ISSN (ONLINE):2456-5717
International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST)
Vol.4, Issue.5, May 2018

Load Balanced Data Gathering by Distributed Algorithm using Wireless Sensor Networks

[1] M. Bargana, [2] R.Karthikeyan

[1] II M.E CSE, Mohamed Sathak Engineering College, Kilakarai – 623 806.

[2] Professor and Head, CSE Dept., Mohamed Sathak Engineering College, Kilakarai – 623 806.

Abstract—Information gathering is a fast growing and challenging field in today's world of computing. Sensors provide cheap and easy solution of this application by collecting physical information from the environment. In this paper, a novel graded node deployment strategy proposed to gather the stream of data in static wireless network. To limit the network traffic, load balanced data gathering algorithm is developed to delivers the packet to sink node via multi hop paths. A perfect matching of bipartite graph performed an average case probabilistic analysis to establish the theoretical lower bound on the number of nodes to be deployed. Simulation and analysis shows that our proposed system has been enhanced the lifetime of network.

Keywords: NODE; Packet; Load Balanced; Network Lifetime

I. INTRODUCTION

Wireless Sensor Networks (WSN) consists of several sensor enable nodes which are distributed in an environment and use batteries as energy resource. These tiny sensor nodes, which consist of sensing, data processing, and communicating components, result in the idea of sensor networks based on collaborative effort of a large number of nodes. Such sensor nodes could be deployed in home, military, science, and industry applications such as transportation, health care, disaster recovery, warfare, security, industrial and building automation, and even space exploration. Among a large variety of applications, phenomena monitoring is one of the key areas in wireless sensor networks and in such networks, it can query the physical quantities of the environment.

In fact, a typical wireless sensor network is composed of a large number of sensor nodes, which are randomly dispersed over the interested area, picking up the signals by all kinds of sensors and the data acquiring unit, processing and transmitting them to a node which is called sink node. The sink node requests sensory information by sending a query throughout the sensor field. This query is received at sensor nodes (or sources). When the node finds data matching the query, the data (or response) is routed back to the sink. For example, if the sensors nodes be in a tree like structure, the base station roles as the root of the tree and each node will have a parent. Therefore, the data items can be transmitted hop by hop from the leaf nodes to the root.

In WSNs, data compression refers to the use of compression techniques to reduce the amount of bytes required to code the different pieces of information and, thus, the traffic load which needs to be processed within the network. As the sensor nodes are small and battery enable devices, it have limited energy which should be used precisely. Thus, the scarce sensor resources (in particular, the battery power) are easily over consumed. Thus, the key challenge in such phenomena monitoring is conserving the sensor energy, so as to maximize their lifetime. Most of the approaches tried to response to this challenge and this will be continue to gain a better solution.

In Wireless Sensor Networks, sending large amount of data directly to the sink node may cause several problems. So, the data collection is a basic task in wireless sensor network. Certain application needs approximate data collection. The wireless sensor networks are used in applications like military surveillance, battle fields etc. A wireless sensor networks consist of minute resource bounded sensor, which is equipped with limited battery power. The transmission may consume a lot of energy. To avoid this problem, data aggregation technique is taken into account. The data aggregation technique efficiently reduces data redundancy and saves energy. The problems occur due to i) the quality of data getting lost because of packet loss. ii) Huge data collection leading to excessive communication overhead. So, it is necessary to design the data collection strategy carefully to minimize energy consumption and to increase the lifetime of the network as much as possible.

The approximate data collection is the suitable method for long term data collection in wireless sensor networks with bounded bandwidth. The number of application in WSNs needs to collect data approximately and efficiently due to constraints in energy budget and communication bandwidth. This technique is called ADC (Approximate Data Collection).In wireless sensor networks; the main power supply of the sensor node is battery. However, in most application scenarios; users are usually difficult to reach the location of sensor nodes. Due to a large number of sensor nodes, the replacement of batteries is impossible.

However, the battery energy is finite in a sensor node and a sensor node draining of its battery may make sensing area uncovered. Hence, the energy conservation becomes a critical concern in wireless sensor networks. In order to increase energy efficiency and extend the network lifetime, New and efficient power saving algorithms are developed. The Approximate Data Collection scheme should be scalable. This technique is more efficient to physical environmental changes and reduces message retransmission.

The main objective of this study is to understand the fundamental scalability of large-scale wireless sensor networks used for field or data-gathering. Such understanding is essential in the deployment of these networks and the development of efficient protocols. The reason for considering many-to-one type of communication among other possibilities is because many-to-one and many-to-few are communication modes that commonly take place in a data-gathering wireless sensor network. Consequently they are the system-level abstractions that capture the nature of communication in a wide range of sensor network applications, where the ultimate destination of data is a single control center (subsequently referred to as the sink or receiver) or a few connected control centers that have the resource to process the data and the authority to issue/take actions. Such applications include various data-gathering, monitoring and surveillance sensor networks, such as field imaging or monitoring where periodic snapshots of the field are reconstructed from the sensing data.

