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Review on Optimization Structure for Data Collection in Wireless Sensor Networks

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Abstract: Wireless Sensor Networks (WSN) represents a very promising domain. They can be used in a large variety of applications due to their easy deployment and, their low cost of construction. These networks are composed of plenty of sensor nodes that are deployed in the monitoring field, and they form a self configured network by means of wireless communication. The Major issues in Wireless sensor Networks (WSN) are Energy Consumption, node deployment, network lifetime, Localization of nodes, task allocations, Coverage etc., to meet out the requirement at various Optimization frame work are proposed by several researchers. A few node deployment Schemes are discussed as a solution of node failures with load balancing techniques. Quantities of the optimization methodologies have studied at this point to maximize lifetime of wireless sensor network.
Keywords: Sensor Networks, Optimization, Data collection, Node deployment and Lifetime

I. INTRODUCTION

Current technological advances have made sensible the deployment of inexpensive sensor nodes over a region of interest to collect sensor data, to process it and to route it to a sink node for aggregation that as an entire comprises wireless Sensor Network (WSN).In Wireless Sensor Networks (WSN), the key challenge is to prolong the network life time by reducing the energy consumption among sensor nodes and reduce energy dissipation in network operation, improve network load and stability(sheik Dawood et al.2015&2016). In fact, WSN's have numerous applications in weather monitoring, disaster management, inventory tracking, smart spaces, habitat monitoring, target tracking, surveillance and many more. In a multi-hop Wireless Sensor Network (WSN) with continuous traffic, each sensor node acts as a data originator that introduces a data packet into the network at regular intervals, to send its data to the sink node. At the same time, each node also acts as a router to forward others data packets to the sink node via minimum-hop paths.

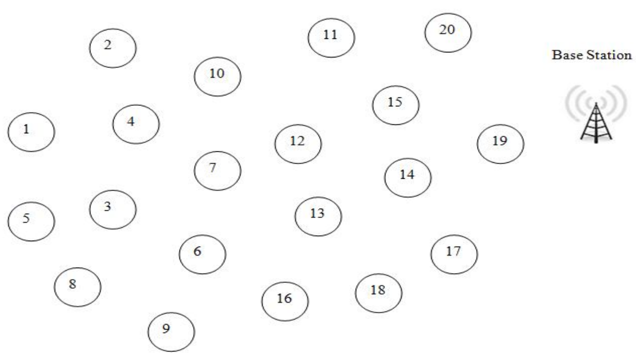

Fig 1: Sensor Nodes deployed in Wireless Sensor Network

In many applications, the sensor nodes are battery-powered, and without any recharging Facility. Most of the energy of the sensor nodes is depleted in the process of data communication. When the battery power is exhausted, a node fails to operate and conventionally this ends the lifetime of the network which is the time duration of network operation until the first node fails, mainly due to energy shortage. Hence for energy-efficiency, it is a fundamental issue to reduce the total number of packet transmissions in the network. The network load, i.e. the total number of packets to be delivered to the sink node is lower bounded by the coverage constraint. Given that bound, it is obvious that, each packet should follow the path with minimum hop to reduce the total number of packet transmissions. But, if nodes always forward their packets to the sink node via minimum- hop paths, nodes nearer to the sink will carry heavier traffic and will deplete their energy faster, creating energy holes around the sink. Hence, in a multi-hop WSN, it is a challenging issue to exploit the energy of all the nodes uniformly so that the network lifetime is maximized.

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A. *Node Deployment Strategy for Wireless sensor Networks*

The distributed greedy load balance algorithm proposed by way of Chatterjee et al. (2016).A novel graded strategy is proposed that generates minimum traffic, just for coverage. Based on this node distribution ,a distributed nearly load balanced data gathering algorithm is developed to deliver packets to the sink node via minimum- hop path that also in turns helps to limit the network traffic. The proposed model gives a huge enhancement in network lifetime that significantly overrides the increase in cost due to over-deployment.

