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## A Survey on Lifetime Maximization of Wireless Sensor Network using Load Balancing

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**ABSTRACT:** Now a days all the applications are worked in wireless manner as well almost all areas using wireless sensor network in some manner. The main problem in wireless sensor network is energy consumption. Because of energy consumption lifetime of wireless sensor network is decreased. In wireless sensor network, all sensor nodes generate data and send data to a single node called as sink (base station), via multi-hop transmissions. When all the sensor nodes collect data and forward that data to a single base station through multi-hop routing, the traffic pattern is highly non-uniform, this procedure puts a high burden on the sensor nodes which are close to the base station. Some strategies are used that balance the energy consumption of the nodes and helps to ensure maximum network lifetime by balancing the load are proposed and analysed.

We propose some strategies like load balancing that balance the load of these sensor nodes and ensure maximum network lifetime. First, we formalize the network lifetime maximization problem using load balancing as well as we propose a solution which checks energy of every node while load balancing. Then we compare both existing solution and our solutions with most common strategies such as shortest-path and equi-proportional routing. We conclude that through the results of this work, load balancing as well as energy checking of every node with the traditional routing schemes in terms of network lifetime maximization.

**KEYWORDS:** Wireless Sensor Network, Load balancing, Lifetime Maximizing, Performance evaluation, Energy Efficiency.

### I. INTRODUCTION

Wireless sensor networks are becoming a reality in different applications, such as area monitoring, healthcare, military applications and so on. A wireless sensor network (WSN) consists of a huge number of sensor nodes deployed in order to coordinatedely monitor physical or environmental conditions. In such networks, nodes are heterogeneous, have limited on-board resources (e.g. power, storage or data processing capacity) and position of nodes can be fixed or mobile. The lifetime of WSN is critical factor. Network lifetime is the time span from the deployment to the instant when the network is considered non-functional.

Minimizes energy consumption is a main purpose in many multi-hop wireless networking systems, especially when the nodes of the network are operated on battery. This requirement has become increasingly important for wireless sensor networks. Wireless sensor networks stand apart from other types of multi-hop wireless networks by the fact that, in most cases, the sensor data has to be brought to a single sink or base station (BS).

Clearly, one of the primary goal is the lifetime of the network. Although different definitions of lifetime exist [1], certainly a sensor network has to be considered “dead” whenever it is no longer able to forward any data to the BS. We can define a network lifetime where network lifetime is the time span from the deployment to the instant when the network is



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considered non-functional. The moment when we considered network as non-functional is the instant when the first sensor dies, a percentage of sensors die, or the loss of coverage occurs [2].

In the present paper, we will assume that network lifetime corresponds to the instant when the first node dies. We are also interested in load balancing as well as less energy consumption strategies to maximize sensor network lifetime. Using load balancing techniques, we derive an optimal solution and propose a heuristic for this problem and compare them to other routing techniques, namely, equi probability and shortest-path.

## II. RELATED WORK

### A] Load balancing techniques for lifetime maximizing in wireless sensor networks[3]

In this paper Rahim Kacimi , Riadh Dhaou, André-Luc Beylot studied load balancing approach in wireless sensor network for grid topology. They concentrated on the nodes which are near to the base station and apply load balancing on those nodes. They try to improve lifetime of those nodes using load balancing. To achieve this objective they apply Pythagoras theorem.

### B] U-LEACH: A Routing Protocol for Prolonging Lifetime of Wireless Sensor Networks[4]

U-LEACH is a extension of LEACH. As LEACH chooses the Cluster Head randomly among the all Cluster nodes. But there is probability that the CHs is concentrated only in a particular area. U-LEACH overcome this problem by uniform distribution techniques used for the select Cluster Heads.

### C] LOAD BALANCING BASED APPROACH TO IMPROVE LIFETIME OF WIRELESS SENSOR NETWORK[5]

In this paper Dipak Wajgi , Dr. Nileshsingh V. Thakur studied existing LEACH algorithm and improve some point in previous LEACH algorithm. They added extra feature in previous LEACH algorithm i.e. Backup node. In setup phase after selecting CH, nodes which are having high residual energy are selected as a backup node. When Cluster Head's residual energy reaches to the threshold value CH will activate the backup nodes.

### D] Load-Balancing Strategies for Lifetime Maximizing in Wireless Sensor Networks [6]:

Rahim Kacimi, Riadh Dhaou and André-Luc Beylot They analyzed and proposed the strategies to balance the energy consumption of the nodes and ensure maximum network lifetime by balancing the load as equally as possible assume that network lifetime corresponds to the instant when the first node dies. They also worked on the energy balancing strategies to extend sensor network lifetime. Based on load balancing techniques, they derived an optimal solution and propose a heuristic technique with comparison with, other routing techniques like equi probability and shortest-path.

### E] Energy-Efficient Multi-Path Routing in Wireless Sensor Networks [7]:

Philipp Hurni and Torsten Braun concluded that multi-path routing is useful to maximize lifetime of network by load balancing on the nodes and exploiting cross-layer information in wireless sensor network. A performance obtained by altering path update rules on existing on-demand routing algorithms. Problems are identified with concurrent traffic along interfering paths as a direct consequence of special MAC protocol properties.

### F] Energy-Efficient Communication Protocol for Wireless Microsensor Networks (LEACH) [8]

In this paper Heinzelman W, Chandrakasan A, Balakrishnan H. describes LEACH (Low-Energy Adaptive Clustering Hierarchy). It is a Clustering Based algorithm Which is implemented for reduction in consumption of energy. The different Cluster Head is been chosen every time which causes a evenly distributes a energy among all the sensor nodes in the network. That means evenly distributes a energy among all nodes which results reduction of energy dissipation as well as increases network lifetime.