At the same time, many statistical signal processing algorithms and studies that utilize sensor networks for detection and tracking are based on a hierarchical structure that uses clusters. Communications within each cluster are again of the many-to-one type, i.e., data flows from each sensor to the cluster head where they can be processed, compressed, aggregated and relayed. More broadly, clustering is arguably one of the most frequently proposed and used methods to organize communications in a large-scale network. Thus we can easily envision many future large sensor networks to have many-to-one communication overall at a higher level, as well as within clusters in local area.

Hence fully understanding the scalability properties and implications of many-to-one communication is of great importance in the design and configuration of networks employing such communications. Within the context of many-to-one communication, possible organizations of the network include the flat and hierarchical organizations. In a flat organization all nodes/sensors act as peers in transmitting and relaying data for one another. In a hierarchical network, layers of clusters are formed. Nodes send their data to the cluster heads who then relay the data to either a higher layer cluster head or the sink.

Goals:

The goal of our paper is,

- To enhance the network lifetime
- To improve the energy efficiency of the system
- To provide sufficient load balanced coverage

II. Existing System

In existing system, Low Energy Adaptive Clustering Hierarchy (LEACH) is a clustering based protocol which distributes the energy load evenly among the sensors in the network by randomized rotation of local cluster base station. The sensors are deployed uniformly across the network thereby each sensor experience different traffic intensities. The sensors have different energy depletion rates based on their location, in which the sensor nearby the sink, tend to deplete the energy sooner. When the energy of the node is exhausted that leaves from the network and creates hole which leads to disconnection of other sensor nodes in the network and it reduce the lifetime of network.

Issues:

- Maximum Energy Dissipation
- Minimum Network Lifetime

Problem:

Achieving maximum coverage deployment is a major problem in wireless sensor network because each sensor in the network consist different energy depletion rate and network traffic. Due to the energy variation of sensor nodes in network, the lifetime of network is varied. The sensor node which consist high energy load have long network lifetime so all the sensor nodes in the network should have balanced load coverage to improves the lifetime of network.

ISSN (ONLINE):2456-5717
International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST)
Vol.4, Issue.5, May 2018

Need for New system:

To solve this problem, the load balanced coverage in WSN by using load balancing data gathering algorithm and probabilistic coverage analysis to improve the lifetime of network.

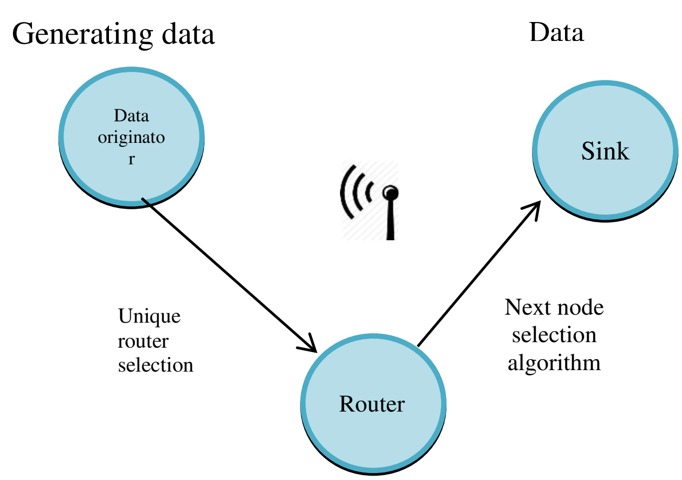
III. Proposed System

The novel graded node deployment strategy to gather stream of data in static wireless sensor networks. In this system, the number of nodes grows in coronas towards the sink to cope up with increased load. In each corona, the limited number of nodes generated data packets which are sufficient to cover the area of network. Some additional nodes in corona, acts as routers to make the nodes load balanced. An average case probabilistic analysis is performed based on perfect matching of bipartite graph to establish the lower bounds on the number of nodes to be deployed. Finally, we present the distributed greedy heuristic algorithm to construct the load balanced data gathering tree rooted at the sink node. Our proposed scheme performs significantly better than the existing system in terms of network traffic and network lifetime.

Advantages of Proposed System:

- Improvement in Network Lifetime
- Higher Energy Efficiency the network.