Liu (2006) analyzed a deployment strategy of sensor nodes to extend the life time for multi-hop wireless sensor networks are addressed based on load-balancing concept. An algorithm is proposed to deployment homogeneous sensor in a wireless network within a given number of nodes which are continuously monitoring an area of interest. The densities of sensor nodes are determined by solving optimization problem. It has extended lifetime and break down more gracefully than that for 2-D Poisson distribution while maintaining satisfactory coverage. Node failure does not concentrate on this research. So, it has more number of redundant nodes. The artificial Ant colony optimization algorithm proposed by way of Mahboubi and Labeau(2015) .It described a Voronoi-primarily based diagram which assigns a distinct region to each sensor within the presence of limitations such that the regions are at the same time disjointed. If one sensor cannot cowl a factor interior it's any region, no different sensor can detect it both. The proposed diagram referred to as obstructed guaranteed additively weighted (OGAW) Voronoi diagram is the main tool for developing the sensor deployment algorithms in a network of mobile sensors with non identical sensing tiers within the presence of limitations. This proposed algorithm is used to improving the Prioritized insurance .energy intake issue does no longer discussed on this research. Zhang (2010) defined the effects of spatial and temporal distribution on the node deployment is considered. Firstly the amount of data transmission network is calculated, taking the spatial distribution of the events and coverage effects into concern. Exploiting this result the energy balance equation is proposed based on the temporal density of the events, for estimating the network lifetime the non-uniform deployment of nodes should be leveraged to balance the energy consumption by deploying more nodes close to the sink. Where Spatial and temporal distributions of events greatly influence the strategy of the node deployment, for balancing the energy consumption of the network and Unpredictable deployment will occur. Bartolini and Calamoneri (2011) investigated an autonomous deployment algorithm that guarantees the adaption of sensor density to the sink proximity and enables their selective activation. The proposed algorithm also permits a fault tolerance and self-healing deployment, dynamic reallocation and selective sensor activation. The proposed algorithm efficiently reaches a deployment at the desired variable density with moderate energy consumption under a wide range of operative settings. Where high delay overhead for adaption.

Indhumathi and Venkatesan (2015) developed a Genetic Algorithm in to deploy Sensor Nodes for the Maximum coverage within the area, where the sensors are different types. In this work, first analyze the total coverage area of the WSN, identify the types of Sensor nodes and calculate the coverage sensing distance for the combination of all sensor types based on radius of each node. Deployments of dynamic nodes are achieving maximum coverage by using genetic Algorithm. Proposed algorithm provides best performance in coverage and improving network lifetime.

Mahboubi et al. (2017) described a sensor deployment algorithm in the presence of location estimation error, for sensors with non-identical sensing ranges. It proposes a set of Voronoi-based diagrams, named guaranteed Voronoi diagrams, that guarantee single-cell-based coverage hole detection algorithms, provided that upper bounds on localization errors are assumed. These localization errors are affecting the total coverage. So, Deployment algorithm is increasing the network's coverage in the presence of localization error. The proposed Algorithm is complex in nature.

Djenouri et al. (2017) described the problem of communication Coverage for sustainable data forwarding in wireless sensor Networks, where an energy-aware deployment model of relay Nodes is proposed. Considers constrained placement and is different from the existing one -tiered and two-tiered models. It support two different types of Sensor nodes to be deployed, i) energy rich nodes, and ii) energy limited nodes. It has some advantage of Proposed heuristic has runtime close to the Integer linear programming (ILP) while clearly reducing the runtime compared to both ILP and existing heuristics. The author does not concentrate on the network failure.

Un and Lei (2014) described a light application-orientated placement of actuator nodes (LUOPAN) for wireless sensor/actuator networks (WSAN) to spread serving obligations amongst actuator nodes (ANs).via suitable placement of ANs and allocation of serving duties. The device deployment value can be decreased, and the system toughness may be advanced. An energy intake problem does not deal with this paper.

Sensor localization and obstacle boundary detection algorithm (SLOD)is developed by Das et al. (2013).It proposes a novel approach for localizing obstacles and sensors nodes using four GPS enabled anchor nodes. Based on four high energy anchor nodes, sensor localization is done, and an approximate rectangular boundary of each obstacle is detected. It has some advantage of Hostile deployment area maintaining an acceptable accuracy level.

The greedy algorithm proposed by Abrams et al. (2004).It described a strategy for energy efficient monitoring in Wireless sensor networks that partitions the sensors into covers, and then activates the covers iteratively in a round-robin fashion. The objective is to partition the sensors into covers such that the number of covers that include an area, summed over all areas is maximized. It has some advantages such as Fast, Easy to use and significantly increase the longevity of sensor networks. A delay complexity issue does not concentrate on this research.

