IARJSET
ISSN (Online) 2393-8021
ISSN (Print) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
ISO 3297:2007 Certified
Vol. 3, Issue 12, December 2016

Performance Evaluation of Efficient Coverage and Connectivity Preservation with Load Balance for Wireless Sensor Networks

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Abstract: In this paper develop a unique maximum connected load-balancing cover tree (MCLCT) rule to realize full coverage further as BS-connectivity of every sensing node by dynamically forming load-balanced routing cover trees. A wireless sensor network is network form of sense compute, and communication elements which helps to observe, events in a specified environment. Sensor nodes in wireless sensor network are depends on battery power they have limited transmission range that's why energy efficiency plays a vital role to minimize the overhead through which the Network Lifetime can be achieved.

Keywords: Wireless sensor networks, coverage/connectivity preservation, scheduling, lifetime maximization.

I. INTRODUCTION

This WIRELESS sensor Networks (WSNs) are formed by connected wireless sensor nodes that each is compact and has the power of sensing, processing, and storing environmental data still as communication with totally different nodes. High fault tolerance, strong ability, and comprehensive sensing coverage are the most merits. A Wireless Sensor Network is a network which is a collection of sensor nodes which are self controlled through the radio links. Each node in the wireless sensor network has the ability of processing separately which contains numerous memory, transceiver and power resources. These detecting devices i.e. sensors are legally responsible for data transmission from source location to destination location. Energy efficiency is the essential criteria for network lifetime enhancement.

Network lifetime is the mainly key metric for the assessment of wireless sensor networks and sensor nodes involved in WSN. In a resource-constrained situation, the use of each poor resource must be cautiously taken in consideration. The network can only accomplish its standard as long as it is considered "alive" in the network. It is as a result a metric for the highest efficiency a sensor network can offer. If the metric is used in an study preceding a real-life operation, the considered estimation of network lifetime can also include on to justify the cost of the utilization.[6] Lifetime is also measured a elementary limit in the position of accessibility and safety in networks. Network lifetime robustly depends on the lifetimes of the particular sensor nodes that generate the network. [1],[2],[3]. For these sensor network applications, most research has discussed problems in a deployment of large number of low-cost homogeneous devices. However, it is often feasible to consider the deployment of heterogeneous devices with different capabilities. For example, if two deployments have the same size of covered area but have different coverage degrees, the higher coverage degree deployment can extract more fine spatial information from the field.

Wireless sensor networks (WSNs) consist of tiny devices which are equipped with processing, transceivers, storage resources and batteries. Wireless sensor networks are deployed in open and in discreet environment. The collected information is sent through wireless links using multiple hops to a sink which can use it locally, transmit to other networks through a gateway. A node in sensor network consists of memory, battery and transceiver. The memory stores data, battery provides energy, and the transceiver receives and sends data. There are two types of WSN, homogeneous WSN and heterogeneous WSN. Heterogeneous WSN have the following advantages: (1) Prolonging network lifetime (2) Improving reliability of data transmission (3) Decreasing latency of data transportation. One of the important issues in sensor networks is power supply that is constrained by battery size which cannot be enhanced. Thus, an optimal use of the sensor energy has a great impact on the network lifetime.
In order to prolong the life time of a WSN, an effective coverage control protocol should be have the following features.

1) It should be completely distributed and self-configured. Each node independently makes its decision based on the

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local information, within a constant number of hops. Because WSN has a dynamic topology and needs to accommodate a large number of sensors, the protocols should be distributed and localized to better accommodate a scalable architecture.

2) The working nodes should be well-distributed over the monitored field in order to balance the energy load among the sensors. Because the energy consumption of working sensors are greater than those of sleeping sensors, the poor distribution of working sensors may result in the sensing hole.

3) It should have low control overhead for coverage protocol, which can long the network lifetime.

The source of the energy for sensors is battery and which cannot be again charged after the deployment. But the networks of sensors are created in such way so they can work their last. In wireless sensor network have two important issues are coverage and connectivity. Coverage determines how well an area of interest is monitored or tracked by sensors.

