Event Driven Clustering Scheme and Energy Efficient Routing for Wireless Sensor Network - A Review

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Abstract— **Wireless Sensor networks are collection of huge number of sensor nodes that sense the environmental and physical conditions such as temperature, pressure, humidity, sound etc. and send it to the sink. Sensor nodes in the wireless sensor network have limited storage, processing, transmitted capabilities as well as limited energy sources. Sensor nodes have limited energy and resource constraints so efficient utilization of energy is essential for extending sensor network longevity. Clustering is an effective technique in prolonging the lifetime of the WSN. As sensor nodes sense the data, process it and transfer it to the base station, there are chances of redundant data send by the neighboring nodes. The unavoidable issue is that in large sensor networks, the amount of data generated is enormous for the base station to process. So methods like data aggregation are required that combine sensed data into high quality information which lead to energy conservation by reducing the number of packets transmitted to base station.**

Keywords— **Routing Protocol, Clustering in-Network Aggregation, Wireless Sensor Networks. QoS**

I. INTRODUCTION

Wireless Sensor Network (WSN) is at the top of the list of the most important technologies of twenty-first century. Wireless Sensor Network as name suggest is a wireless network consist of small low power devices called nodes which making use of sensors for sensing their surrounding conditions and communicate with each other in the network through a wireless medium. The number of Sensor nodes in wireless sensor network may be hundreds or thousands. Sensor nodes are equipped with sensors; there are different sensors such as thermal sensors for measuring temperature, microphone sensor for measuring sound, accelerometer, pressure sensors etc. The features of these sensor nodes include low cost, small size, low power, short range communication, multifunctional in term of performing sensing, processing, routing etc. Now days Wireless sensor network used in many civilian applications such as in health, environment, home, space exploration, disaster relief, chemical processing, and other commercial areas. The main characteristics of WSN include densely node deployment, limited battery powered nodes deployment, application specific, random topology change, self-

configuration etc. A sensor node in wireless sensor network has limited energy for performing various processes such as sensing, processing, communication and storage and sometimes it become difficult to replace or recharge batteries so power must be used efficiently [1].

Wireless sensor network contain thousands of sensor nodes deployed in interested geographical area and a base station that is located inside or near the sensing region. Sensor nodes deployed in area of interest in WSN sense the data and transfer it to the base station. Energy consumption of nodes in wireless sensor network for sending the data to the base station is much higher than other task like sensing and processing. The communication between base station and sensor nodes can take place either in flat or hierarchal fashion. Hierarchal architecture also known as clustering in which sensor nodes first grouped into cluster and a higher energy node from each cluster is selected as a cluster head. Sensor nodes send their data to the base station through different cluster heads. Each cluster head aggregate the data send by their neighbour nodes. Data aggregation is important in WSN because sensor nodes are densely deployed in wireless sensor network and there is huge possibility that different nodes send same data to the cluster head. In flat Sensor nodes send their data directly to the base station. Hierarchal architecture consumed less energy than flat because in hierarchal data is send over a short distance.

Wireless sensor network are used in many applications like military, Environmental, habitat monitoring, building monitoring, health monitoring etc. In many applications, small sensor nodes are densely deployed in interested geographical area either in adhoc or in pre-planned manner and left unattended to sense parameters like humidity, pressure, speed, temperature etc. data send by these sensors are collected by the base station(observer).

Unattended nature of WSNs makes it difficult to recharge batteries of the nodes. Energy efficiency is a major design goal of WSNs. Several applications require only aggregated data to reduce communication overhead e.g. in habitat monitoring average reported humidity value is sufficient for the sink. Data aggregation reduces the network overhead which results in energy savings [2]. Various examination studies show that efficient network organization, nodes grouped into clusters support data aggregation. Clustering mechanism make an improvement in Wireless sensor network in reducing energy consumption and overhead.

II. CLUSTERING PROCESS IN WSNS

Wireless sensor network composed of thousands of sensor node deployed either in predefined or in adhoc manners. Each sensor node in the network is capable in sensing, processing and transmitting the data to the sink via wireless channel. Sensor nodes are equipped with small powered battery, transceiver, and processing and communication unit. Node has limited energy and it cannot be recharged easily so special attention has to be made to low power consumption. Many researches show that clustering/ hierarchal network increase network performance than a flat network.

In hierarchal network, sensor nodes are group together to form clusters and a node from each clusters which satisfying evaluation criteria such as high received signal strength and high energy level is selected as a cluster head(CH). CH not only aggregate the data send by the nodes in the cluster but also act as a controller to make various routing and scheduling criteria [2]. Hierarchical clustered sensor networks can be divided into two categories: *homogeneous* and *heterogeneous*.

Clustering process is divided into two parts:
 1) Cluster formation.
 2) Cluster head selection.

Cluster formation phase: This is the first phase in clustering. In this phase whole sensor nodes in the network are arrange into groups and a group of nodes in the network is called cluster.

