A Survey: Coverage Sensing Ratio for Homogenous-Heterogeneous Network in Wireless Sensor Network

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Abstract: ***Wireless sensor networks (WSN) have been widely studied and usefully employed in many applications such as monitoring environment, embedded system and so on. Coverage preservation, unique ID assignment and extension of network lifetime are important features for wireless sensor networks. In this survey, coverage control models fall for various approaches like clustering, evolutionary, QoS, coverage sensing, network failure, higher energy consumption of nodes in homogenous and heterogeneous network which minimized network performance based approaches is discussed.***

Keywords: overlap sensing ratio, Homogenous, heterogeneous, QoS, Energy efficient.

1. Introduction

In 1980s Defense Advanced Research Projects Agency (DARPA) is working over *Distributed Sensor Networks* (DSN) program [3, 2]. The main task of the program was to test applicability of a new approach to machine communications, introduced for the first time in Arpanet (predecessor of the Internet). The task of researchers was to engineer a network of area-distributed sensors. At the same time, sensors had to be inexpensive, work autonomously and exchange data independently. Such demands are still made for developing sensor networks for modern applications. Hence, it is possible to say that the DARPA research was a base for modern WSNs.

A sensor network of acoustic sensors tracking aircrafts appeared as a result of collaboration of researchers from Carnegie Mellon University (CMU), Pittsburgh, PA, and Massachusetts Institute of Technology (MIT), Cambridge. For a demonstration there was a platform made to passively detect and track low-flying aircraft. Connection between mobile nodes and a central computer was implemented through wireless transmission channel. Certainly, this system included not so many wireless nodes, and it was necessary to transport mobile nodes in the lorries, also system was able to track only low-flying objects with simple trajectory in rather short distance [4]. However, this work was well in advance of that time and gave a considerable impetus to sensor networks developing.

But for practical use distributed sensing with a great number of sensor nodes is of much more interest. The first steps to creating such systems were the following projects: *Wireless Integrated Network Sensors* (WINS), which started in 1993, and *Low Power Wireless Integrated Micro sensors* (LWIM), which started in the mid-1990s.

WINS combine sensor technology, signal processing, computation, and wireless networking capability in integrated systems [5]. The project was carried out in the University of California at Los Angeles in collaboration with the Rockwell Science Center. The project elaboration included working over various aspects of WSNs: sensing elements (*micro-electro-mechanical system (MEMS) sensor*), closer integration between transceiver and other elements in order to reduce the size, signal processing points, network protocol design.

The researchers have aimed at distributed network and Internet access to sensors. The network from WINS supported a great number of sensor nodes with small transceiver coverage area and low-speed data transmission (1-100 kbps) [6]. The first WINS devices had been demonstrated in 1996, and then work continued as the project WINS NG (new generation).

Sensor node's hardware platform, worked out in the framework of the WINS project, included sensitive element, analog-to-digital converter, spectrum analyzer, buffer memory. This platform was meant for continuous measurements. In addition to that, sensor nodes included digital signal processor and low power transceiver.

The entire sensor node's components mentioned above have been worked out with tight restrictions on energy consumption, because every sensor node's supply was provided by a simple Li-Ion battery which had a diameter 2.5 cm [7], wherein the sensor nodes had to be working on one battery for a long time. Such an efficient energy use was achieved by reducing speed of signal processing, decreasing sensor nodes connection range, reducing radio channel data throughput, applying MEMS and CMOS (*Complementary metal–oxide–semiconductor*) technologies for sensing elements and integration circuits production, and also by reducing the demands on WSN response delays.

WINS technologies have offered the brand-new opportunities for distributed sensing and controlling. A range of low-power integrated circuits have been worked out: interface, signal processing and communicative circuits. Its results allowed the researchers to create a great number of new ways to use WSNs for both military and civil tasks.

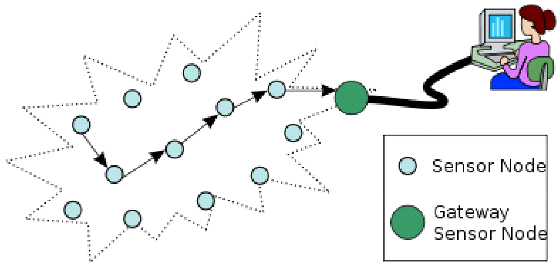

Figure 1: Wireless Sensor Network

A Wireless Sensor Network can be composed of homogeneous or heterogeneous sensors, which possess the same or different communication and computation capabilities, respectively. Fig 1 shows the heterogeneous sensor network

1.1 Heterogeneous Sensor

When a mobile wireless sensor is moving along heterogeneous wireless sensor networks, it can be under the coverage of more than one network many times. In these situations, the Vertical Handoff process can happen, where the mobile sensor decides to change its connection from a network to the best network among the available ones according to their quality of service characteristics.

1.2 Homogenous sensor

In homogeneous networks all the sensor nodes are identical in terms of battery energy and hardware complexity. With purely static clustering (cluster heads once elected, serve for the entire lifetime of the network) in a homogeneous network, it is evident that the cluster head nodes will be downside of using a homogeneous network and role rotation is that all the nodes should be capable of acting as cluster heads, and therefore should possess the necessary hardware capabilities.

2. Related Review

By introducing the concept of "centroid," Tao [51] translated the coverage problem into the centroid points' uniform distribution problem.

Ahlawat et al. [1] has proposed a new technique in which concept of Vice Cluster head has been taken out to improve the network lifetime. Vice Cluster head has been selected as alternate head that has worked when the cluster head has fallen down. Criteria for the selection of vice cluster head have set up on the basis of three factors i.e. Minimum distance, maximum residual energy, and minimum energy. Improvement in the network life has been obtained because of the cluster head has not dead ever. As a cluster have head has been died it has been replaced by its vice Cluster head.