IV. System Architecture And Result Analysis



Probabilistic coverage analysis

Energy consumption has been the focus of many studies on Wireless Sensor Networks (WSN). It is well recognized that energy is a strictly limited resource in WSNs. This limitation constrains the operation of the sensor nodes and somehow compromises the long term network performance as well as network activities. Indeed, the purpose of all application scenarios is to have sensor nodes deployed, unattended, for several months or years. This provides the lifetime maximization problem in "many-to-one" and "mostly-off" wireless sensor networks. In such network pattern, all sensor nodes generate and send packets to a single sink via multi-hop transmissions. Then noticed, in the previous experimental studies, that since the entire sensor data has to be forwarded to a base station via multi-hop routing, the traffic pattern is highly non-uniform, putting a high burden on the sensor nodes close to the base station. In this paper, we propose some strategies that balance the energy consumption of these nodes and ensure maximum network lifetime by balancing the traffic load as equally as possible. First, it formalizes the network lifetime maximization problem then it derived an optimal load balancing solution. Subsequently, it proposes a heuristic to approximate the optimal solution and we compare both optimal and heuristic solutions with most common strategies such as shortest-path and equi-proportional routing. Then it is concluded that through the results of this work, combining load balancing with transmission power control outperforms the traditional routing schemes in terms of network lifetime

Next node selection algorithm is performed to construct the load balanced data gathering tree rooted at the sink node. Each sensor node randomly distributed in corona and the nodes know their roles in particular cycle. They act as data originator in one cycle, may acts as router in next cycle. During the initialization of the network, each sensor node discovers its one hop neighbor and its hop count. With this information each node maintains option list of its neighbor router node. A node can select its next node to forward its data, when all of its neighbors with higher hop-count have completed their next node selection procedure. In its turn, a node i selects a single node from its Option list having minimum number of children. Finally, nodes with hop count equals to 1 select the sink as a next node.

In data gathering phase, the load balanced data gathering tree is generated by next node selection and the nodes forward their data to next node. If more than one node selects the same next node, in each round, a single packet is forwarded dropping the others in round robin fashion. Hence each round, each node other than the data originator sends and receive at most one packet.

Coverage Constrained Node Distribution:

In coverage constrained node distribution, we consider a circular deployment region, which the area being divided into 'p' number of coronas with sink node at the center. Nodes are deployed over the area such that data originator senses data and forwards it towards the sink to cover the area and router nodes creates load balanced data gathering path to forwards other's packet. In each round, the data originator generates data packet that is forwarded to a router in the adjacent corona towards the sink, to follow minimum hop path.

Load Balanced Data Gathering:

In load balanced data gathering, we consider both deterministic and random placement of nodes for node distribution strategy. In large network, the number of data originator nodes in the network is always lesser than the total number of router nodes. A node will change its role in each successive cycle .i.e. a node acts as data originator in one cycle, may acts as router in next cycle. In random uniform placement, sufficient subset of nodes is selected to cover the area. At each iteration, the data originator sends the data packet to 1 hop neighbor that maximize the coverage and send it back to data originator. Finally the data originator sends the data packets towards the sink by unique router.

Probabilistic Coverage Analysis:

Probability coverage analysis guaranteed a very low probability of packet dropping to ensure the coverage. The bipartite graph is constructed using data originator in one partition of corona and the router nodes in another partition in corona. The lower bound is established for nodes respect to perfect matching of each successive corona pairs.

Distributed Algorithm for Data Gathering:

In our proposed system, we present a distributed algorithm to construct the load balanced data gathering tree rooted at the sink node. Each data originator node in the corona generates the packet and select a unique router in corona to create the load balanced routing tree stored in option list which is used to selects the next node.

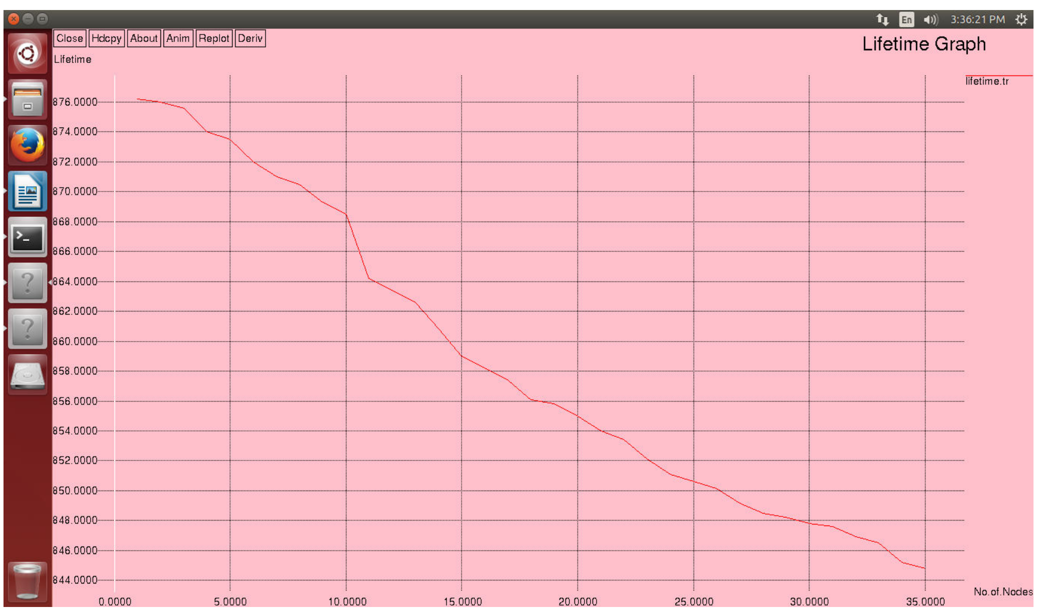
Algorithm Description:

Next node selection algorithm is performed to construct the load balanced data gathering tree rooted at the sink node. Each sensor node randomly distributed in corona and the nodes know their roles in particular cycle. They act as data originator in one cycle, may acts as router in next cycle. We perform the proposed algorithm without the knowledge of the physical positions of the individual nodes. During the initialization of the network, each sensor node discovers its one hop neighbor and its hop count. With this information each node maintains option list of its neighbor router node.

A node can select its next node to forward its data, when all of its neighbors with higher hop-count have completed their next node selection procedure. In its turn, a node i selects a single node from its Option list having minimum number of children. Finally, nodes with hop count equals to 1 select the sink as a next node. In data gathering phase, the load balanced data gathering tree is generated by next node selection procedure and the nodes forward their data to next node. If more than one node selects the same next node, in each round, a single packet is forwarded dropping the others in round robin fashion. Hence each round, each node other than the data originator sends and receive atmost one packet.

Result Analysis:

After completion of distributed algorithm for data gathering a system is allowed to the graph generation process. Since graph generation is the final module of our proposed system. During a graph generation process shows the lifetime of network with our proposed system. It also measures how well our proposed system is better when compared to an existing system. Finally we generate a graph for the parameter network lifetime vs No.of. Nodes we chosen for our concept.



This proposal fulfills the network lifetime by the load balanced data gathering, at the same time round robin fashion is guarantees that no area is left uncovered.

REFERENCES

[1] S.K.A.Imon, A. Khan, M. D. Francesco and S. K. Das, RaSMaLai: A Randomized Switching Algorithm for Maximizing Lifetime in Treebased Wireless Sensor Networks, Proc. IEEE INFOCOM, pp. 2913-2921, 2013.

[2] R.Kacimi, R. Dhaou and A.-L. Beylot, Load balancing techniques for lifetime maximizing in wireless sensor networks, Ad Hoc Networks Journal, vol. 11, no. 8, pp. 2172-2186, 2013.

[3] A.Jarry, P. Leone, O. Powell and J. Rolim, An optimal data propagation algorithm for maximizing the lifespan of sensor networks, Proc. IEEE International Conference on Distributed Computing in Sensor Systems, pp 405-421, June 2006, San Francisco, USA.

[4] A.Jarry, P. Leone, S. E. Nikoletseas and J. D. P. Rolim, Optimal data gathering paths and energy-balance mechanisms in wireless networks, Ad Hoc Networks Journal, vol. 9, no.6, pp.1036-1048, 2011.

[5] J.C. Dagher, M.W. Marcellin and M.A. Neifeld, A theory for maximizing the lifetime of sensor networks, IEEE Transactions on Communications, vol. 55, no. 2, pp.323-332, 2007.

[6] C.Efthymiou, S. E. Nikoletseas and J. D. P. Rolim, Energy balanced data propagation in wireless sensor networks, Wireless Networks, Vol.12, Issue 6, pp. 691 - 707, November 2006.

AUTHOR(S) BIOGRAPHY

M.Bargana received the BE degree in Computer Science and Engineering from Anna University Chennai. Now iam studying in II ME CSE in Mohamed Sathak Engineering College at Kilakarai, Ramanathapuram.

Dr. R. Karthikeyan received the PhD degree in Computer Science and Engineering from Anna University Chennai. He received the ME degree with Distinction from the Anna University Chennai. Now working as a Professor and Head in CSE department at Mohamed Sathak Engineering College, Kilakarai, Ramanathapuram. His current research focuses on Power Consumption for cloud computing systems and the area of specialization is Cloud Computing and Mobile Computing. He has published 10 technical papers in reputed international journals and conferences. He is a lifetime member of ISTE.