, the proposed approach needs to solve the following problems: the minimum number of mobile sensor nodes used for healing coverage holes and the best matching between mobile sensor nodes and coverage holes. In the proposed approach, the above two problems are first transformed into the modified circle covering and minimum cost flow problems, respectively. Then, two polynomial-time algorithms are presented to efficiently solve these two modified graph problems, respectively. Finally, he performs simulation experiments to show the effectiveness of proposed approach in providing the coverage for a motorized target in a hybrid sensor network. The main work of Jenn-Wei Lin[6] is to provide large coverage for a motorized target in order to achieve the complete monitoring.

Algorithm:

Step1: A motorized target enters are region of the sensing field.  
Step2: Sensor nodes in certain grids are required to be activated for detecting and tracking all objects of the motorized target.  
Step3: A monitoring region contains a number of monitoring grids.  
Step4: Each monitoring grid individually checks whether coverage holes exist in the grid. If so, it represents that the number of sensor nodes in the monitoring grid is not sufficient for monitoring the motorized target.  
Step5: They extends the solution of circle covering to calculate the number of mobiles sensor nodes required for healing the coverage holes within each monitoring grid.  
Step6: The grid head nodes in the monitoring region are designated as a coordinator.  
Step7: The coordinator gets the demand and the supply information about the useful mobile sensor nodes that can be used to heal the coverage holes within the monitoring region.  
Step 8: The coordinator extends the solution of the minimum cost flow on the flow network to make an optimal movement plan of mobile sensor nodes.

As in Jenn-Wei Lin[6] approach has capacity to cover larger area because of the movement in mobile sensor nodes but at the same time this approach will consume more energy



because this mobility. Thus Yanheng Liu[13] has proposed A virtual square grid-based coverage algorithm (VSGCA) where Each sensor node divides its sensing range into virtual square grids, if all the grids are covered by neighbors, the target node is redundant node. Compared with some previous algorithms, VSGCA can guarantee the coverage and connectivity in the whole network and has a computational complexity of  $O(n_M)$ , which is less than most of other algorithms. Simulation results show that VSGCA can achieve better performance with fewer active nodes and lower computational complexity.

Algorithm:

Step1: In VSGCA the first step is constructing the set  $s$  of grid centers.

Step2: Then find the redundant node.

Step3: VSGCA find the redundant node by calculating how many grid's centers are covered by its neighbor.

Step4: To calculate whether the grid is covered by neighbor we calculate the determined distance and compare it with the difference between the abscissa of grid's center and the abscissa of neighbor's center point.

Step5: The determined distance become same when the ordinate of the grids' z center points are the same .so if ordinate's value are the same, the determined distance is calculated only once y grids' centers are covered by neighbors. Virtual square grid-based coverage algorithm (VSGCA) guarantees coverage and connectivity.

### C. Congestion Control

Directed diffusion, Optimal aggregation tree problem, greedy algorithm, greedy incremental tree (GIT) ant colony optimization are the various methods used for data aggregation so far. In the ant colony optimization technique found by Misra and Mandal ) [12], the probability of finding aggregation nodes based on any two routing paths is not high. To increase the probability, Wen-Hwa Liao, Yucheng Kao [12] suggests an extension of the search region around the routing paths. If the search regions of the two paths are extended individually, the aggregation node G [12] will be found and two new routing paths (indicated in dashed lines) will be formed. The ant colony algorithm includes three steps.

Step (1): how to select next hop node;

Step (2): to extend the routing path;

Step (3): to update the pheromone trails on the sensor nodes.