Babaie et al. [2] have proposed a novel method to select a cluster Head. LEACH protocol has set threshold value to 0 for next 1/p rounds when a node has been selected as a cluster head. This technique optimized LEACH method, by adjusting threshold considering some factors. Proposed algorithm has settled the threshold of each node correspondingly to the number of live and dead nodes in each round, so the probability for more nodes has been established to become clusterhead. Energy factor has taken into consideration in this technique, During Cluster Head selection phase and no-clusterhead selecting node as its cluster head, while data transmitting procedure is the same as LEACH.

Bakr et al. [3] have made focus mainly on extending the WSN lifetime. Lifetime has been extended by making WSNs redundant by adding spare nodes. The passive (switched off) spares has been made available to become active (be switched on) whenever any active WSN node energy exhausted. A new proposed LEACH-SM (LEACH Spare Management) has modified the prominent LEACH protocol by enhancing it with an efficient management of spares. Addition of the spare selection phase has been done in LEACH; this functionality has been named as spare management features in LEACH-SM. During Spare Selection phase, each node has been decided in parallel whether it would be become an active primary node, or a passive spare node. The nodes decided spares go asleep, while the WSN as the whole has been maintained the required above-threshold target coverage.

Beiranavand et al. [4] have proposed a enhancement in LEACH named I-LEACH, An Improvement has been done by considering basically three factors; Residual Energy in nodes, Distance from base station and number of neighbouring nodes. A node has been considered as head node if it has optimum value for discussed three factors i.e. have more residual energy as compare to average energy of network, more neighbours than average neighbours for a node calculated in network and node having less distance from base station as comparison to node's average distance from BS in network. Reduction in energy consumption and prolongation in network life time has been observed.

Chen et al. [5] have explained an improved model in WSN which has been based on heterogeneous energy of nodes for same initial energy and multiple hop data transmission among cluster heads is proposed. New threshold has been introduced on the basis of current energy and average energy of the node to cluster head election probability and provide reliability that higher residual energy have greater probability to become cluster heads than that with the low residual energy. Problem of number of cluster heads reduces with the increase of the number of rounds.

Elbhiri et al. (2013) [6] have explained the spectral clustering methods. Spectral Classification for Robust Clustering in Wireless Sensor Networks (SCRC-WSN) named algorithm has been proposed. Spectral partitioning method has used the graph theory technics for separate the network in a fixed optimal number of clusters. Optimal number of clusters and changing dynamically the cluster head election probability has been very effective to increase the performance.

Heinzelman et al. (2000) [7] has proposed the first Leach protocol ever. Wireless distributed micro sensor systems that provide the consistent observing the areas for military and civil applications have been explained. It has also explained that the communication protocols, which have done the effective improvement on the overall energy dissipation of WSN. Direct transmission, multihop routing, and static clustering have been considerate more effective in sensor networks, So LEACH (Low-Energy Adaptive Clustering Hierarchy), a clustering-based protocol has been proposed that have developed non randomized scheme for cluster-heads. Localized coordination has exploited scalability and robustness.

3. Energy Coverage Ratio

Next to lifetime, coverage is the primary evaluation metric for a wireless network. It is always advantageous to have the ability to deploy a network over a larger physical area. This can significantly increase a system's value to the end user. It is important to keep in mind that the coverage of the network is not equal to the range of the wireless 20 communication links being used.

3.1. Sensing Model

Prior to build sensing model of WMSNs, some definitions are given below:

- **Sense Cone**
  Sensing cone is the three dimensional area being sensed by multimedia sensor in three dimensional target area, shown with shadow area in **Figure 1**.
- **Possible Sense Area**
  Possible sense area is a sphere being sensed by multimedia sensor rotation in three dimensional target area
- **Sense Direction**
  In three dimensional target area, three dimensional coordinate axis is built through sensor position, sense direction, that is α, are expressed by (β ,θ ,w) those respectively are vidicon's offset angles to the X, Y AND Z coordinate planes.
- **Neighboring Sensor**
  The neighboring sensors are the sensors whose distances are less than 2R, where the R is the radius of Possible Sense Area.
- Neighboring Area and Neighboring Sensor of Intersection.
  The neighboring area of intersection is the circle area whose radius to intersection is less than R and the sensors in this circle are neighboring sensor of intersection.

3.2 Denial of Service Attack in Wireless Sensor Networks

As one of the cornerstones of network infrastructure, routing systems are facing more threats than ever; they are vulnerable by nature and challenging to protect. In this thesis, we study different denial of service attack strategies against Directed Diffusion based WSNs. We introduce two new attacks.

3.3 Omnidirectional/bidirectional sensing coverage

Another challenging issue in WSNs is the sensing coverage, which reflects the quality of service provided by a particular sensor network. The coverage problem is defined as the sufficient number of active sensors in the network such that any point on the desired region can be monitored.

4. Conclusion

Since sensors have battery-limited power, energy conservation can be achieving efficient use of energy we mayschedule nodes to go into sleep for reduction in energy consumption, reduce the overhead of retransmissions and control packets and regulate the excessive traffic which will also avoid probable congestion. On the other hand, WSNs may be densely deployed which results in overlapping 3 sensing regions. To reduce unnecessary traffic, an efficient way is to classify the sensors to find the set of essential ones for reliability especially large scale networks in terms of the number of nodes.

In future, using the EECHR (Energy efficient coverage heterogeneity routing) protocol &some coverage distance protocol can be enhancing in 5G evaluation area should be rotational based scheme.

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