II. THEORY

Wireless Ad-hoc Networks are inherently different from the well-known wired networks; it is an absolutely new architecture. Thus some challenges raise from the two key aspects: self-organization and wireless transport of information. First of all, since the nodes in a Wireless Ad-hoc Network are free to move arbitrarily at any time. So the networks topology of WSN may change randomly and rapidly at unpredictable times. This makes routing difficult because the topology is constantly changing and nodes cannot be assumed to have persistent data storage. In the worst case, we do not even know whether the node will still remain next minute, because the node will leave the network at any minute.

Bandwidth constrained is also a big challenge. Wireless links have significantly lower capacity than their hardwired counterparts. Also, due to multiple access, fading, noise, and Interference conditions etc. the wireless links have low throughput. Energy constrained operation. Some or all of the nodes in a WSN may rely on batteries. In this scenario, the most important system design criteria for optimization may be energy conservation. Limited physical security: Mobile networks are generally more prone to physical security threats than are fixed cable networks. There are increased possibility eavesdropping, spoofing and denial-of-service attacks in these networks.

The Wireless Ad-hoc Networks itself is not hierarchy. In order to manage all the nodes and make Routing Protocols as well as Collision Detection mechanism easier, People bring out the idea of constructing the Wireless Ad-hoc Networks into a hierarchic architecture. Thus we have the definition of Cluster. The networks is divided into clusters, each cluster has its own cluster head. The cluster head will contain the information of the other nodes in this cluster. This idea is great, by using cluster; we avoid the flooding process when doing routing and fault diagnoses. And also the self-organization method was explored. Self organization networks are improved Light MAC networks. They distinguish themselves from traditional Light MAC networks, based on the traditional internet two level hierarchy routing architecture, by emphasizing their self-organization peculiarities. Self-organized networks can act in an independent way from any provider.

Self-organized networks are also potentially very large and not regularly distributed. For example, one single network can cover the entire world. Also, self-organized networks are highly co-operative, the tasks at any layer are distributed over the nodes and any operation is the results of the cooperation of a group of nodes. People believe that WSN will be the main architecture of the future wireless networks where the normal wireless networks are impossible to build, especially in military usage or emergency. They think the most important characteristic which sets Wireless Ad-hoc networks apart from cellular networks is the fact that they do not rely on a fixed infrastructure. They also think Light MAC networks are very attractive for tactical communication in military and law enforcement. Again, they believe that Wireless Ad hoc Networks will play an important role not only in military and emergency application, but also can be applied in civilian forums such as convention centres, conferences, and electronic classroom.

III. METHOD

In this thesis proposed approach the relay node which is responsible for deliver packets for all the nodes within the cover set. The relay node will initially be closer to center. After routing it will chosen based on probability of maximum coverage and energy levels. In the proposed MCLCT algorithm the multiple routes are discovered for delivering the packets and the routes will have highest residual energy.

The fig.1 shows the flow diagram of dynamic path scheduling algorithm. In this flow describe the various stages as follows:

3.2.1 Node Deployment

The Node Deployment is the algorithm which is used to place the nodes in the network.

3.2.2 Neighbor Nodes in the Network

This Module is used to determine the NEIGHBOR Nodes in the Network. These are the set of nodes which are within the transmission Range.

3.2.3 OOCH Randomness Routing

OOCH Randomness algorithm discovers multiple routes from source node to destination node. The 2 level neighbors are found by finding the set of nodes over double the coverage area. Each of the neighbor acts like source node. The route is discovered by the process of flooding. During route discovery process the next forward node is chosen based on which node sends a REPLY first. Among

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the multiple routes the route which has the minimum end to end delay is chosen as the best route.

During the packet delivery phase each node of the route will find neighbors. All neighbors undergo a probing scheme and a special node known as relay node is selected. Relay node is a node which has maximum value of is chosen as relay node and they deliver the packets to all the nodes within the transmission range.