On the protocol side, a dual-path QoS routing protocol, Adaptive Real-time Routing Protocol (ARP), MQOSR, cross-layer approach cross-layer approach, SPEED, COMUT, EQSR, a multi-path routing protocol are the so far found protocol to control the congestion. Basically there are major differences between the protocol proposed by Omar Banimelhem, Samer Khasawneh [8] protocol and the two other namely multipath routing and DD [12] .The newer protocol assumes the existence of several and concurrent traffic-generating sources where the other two creates multiple paths between single source and the sink. When WSN is deployed, hundreds (or thousands) of sensor are deployed in the field, so depending on a single (unreliable) sensor to report the events will not be the best assumption in terms of fault tolerance. Furthermore, when a heterogeneous WSN is deployed to monitor a variety of phenomena, it is likely to find two non-similar events that are being reported concurrently by two non-similar sensors. For these reasons, we believe that we

accommodate more realistic assumptions in developing GMCAR.

Algorithm:

Step1: Grids formation phase (dividing the sensor field into grids in order to build diagonal paths from each grid toward the sink)

Step2: Building routing tables phase (takes into consideration the density of nodes as a decision factor in data forwarding)

The Flock-CC model, works as follows for each packet:

Step1: Repelled from neighboring packets located on nodes at close distance (i.e one hop away from packet) within the packet's FoV.

Step2: Attracted to neighboring packets located on nodes at medium distance (i.e. two hops away from packet) within the FoV.

Step3: Oriented and attracted to the global attractor under the influence of the environmental magnetic field, and

Step4: Experience some perturbation that may help the packets to pick a random route (i.e. trading exploration versus exploitation).

Paper [12] suggests congestion control mechanism through data aggregation and the other two papers [8] & Pavlos Antoniou [9] suggests routing protocols. So its impossible to compare the [12] with [8] & [9]. In data aggregation mechanism, tree is constructed by the accumulation of pheromone. After a short transitory period, the amount of pheromone on the aggregation nodes is sufficiently large to guide ants (the data packets from different sources) to meet together at these nodes for data aggregation. Simulation results show that our proposed algorithm actually consumes less data delivery energy than the other traditional methods such as the DD and GIT methods whereas papers [8] & [9] exploits protocols for routing to reduce congestion control.

### D. Load Balancing

Most of the Techniques for Load Balancing In the wireless sensor Network follow the clustering Method. Because its energy its energy saving advantages and some desirable features related to network management, scalability, reliability ect... In this Survey we are considering three papers for load balancing which all follows the clustering Techniques. The main difference in these papers is the way how they make the cluster. In a cluster based Method the sensor nodes are grouped into distinct clusters with leader known as cluster header. For each sensor nodes are belongs to only one cluster .The CH collect and process local data from their member sensor node and send it to the Base station directly or via other cluster head. Comparing to other technology the Cluster based WSN have so many advantages:

1. In this method we are using only one representative (i.e.,CH) per cluster needs to be involved in data aggregation and routing process in this way we can reduce energy consumption significantly .

2. In this method the sensor nodes communicate only with their CH so that It can considerably conserve communication band width and can avoid exchange of redundant messages among them.

3. The clusters can be managed easily because they can localize the route setup and require small routing tables for the sensor nodes. This in turn improves the scalability of the network significantly.

The Algorithm explained by Namhoon Kim, Jongman Heo, Hyung Seok Kim, Wook Hyun Kwon [7] introduces a

method which mainly concentrates to increase the lifetime of the network by fairly distributing the cluster head. This Algorithm uses the clustering method for balancing the load in the WSN system. The main Steps involved in this algorithm can be explained briefly as follows. In this algorithm, the operation of cluster can be divided into two the step up phase and steady state phase. The period which contains the setup and steady-state phases is called a round.

