International Journal of Advance Research in Science and Engineering
Vol. No.6, Issue No. 10, October 2017
www.ijarse.com
IJARSE
ISSN 2319 - 8354

Literature Survey on Load Balancing Algorithm in Wireless Sensor Network

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ABSTRACT

In sensor-network, enhancing network-lifetime is an essential concern due to "battery-constraints". So maximize the duration of the network is considered as main objective while designing the algorithm. Some sensor nodes are nearer to the base-station and that nodes are burdened because they are doing a task to gather data of entire area and forward to the base-station. The tree structure is designed for collecting the data at base-station. The energy utilization of sensor-nodes depends upon various parameters like topology and resources-availability. The duration of the network increases by distributing the workload over a sensor network. This paper focuses on lifetime-maximization-problem of network using "load-balancing" method. We present an efficient-algorithm to increase the lifetime of network considering network parameter like a network-density using "randomized-switching-concepts".

Keywords: "Energy-efficiency", "Network lifetime", "Load-balancing", "Data-collection-tree".

I. INTRODUCTION

Sensor-networks are widely used in environmental monitoring and surveillance for finding out milestones over the network. Sensor-nodes are low-battery-power and communicate wirelessly. They can be arranged in whatever way over sensing or monitoring area. In most-scenarios, sensor -nodes are connected in tree-structure design which is grounded at sink and sensed data are submitted to base-station by organizing given WSN into "data-collection-tree". Due to "battery-constraints" utilization of energy is an extensive challenge in sensor-network [1]. Therefore broad-research has been proposed in the literature on "energy preservation". The techniques that are used for preserving energy like "duty-cycling" [2], "aggregation-of-data" [3] and "Energy-balancing" [4][5].The Energy-Balanced approaches are suitable for "lifetime maximization" problem [5][6] by creating "balanced tree". Yet existing-approaches in this area resides big-challenges like the situation where the topology changes repeatedly and also in terms of time complexity. Due to these limitations, existing-approaches are not suitable for distributed-version.

Only a few nodes may determine the network-lifetime in previous approaches [7].The major responsibility of nodes is sending and receiving the whole traffic. So their "energy preservation" is demanding concern in sensor-network. This is particularly suited for application-specific where “collection of data” is compulsory. So, it is essential to increase the “network-lifetime” by distributing the load-utilization equally over the region. The definition of “network-lifetime” is very cleared in distinct ways in the research-literature [8].Our work addresses “network-lifetime-maximization” of tree–topology. Consider the “network-lifetime” is the time until initial node finishes all of its energy.[5] This definition is application-independent and useful for varied scenarios. Hence our work aims to increase the “network-lifetime” by constructing the “balanced-tree”.

“Balanced-tree” concepts are considered here to increase the “network-lifetime” by applying “switching-concepts”. This tree cannot be static rather than it can be updated dynamically according to the enduring-energy. Basically, this method proposes two major challenges. First one is the scalability. To achieve this significant-resources are required to distribute the load uniformly over the region. Second, is the efficiency related to convergence i.e. reach to converge “data collection tree “using dynamic “load-balanced-scheme”. This paper principally-addresses these challenges and proposes a novel approach to overcome that challenges by “load-balanced scheme”.

II. LITERATURE SURVEY

This paper provides the source for the research in wireless sensor network for energy-efficient and balanced approaches.

Title: “A Node-Centric Load Balancing Algorithm for Wireless Sensor Networks”

METHODOLOGY:

Tree-structure is used in node-centric algorithm for energy-balancing.This algorithm iteratively increases energy-balancing within tree from the sink node. At every state first, selects the branch having a smallest load and then inserts this branch onto the unassigned-boundary node which results in excessive load. Probably, the algorithm absorbs such a node which generates excessive node to the lightest-branch for obtaining the balance. So here monitoring is that to find out those absorbing nodes which generate excessive-consumption on earliest stage to maintain flexibility for the balancing in future. At some situation where a large number of “heaviest border node” is present then that time selects the boundary-node having largest “growth-space”. The algorithm enlarges the routing-tree into the empty reign rather than jammed region. The willingness is that to increase the flexibility concern with routing options.

DISCUSSION:

They present “a node-centric model” for load-balancing of wireless sensor network. Their load-balancing scheme increases trees repeatedly from the sink. Initially, they select the smallest load and bounded branch for growth. After that select such a node which is excessive load and having maximum expanding area is available. After constructing roughly “balanced-tree” they move sub-trees to the nearest one and hence obtain greater balance. This algorithm obtains greater balancing rather than “Breadth-first-search” and “shortest-path-routing”.

LIMITATIONS:

This algorithm presents explanation about forming an initial tree and rebalances the tree using topological knowledge instead of randomly. They focused on wireless-sensor-network with an asymmetric architecture and considered centralized architecture only. Also, assume the common case in which position of the sensor node is fixed.

Title: "Constructing Maximum –Lifetime data Gathering forests in sensor Networks"

METHODOLOGY:

Many solutions are proposed in the literature for constructing tree from the connectivity-graph by exclusive communication of "an initial routing tree structure". In this paper, they well thought about maximum-lifetime of tree topology while analyzing "minimum-degree spanning tree problem". They provide an approach in which repeated improvements are carried out and that diminishes the number of bottleneck-nodes at each iteration. The same approach was presented by the"LOCAL_OPT" algorithm that rather switching the nodes among parent considering optimal-tree. The idea of the repeated improvements was adopted to find "a min-max weight spanning tree" through switching for extending the network.