Cluster head selection phase: In this phase a node from each cluster is selected as a cluster head (CH) based on an evaluation criteria such as high energy node is selected as a cluster head (CH)

Cluster based protocols group the wireless sensor nodes into clusters and provide many advantages to the WSNs such as distributing energy evenly, reducing overhead, reducing data redundancy and improve network longevity. Clustering protocols are divided into two categories: 1) leader first approach and 2) cluster first approach. In cluster first approach sensor nodes first form clusters and then cluster head is selected. In leader first approach cluster head is selected first on the bases of certain metrics and then nodes are assigning to each cluster head.

Time driven and Event driven routing are two approaches in hierarchal cluster based routing protocols. In time driven protocols sensor nodes send the sensed data to the base station periodically but in event driven routing protocols sensor nodes send the data to the base station only when an event is detected. Wireless sensor networks cover a large geographical area. Sensor nodes send their data to the base station either through single hop or multi-hop. Practically it is impossible to have a one hop routing model in which each node directly send data to the base station. Energy level of sensor nodes decreases quickly because of large transmission distance. Hierarchal routing is a good option to deal with such problems in which large distance is covered by using multi-hop communication. Nodes communicate over small distance by using hierarchal architecture, hence reduces energy consumption. There are many advantages of clustering are [3]:

1. It saves a lot of energy of the node that send the data by reducing the distances travelled by the data.
2. In clustering cluster head perform data aggregation process and reduce the amount of redundant data.
3. It also reduces channel contention.
4. Clustering reduces packet collision.
5. Clustering result in better throughput of the network under high load.

III. DATA AGGREGATION.

Sensor nodes are very closely deployed in wireless sensor network that means sensor nodes might produce much alike data of the sensed parameters. Redundant data produce by the two or more nodes increase network overhead, packet collision. All these truths empower data aggregation technique. In data aggregation technique data collected by the sensor nodes in the cluster is aggregated at a point known as cluster head. At this point all redundant data are removed and transfer the data to other cluster heads (CH) in the network that combine the data with its own data and remove redundant data and transfer it to the sink. This can reduce localized traffic in individual group and also reduce global data. In WSNs sensor nodes are usually battery limited and resource constrained. In order to save resources and energy data must be aggregated so as to avoid network traffic, packet collision, congestion etc. The aim of data aggregation is to reduce redundant data transmission in the network.

A significant energy saving mechanism for removing redundant data is in-network aggregation. Raw sensed data collected by the sensor nodes in the network is forward to the sink for processing. The main aim of in-network data aggregation is to remove unnecessary data transmission by removing redundant data. The design of an efficient data aggregation protocol is a challenging task. Data aggregation techniques are tightly coupled with how packet is routed through the network. Wireless sensor architecture is assumed as a crucial part in the performance of data aggregation protocol. Data aggregation and packet routing is done simultaneously by many protocols [4]

IV. HYBRID ENERGY EFFICIENT DISTRIBUTED PROTOCOL

The main requirement of sensor network is to increase network lifetime. Data aggregation method helps a lot in improving network life. HEED uses residual energy level as primary parameter for selecting cluster head (CH). In case of tie where two or modes have same residual energy and are capable of being a cluster head (CH), network topology features e.g. node ID, node degree, distances to neighbour are considered as a secondary parameters. Sensor nodes are of two types: homogeneous nodes and heterogeneous nodes. Homogeneous nodes are those which have same initial energy level and heterogeneous nodes are those which have different initial energy level. In this all nodes in the network are assumed to be homogeneous having same energy level [5]. HEED (Hybrid Energy Efficient Distributed) protocol uses the concept of

clustering. Clustering can be extremely effective in one-to-many, many-to-one, one-to-any, or one-to-all (broadcast) communication. HEED has four primary objectives:

1. Prolonging network lifetime by distributing energy consumption.
2. Terminating the clustering process within a constant number of iterations.
3. Minimizing control.
4. Producing well-distributed cluster heads.

V. TREE BASED APPROACH

Many wireless sensor network protocols are usually based on hierarchal organisation of nodes in the network. The easiest way to aggregate data forwarding from source to destination is to assign some nodes in the route as an aggregation point known as aggregator. In these protocols tree structure is constructed first in which root is represented as sink and sensor nodes are referred as leaves. Data aggregation started when a node receives two or more data packets, this node then aggregate all the data collected from the nodes with its own data and remove redundant data. Aggregator send only one data packet to the node present below the aggregator in the tree. Tree based approach as also some drawbacks. For example when data is lost at certain level of tree, data is lost from the whole sub tree.

VI. CONCLUSION

In this paper, an overview of secure data aggregation concept in wireless sensor networks has been presented. This paper presents that wireless sensor network consists of huge number of sensor node having sensing, processing and communication capabilities. These nodes are resource constraint. Hierarchal architecture is beneficial for network longevity. That's why lifetime of the network is limited so the various approaches or protocol has been proposed for increasing the lifetime of the wireless sensor network.

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