For nodes which are in different inter base station ranges the source node sends the control packet to neighbors and then the same process is followed are internal routing until a node which is within the communication range of base station is reached.

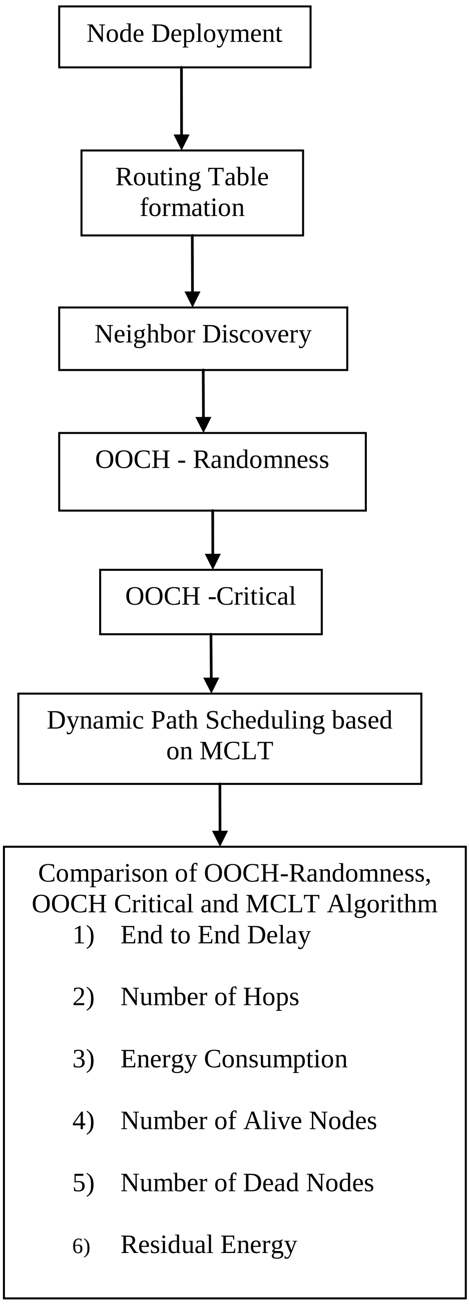

Fig.1 Flow diagram of Dynamic Path Scheduling Algorithm

3.2.4 OOCH –Critical

The OOCH-Critical algorithm works in a similar fashion as that of OOCH-Randomness. The OOCH Randomness makes use of 2L number of neighbors whereas the OOCH critical makes use of 1L set of neighbors.

3.2.5 Maximum Connected Load-Balancing Cover Tree (MCLT) Algorithm

The proposed MCLCT is composed of two sub strategies: a coverage-optimizing recursive (COR) heuristic and a probabilistic load-balancing (PLB) strategy. The COR heuristic aims at finding a maximum number of disjoint sets of nodes, which can be achieved by one of the sensor nodes (such as the sink node). In each disjoint set, the nodes are able to monitor all the DPOIs together. That is, the COR heuristic focuses on dealing with the full coverage preservation issue. Moreover, the PLB strategy is used to figure out the appropriate path from each node to the BS after the disjoint sets are initiated. For each possible transmission path from a given node to the candidate parent nodes, the PLB strategy will assign different probabilities in order to more uniformly distribute the load.

The MCLCT algorithm finds the neighbor nodes. If neighbor nodes has destination it stops the process otherwise find the forward node based on maximum probable coverage and high energy. The process is repeated until destination is reached.