DISCUSSION:

In this paper, they have studied about the construction of "data-gathering trees" and forests for extending network-lifetime of sensor-network. The "data gathering tree" problem comes in NP-complete and its difficult to solve. However; they have provided optimal-solution within solvable period by investing its structure. It gives outcomes in better-approximation ratio to extend the duration of network and also reduces the load of the base station. Simulations show that this given approach distributes the energy and significantly maximize the duration of the network.

LIMITATIONS:

They have been implemented decentralized approach among trees but still in local-tree sink node make centralized-decisions. In this case, sink node is not too much-capable so, that application required the algorithm for distributed approach.

Title: "Maximize Lifetime for the shortest Path Aggregation tree in Wireless Sensor Networks"

METHODOLOGY:

For solving "minimum spanning tree problem", initially they designed a fat-tree from the given network and it shows that each edge of the resulting shortest-path tree be a part of fat-tree. After that, they split the "minimum spanning tree" into sub-problems. They demonstrate that this given version of "semi-matching" may be solved by applying "min-cost max-flow" approach within polynomial time. They used a "Breadth-First-search" algorithm to derive a fat-tree which is rooted at the base station. Every node accumulates its height to the base-station and next-hop node is a part of the shortest-paths to base-station. Hence, the fat-tree is the unification of all "shortest-path-tree" where path is selected with minimum hop-count from the root or base-station. The edge among two nodes which is at the equal height would be detached from the graph seeing as it would not be shown at all in any shortest-path-tree.

DISCUSSION:

In this paper, it has been shown that problem of discovering the "shortest path tree" having maximum-lifetime within polynomial time. To load-balancing scheme aggregation in the network is used at every level of fat-tree and applies the "min-cost-max-flow" approach.

LIMITATION:-

Here they have been considered static tree-structure only. And another limitation is that only aggregated-traffic is used to lifetime-maximization within shortest-path “data collection tree”.

Title: “Maximizing Network Lifetime online by Localized Probabilistic load Balancing”

METHODOLOGY:-

Lifetime-maximization turns out to be as global-problem in sensor-network. This paper maps this problem with a “localized-cost-balancing” problem considering “local-cost-function”. They developed an algorithm a “localized-cost-balancing-algorithm” called as local-wiser for “network-lifetime-maximization” and creates a scalable and stable solution. In this algorithm, adaptive-probabilistic-routing is used and construct “a virtual guidance” for the nodes to defeat instability. Basically, “time-synchronization” and “level-based-scheduling” these two concepts are used while deriving given local-wiser algorithm. In every round, the scheduling of sensor nodes are done based on their level-indices. The sensor node which is at child level gathers the data and run local-wiser algorithm.

DISCUSSION:-

They proposed the network-lifetime-maximization problem which maps with “localized-cost-balancing” problem. The given local-wiser algorithm is constructed to extend the network-lifetime. The following characteristics are provided by given approach: computing locally, stable and provides an optimal solution to extend network-lifetime, easily-implemented and self-adaptive.

LIMITATIONS:-

The mobility of the sensors is having less performance. No global-information is considered in the time of local-computation. Local-wiser cannot be useful for multi-hop heterogeneous-networks.

Title: “Energy-Efficient Randomized Switching for Maximizing Lifetime in Tree-Based Wireless sensor Networks”

METHODOLOGY:

They demonstrated an efficient-algorithm, called “Randomized Switching for Maximizing Lifetime (RaSMaLai)” to increase the network-lifetime using “balanced-tree”. This algorithm finding-out more balanced-tree by taking into consideration the “data-collection-tree” method and at the end extends network-lifetime. It also shows that it covers topological-information with running-time that is significantly lower than other approaches.

Using random-routing-tree “RaSMaLai” applies “randomized-switching-concept” and enters into balanced-tree while going through series of iterations. The “SWITCH” function evaluates the load of the current tree at every iteration and chooses the nodes for switching.”RaSMaLai” then selects suitable parents for the selected-node using “FIND-POTENTIAL-PARENTS” function and finally updates the load of the tree using “UPDATE-TREE” function.

DISCUSSION:-

In this paper, they have presented "RaSMaLai", an efficient "randomized-switching-algorithm" extends the lifetime of "data-collection-tree" in WSN by means of load-balancing. Based on the concept of "bounded-balanced-trees" this algorithm randomly switches the data forwarding-paths of nodes.

LIMITATIONS:-

If "oscillations" were not allowed, "RaSMaLai" would be too-conservative in leaving a "local-optimum" and would never explore better topologies in subsequent- iterations. It may appear that choosing a "load-balancing-parameter" very low may results in more-balanced-trees but more switching is required. However, this is not necessarily true since such a low value may not be realistic. In fact, it may be topologically impossible to achieve an arbitrarily "low-bounded-balanced-tree" for a given connectivity-graph.

III. CONCLUSION

Many solutions proposed in the literature for the maximization-network-lifetime. The work defined in the literature in terms of coverage, which is application-specific and assume that the location of sensor nodes is known and do not characterize the convergence. In some scenarios, only local information is used. In across, we take network-oriented approaches and we do not rely on the location of sensor nodes. We propose the method for maximization of the network-lifetime by considering "load-balancing-parameters" and "switching-probability" as a function and also consider different network-parameters in order to reduce the convergence-time.

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