The second algorithm EEBC by Pratyay Kuila, Prasanta K. Jana [10] is to overcome the problems in the reconfiguration algorithm [7]. Pratyay, Kuila, proposed an approach Energy-Efficient-Load-Balanced-Clustering for load balancing. In this algorithm we consider two type of nodes sensor nodes and gateway node. All of the communication in this network is done over the wireless link. In this network setup is performed using 2 phases first phase is bootstrapping and second phase is clustering. in the Bootstrapping phase all the sensor nodes and the gateways nodes assigned a unique ID. All the sensor nodes sent the information about the location and the own ID to the gateways which are in the communication range. The clustering phase sink executed the clustering algorithm and all the sensors and gateways come to know about their own sensor nodes and gateways. The sensor nodes are divided into two Restricted and Open node. Restricted node is the sensor nodes which are communicated only to one gateway and the Open nodes which can communicate to more than one gateway node. The basic idea of the EELBC is we assigned the restricted sensor nodes to their own gateways. we construct a min-heap using how many number of restricted sensor nodes are assigned to corresponding gateways. Gateways having minimum number of sensor node become root. Then we assign another sensor node which is nearer to those gateways to the root and rearrange the min-heap. Then the gateway with minimum number of sensor nodes assigned to it will beat root of the min-heap. The same procedure is continued until all the sensor nodes are allotted to their correct gateway. At each step, we are assigning sensor nodes to the gateways having minimum number of sensor node so the load is distributed over minimum loaded gateways.

#### Algorithm

Step1: assigning restricted sensor nodes to corresponding gateways.  
Step2: construct a min-heap using the gateways on the number of allotted sensor nodes to the gateways  
Step3: Build a min-heap using the gateways on the number of allotted sensor nodes to gateways.  
Step4: Pick up the root node of the min-heap  
Step5: Select a nearer open sensor to the root node gateways and assign that node to the root node gateways  
Step6: Adjust the min-heap so that the minimum loaded gateway will be at root.  
Step7: do these steps until all the gateways are equally loaded.

#### Clustering:

Step (1): Generate initial population. Here initial population is randomly generated set of chromosomes. Chromosome is the string of gateways which indicates the assignment of all the sensor nodes to their corresponding gateway.

Step (2): Two randomly selected chromosomes (parents) are by a process called crossover in which the parent chromosomes exchange their genetic information.

Step (3): The child chromosomes undergo mutation operation in which their lost genetic values are restored and form better result.

Step (4): The fitness function of the child chromosomes is evaluated.

Step (5): Fitness values are compared with that of all the chromosomes of the previous generation.

Step (6): Two chromosomes of the previous generation with poorest fitness values are replaced with the generated child chromosomes.

The method suggested in [7] increase the network lifetime of the WSN. Algorithm can be an effective tool for data aggregation in WSNs. Since each node can obtain information without additional traffic or complex computation, this method is very simple. But in this algorithm balancing the load is only based on the number of node in the cluster and number of cluster head in the within the transmission range so this calculation do not give the efficient distribution of the load.

#### E. Navigation

Navigation is the art of getting from one place to another in an efficient manner. The concept of Vector Field Histograms (VFH) based on locally constructed polar histograms for robot navigation was the very first technique for the robot navigation application. Neural map based approach. Landmark based approach, are the next approached employed for the navigation. These approaches either assume that a map of the surroundings is provided beforehand or the sensors attached to the robot are very expensive. Atul Verma [1], described a approach that static sensor nodes and mobile sensor nodes collaborate among themselves to guide the mobile sensor node (MSN) to its destination. This cooperation among the MSN and static sensor nodes can significantly reduce the cost of the robot. a navigation path from MSN to the goal location is set up by using a credit field to increase the reliability of the path. The credit field is also used to develop virtual navigational forces from surrounding static sensor nodes to guide the robot to its destination. In that paper, they have used a credit based approach in which nodes are assigned credit values according to their distance from the phenomenon. the MSN calculates its navigation direction towards the phenomenon using the navigation force from the neighboring static sensor nodes. the sensor networks serve as a distributed dynamic map and provide navigation information to mobile sensors.

#### Algorithm:

Step (1): generate a Request Packet with requirements  
Step (2): select MSN which meet the requirements & reply back  
Step (3): select a MSN & form mesh  
Step (4): MSN navigation to event nodes using mesh.