B. Optimization methods for data collection in Wireless Sensor Networks

Wang et al. (2016) discussed a mobile collector, called SenCar to collect data from designated sensors and balance energy consumptions in the network. It presented a two-step approach for mobile data collection. First, adaptively select a subset of sensor locations where the SenCar stops to collect data packets in a multi-hop fashion. Developed an adaptive algorithm to search for nodes based on their energy and guarantee data collection tour length is bounded. Second, focus on designing distributed algorithms to achieve maximum network utility by adjusting data rates, link scheduling and flow routing that adapts to the spatial-temporal environmental energy fluctuations. This algorithm close to optimal and that it even beat the best centralized multi-hop routing strategy. The author only concentrate on reliability but Security issues does not discussed in this research.

Hongchun Li developed a method to discuss relay node deployment with genetic algorithm in(2017).It investigated a relay node placement problem in such complex environment relay node position optimization to minimize the relay node number and improve network performance by optimizing route paths of sensor nodes. Heuristic operations for genetic algorithms are proposed to optimize relay node positions. This proposed algorithm has advantage of Best cost among route paths of all feasible relay nodes.

C. Load Balancing Strategies in node deployment for wireless Sensor Networks

Kacimi and Dhaousand (2010) analyzed multihop transmissions in wireless sensor networks. An analytical model became proposed to derive the higher bound of the sensor network lifetime, given the surveillance region and a Base station, the wide variety of sensor nodes deployed and preliminary power of every node. The visitor’s pattern is extraordinarily non uniform, setting an excessive burden at the sensor nodes close to the bottom station. It has achieved make certain maximum network lifetime by using balancing the load as equally as viable and it has a few coverage losses.

Goa and Zhang (2004) defined routing algorithms on wi-fi networks that use most effective quick paths, for minimizing latency, and achieve true load stability, for balancing the strength use. Proposed routing algorithms make routing decisions by only neighborhood facts and, thus, are extra adaptive to topology changes due to dynamic node insertions or deletions because of mobility. This algorithm used nearby facts and might deal with dynamic exchange and mobility effectively. Scalability problems does no longer mentioned in this research.

Title of the work	Algorithm/ Optimization technique	Performance Parameters	Advantage	Disadvantage
Load balanced coverage with Graded node deployment	Greedy Algorithm	Packet delivery ratio and lifetime	Maximized network lifetime	High cost deployment
Deployment Strategy for Multi-Hop WSN	Gradient-based routing algorithm	Coverage Ratio	Extended network lifetime	More number of redundant nodes
Deployment Algorithms for Coverage Improvement	Obstructed guaranteed additively weighted (OGAW) Voronoi diagram, Ant Colony Optimization	Energy Consumption	Improving the prioritized coverage	Consuming larger Energy for calculating error
Non-Uniform Node Deployment	Non-uniform distribution Strategy	Life time waste ratio ,Life expectation ratio	Energy consumption of the network	Unpredictable node deployment
On Adaptive Density	Autonomous deployment	Energy	Moderate energy	High delay overhead

Deployment to Mitigate the Sink- Hole Problem	algorithm	consumption	consumption	for adaptation
Coverage Deployment for Dynamic Nodes	Genetic Algorithm	Coverage area	Best coverage and network lifetime.	It has some positional error
Deployment Subject to Location Estimation Error	Voronoi-based diagrams	Total coverage ratio	increasing the network's coverage	Algorithm is complex in nature
Energy-Aware Constrained Relay Node Deployment	State-of-the art algorithm	Cost value	Reducing the runtime	Network failed in presence of fault nodes
Optimization Framework for Mobile Data Collection in Energy-Harvesting	Adaptive algorithm, Distributed Algorithm	-	Algorithm is close to optimal	Does not concentrate on security only for reliability
Optimization of relay node position	Genetic Algorithm	-	Best cost among route paths	This network is unfeasible relay locations in application area
Load-Balancing Strategies	Shortest path routing, Equiproportional Routing, Heuristic proposition	Network lifetime	Ensure maximum network lifetime	coverage issue
Load-balanced short-path routing	Greedy algorithm	Packet delivery ratio, Number of energy node	dynamic change and better mobility	Scalability issue
Set K Cover Algorithms for Energy Efficient Monitoring	Greedy algorithm	-	Fast, easy to use	Delay and complexity
A Priori methods for Fault Tolerance	Cluster based Periodic, Event-driven, Query-(CPEQ) algorithm	Energy consumption	Successful transmission	Classification of node failures
Light Utility-Oriented Placement of Actuator Nodes	Mixed integer linear programming (MILP) Method	-	Low deployment cost and better longevity	Consuming additional energy
Sensor Localization And detection	SLOD Algorithm	-	Maintaining an acceptable accuracy level	Less Determination in exposure of obstacles

II. CONCLUSION

This Survey Study the range of Optimization techniques in Wireless sensor networks. It further more analyze is the load balancing Strategies for data collection in WSN and also considers the techniques in WSN to extend the life time of networks.