IV. RESULT

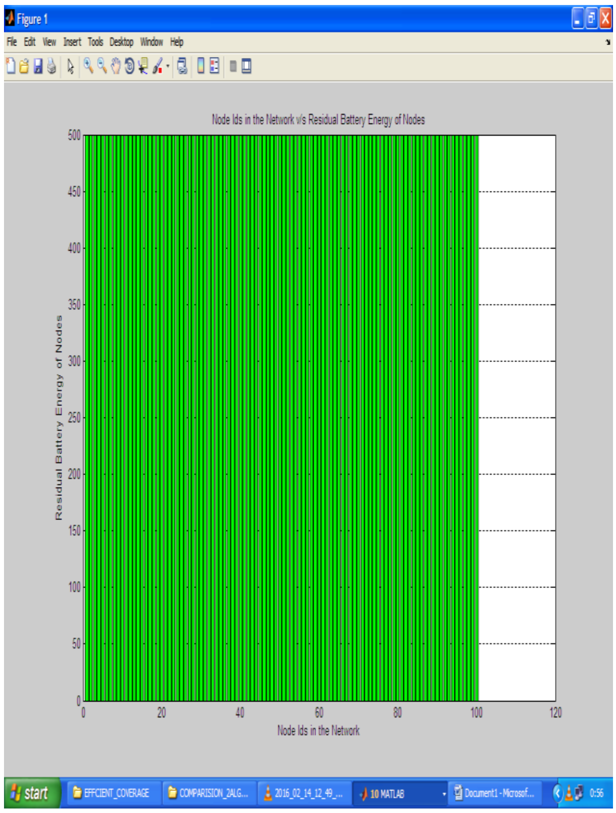

Fig.2 Node Ids in the network v/s Residual Battery Energy of nodes

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This figure 2 shows the Node Ids in the network v/s Residual Battery Energy of nodes. In this figure X level shows node Ids in the network and Y level shows the residual battery energy of nodes.

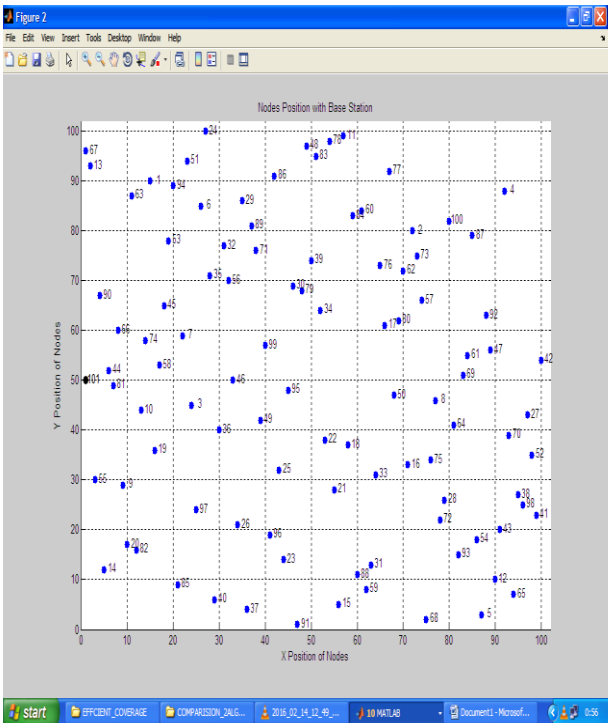

Fig.3 nodes Pattern with Base station

This figure 3 shows the nodes Pattern with Base station. In this figure X level shows the X position of nodes and Y level shows the Y position of nodes.

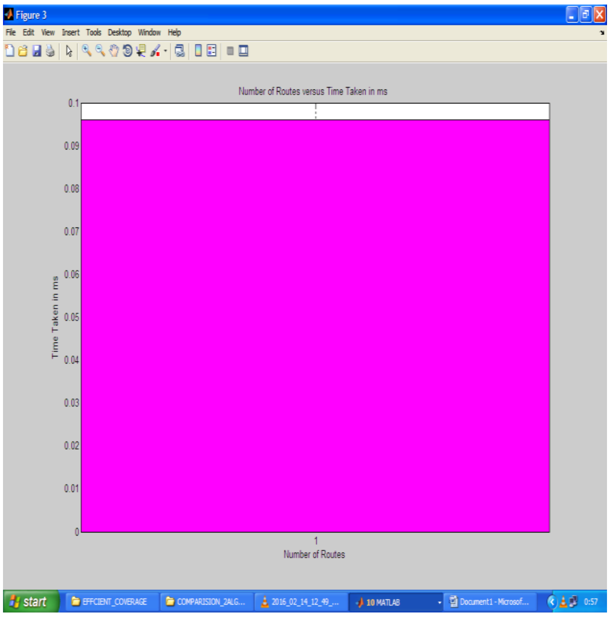

Fig.4 Number of Routes v/s time taken in ms

This figure 4 shows the Number of Routes v/s time taken in ms. In this figure X level shows the number of routes and Y level shows the time taken in ms.