The second category of protocols does not use global flooding but instead use a local query strategy to achieve navigation. This approach avoids global flooding by restricting the mobile entity to a roadmap and by making local decisions.

TABLE 1. Comparison of various Topological Manipulation Approaches based on QoS factors

Algorithm	Energy Efficiency	Coverage	Load Balancing	Navigation	Congestion Control
Load Balancing Clustering approach	As they were using only the active nodes and making unused node to sleep mode which will save the energy by avoiding the unwanted nodes to utilize the energy so this algorithm seems to be more energy efficient compared with other algorithms.	Degree Constrained CDS may achieve higher coverage	Slowly reduction in load. No diversified Solution set.	Not Provided	Not Provided
EELBC	Load balances reduce energy draining moderately.	Comparing to the next algorithm (Evolutionary Load balancing) this covers maximum nodes	Comparing to reconfiguration algorithm this algorithm ensures better load balancing, energy efficiency and execution time instead of using the number of nodes (reconfiguration algorithm)in an area ,in this use distance between the sensor nodes for balancing the load in the system	Not Provided	Not Provided
Reconfiguration Algorithm	Less effective than the other two.	Not Providing	This method suggested in increase the network lifetime of the WSN. But in this algorithm balancing the load is only based on the number of node in the cluster and number of cluster head in the within the transmission range so this calculation do not give the efficient distribution of the load.	Not Provided	Not Provided
Layered Diffusion Approach	Not provided	Approach does not mentioned about the network lifetime maximization	Not provided	Not provided	Not provided
VSGCA	Energy efficiency can be achieved for less no of hops.	It can guarantee the coverage and connectivity in the whole network and has a computational complexity of $O(n_M)$ , which is less than most of other algorithm	Not provided	Not provided	Not provided
Flock-CC	Comparably needs less no of turns to find out the residual energy.	Not Provided	Not provided	Not provided	That the proposed mechanism was able to robustly move packets to the sink, whilst alleviating congestion by balancing the offered load. beyond the hop distance, new techniques for sink direction discovery are also left for future work.
Roadmap method	VFH method wastes energy and bandwidth by collecting information from all nodes in the query area. But this method overcomes drawback by performing only selective sampling to collect only necessary information.	Not provided	Not Provided	Handles better than the proceeding given in that paper	Not provided

EEDTC	providing Lower message complexity definitely leads to lower energy consumption	Not provided	Not provided	Not provided	Not provided
GMCAR	Energy efficiency holds good with scalability.	Not provided	Not provided	Not provided	Although this drains master nodes energy it saves grid nodes energy, improving the network throughput, minimizing the packets delay and achieving better utilization for the available storage.
Hybrid approach	approach has capacity to cover larger area because of the movement in mobile sensor nodes but at the same time this approach will consume more energy because this mobility	Not provided	Not provided	Approach does not reach the goal with minimum complexity. But still have a good solution over the problem.	Not provided
DAACA	The remaining energy and the amount of pheromones to compute the probabilities for dynamically selecting the next hop. So the energy efficiency will be more compared to the EEDTC	Coverage decreases when the no of intermediate hops increases	Not provided	Not provided	It suggests congestion control mechanism through data aggregation and the other two papers [8] & [9] suggests routing protocols. So its impossible to compare the [12] with [8] & [9]. In data aggregation

## V. CONCLUSION

In this paper, we have analyzed and compared various approaches towards wireless sensor network topology control. We claim that topology construction phase plays a major role in wireless sensor's performance. This research work focuses on various QoS metrics and highlights the challenges for QoS in sensor's performance. Therefore, design of any wireless network should provide high-quality services with QoS requirements. We have defined QoS and its role in topology of a network. This topology is composed based on QoS metrics by evaluating the utility function and thus maximizing the overall QoS requirements. As a result, we can estimate QoS for every metric thus leads to a better way of arranging nodes in the network.

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