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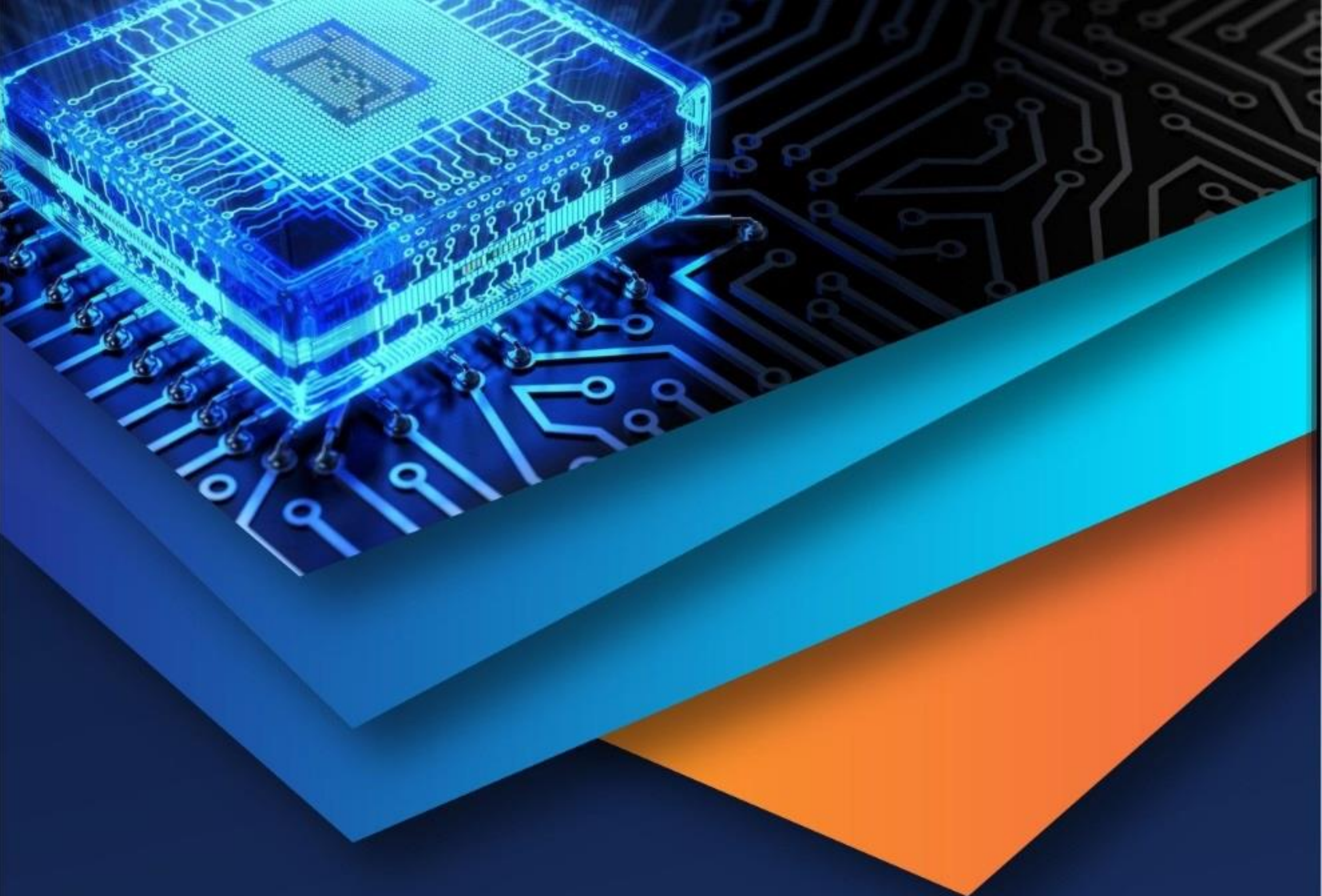

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