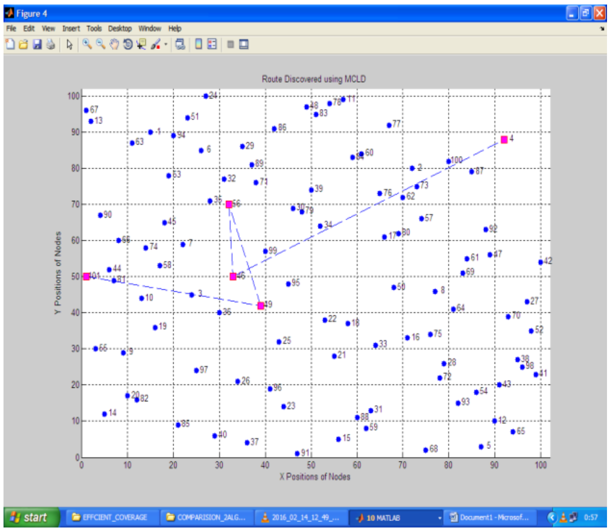

Fig.5 Route Discovered using MCLD

This figure 5 shoes the roué discovery using MCLD. In this figure X level shows the X position of nodes and Y position of nodes.

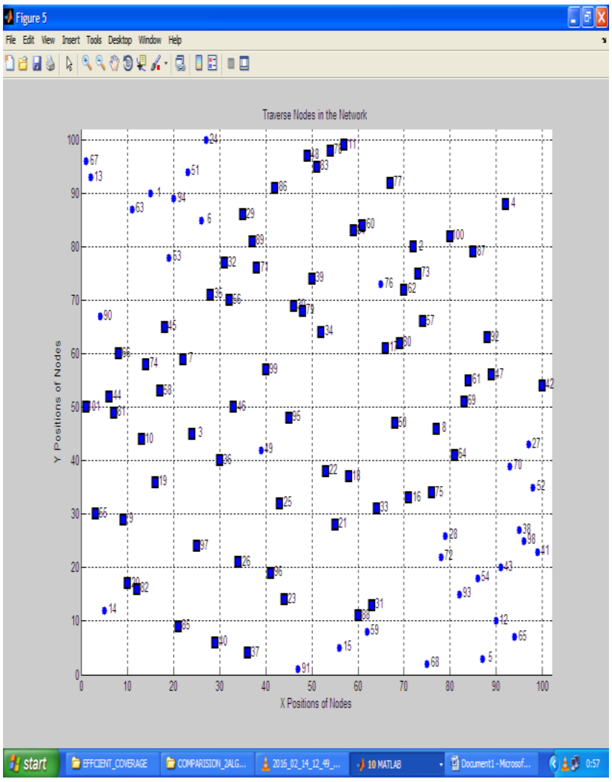

Fig.6 Traverse nodes in the network

This figure 6 shows the traverse nodes in the network. In this figure X level shows X position of nodes and Y level shows the Y position of nodes.

V. CONCLUSION

In the planned MCLCT, 2 algorithms are utilized, and that they are a COR heuristic and a PLB strategy. The COR heuristic is able to rapidly find a maximum number of cover sets consistent with the global data of WSNs. every cover set includes a small number of sensing nodes. Afterwards, the PLB strategy dynamically determines the simplest parent node to relay sensed information using local data among neighbor nodes whereas achieving even energy consumption of nodes. By doing thus, energy-efficient operation will be achieved by the MCLCT.

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