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### G] Multi-hop clustering Algorithm For Load Balancing in Wireless Sensor Networks [9]

This algorithm works on homogeneous wireless sensor network strategy. This Algorithm uses layered approach for communication between inter-cluster and intra-cluster.

Title	Publication	Author	Facts
Load balancing techniques for lifetime maximizing in wireless sensor networks	Ad Hoc Networks 11 (2013) 2172–2186	Rahim Kacimi , Riadh Dhaou, André-Luc Beylot	Using Pythagorous theorem and load balancing performance is improved.
U-LEACH: A Routing Protocol for Prolonging Lifetime of Wireless Sensor Networks	International Journal of Engineering Research and Applications (2012)	Nazia Majadi	Uniform distribution of cluster heads and their corresponding clusters to prolong the lifetime of the network.
LOAD BALANCING BASED APPROACH TO IMPROVE LIFETIME OF WIRELESS SENSOR NETWORK	International Journal of Wireless & Mobile Networks (IJWMN) Vol. 4, No. 4, August 2012	Dipak Wajgi , Dr. Nileshsingh V. Thakur	Concept of backup node is added in existing LEACH algorithm
Load-Balancing Strategies For Lifetime Maximizing In Wireless Sensor Networks	IEEE ICC 2010	Rahim Kacimi, Riadh Dhaou Andr'E-Luc Beylot	In this different load balancing strategies are used and optimal solution is obtained to improve lifetime of wireless sensor network
Energy-Efficient Multi-Path Routing In Wireless Sensor Networks	Springer 2008	Philipp Hurni, Torsten Braun	Multi-path routing is used to achieve maximum lifetime of wireless sensor network.
Energy-Efficient Communication Protocol for Wireless Microsensor Networks (LEACH)	IEEE(2000)	Heinzelman W, Chandrakasan A, Balakrishnan	Distribution of energy among the sensor nodes results in reduction of the energy dissipation and improves life time.
Multi-hop clustering Algorithm for Load Balancing in WSN	International Journal of SIMULATION	N. Israr , I. Awan	Load balancing algorithm for homogeneous wireless sensor network using layered approach.

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## III. EXISTING SYSTEM

In existing system grid topology is used and BS is placed at corner. So, traffic arriving at BS is through critical nodes (critical nodes are marked with Gray colour). If load is increased on critical nodes they become non-functional. When first layer of sensor nodes become non-functional after some time next layer also become non-functional because now load is on second layer. In that way layers start becoming non-functional and at some point whole network become non-functional.[3]

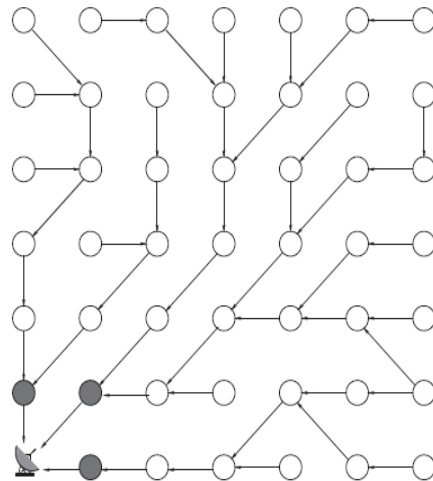


Fig. 1. A many-to-one traffic pattern impact in a 2-D grid topology with BS in the corner.

## IV. PROPOSED SYSTEM

We are proposing a system in which BS is shifted in centre instead of corner. Because of this nodes near to the BS i.e. first layer nodes (critical nodes) are increasing and it helps to maintain load balancing. We are focusing on next layer of the critical node i.e. second layer from BS. In second layer number of nodes are increased as compared to existing system.

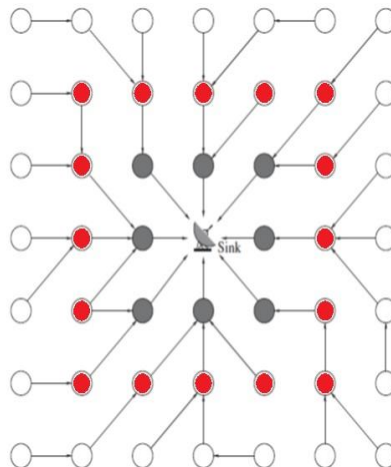


Fig. 2 Proposed System



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In proposed system we are focusing on nodes which are marked by red colour. For performance improvement we are using load balancing as well as energy checking. We are adding extra constrain along with load balancing i.e. energy remaining at that node. If energy remaining of that node is less then we are shifting load from that node to other node. In this way we can increase lifetime of that node.

## V. FUTURE SCOPE

In this approach we can increase lifetime of WSN by including load balancing and checking energy remain at that node. This approach is helpful in all the areas where WSN is used like healthcare, area monitoring, military applications etc. In future, work can also done on next layer as well as another techniques like introducing cluster to cluster communication as well as other topologies like mesh which will help to increase lifetime of WSN.

## VI. CONCLUSION

We focused the attention on lifetime issues of WSN and we designed, analyzed and compared several load-balancing methods for a regular grid topology (Heuristic, Shortest-Path and Equi-proportional), using multiple transmission power levels when BS is at the centre of the Grid.

## VII. ACKNOWLEDGEMENT

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