(IJIASE) 2016, Vol. No. 2, Jan-Dec **e-ISSN: 2454-9258, p-ISSN: 2454-809X**

WIRELESS SENSOR NETWORK: A REVIEW ON DATA AGGREGATION

Anuj

Assistant Professor in Physics
Arya Adarsh Girls College Madlauda (Panipat)

ABSTRACT

Data aggregation is very crucial techniques in wireless sensor network. Because with the help of data aggregation wereduce the energy consumption by eliminating redundancy. When wireless sensor network deployed in remote areas or hostile environment. In the wireless sensor network have the most challenging task is a life time so with help of data aggregation we can enhance the lifetime of the network .In this paper we discuss the data aggregation approaches based on the routing protocols, the algorithm in the wireless sensor network. And also discuss the advantages and disadvantages or various performance measures of the data aggregation in the network.

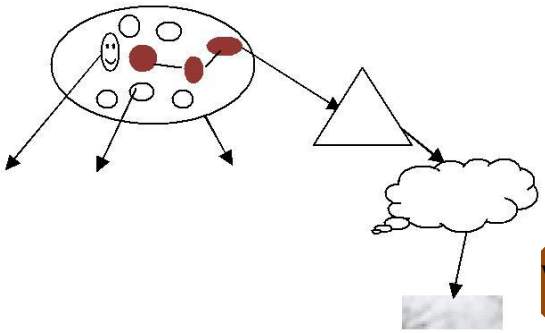
Index Terms— *Wireless sensor network, data aggregation, architecture, Network Lifetime, Routing, Tree, Cluster, Base Station.*

INTRODUCTION

The wireless sensor network is ad-hoc network. It consists small light weighted wireless nodes called sensor nodes, deployed in physical or environmental condition. And it measured physical parameters such as sound, pressure, temperature, and humidity. These sensor nodes deployed in large or thousand numbers and collaborate to form an ad hoc network capable of reporting to data collection sink (base station). Wireless sensor network have various applications like habitat monitoring, building monitoring, health monitoring, military survival lance and target tracking. However wireless sensor network is a resource constraint if we talk about energy, computation, memory and limited communication capabilities. All sensor nodes in the wireless sensor network are interact with each other or by intermediatesensor nodes.

Wireless sensor networks consist of small nodes with sensing, computation, and wireless communications capabilities. WSN contains the sensor nodes and each node is randomly deployed in the regions. Wireless sensor networks are a rapidly growing area for research and commercial development. These types of networks are used to monitor a given field of interest for changes in the environment. They are very useful for military, environmental and scientific applications, distributed computing, detecting ambient conditions such as temperature, movement, sound, light etc to name a few.

In a multihop WSN each node plays a dual role as data sender and data router. The malfunctioning of some sensor nodes due to power failure can cause significant topological changes and may need re-routing of packets and reorganization of network.



work

A sensor nodes that generates data, based on its sensing mechanisms observation and transmit sensed data packet to the base station (sink). This process basically direct transmission since the base station may located very far away from sensor nodes needs.

More energy to transmit data over long distances so that a better technique is to have fewer nodes send data to the base station. These nodes called aggregator nodes and processes called data aggregation in wireless sensor network.

CLUSTERING IN WSN

Sensor node are densely deployed in wireless sensor network that means physical environment would produce very similar data in close by sensor node and transmitting such type of data is more or less redundant. So all these facts encourage using some kind of grouping of sensor nodes such that group of sensor node can be combined or compress data together and transmit only compact data. This can reduce localized traffic in individual group and also reduce global data. This grouping process of sensor nodes in a densely deployed large scale sensor node isknown as clustering. The way of combing data and compress data belonging to a single cluster called data fusion (aggregation).

Issues of clustering in wireless sensor network:-

1. How many sensor nodes should be taken in a single cluster. Selection procedure of cluster head in an individual cluster.

DATA AGGREGATION

In typical wireless sensor networks, sensor nodes are usually resource-constrained and battery-limited. In order to save resources and energy, data must be aggregated to avoid overwhelming amounts of traffic in the network. There has been extensive work on data aggregation schemes in sensor networks, The aim of data aggregation is that eliminates redundant data transmission and enhances the lifetime of energy in wireless sensor network. Data aggregation is the process of one or several sensors then collects the detection result from other sensor. The collected data must be

processed by sensor to reduce transmission

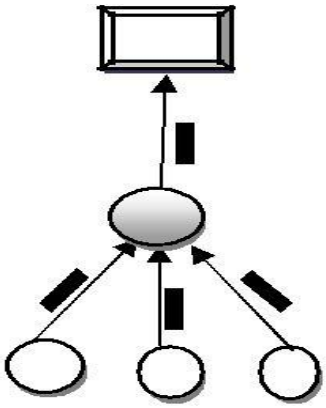


Figure 2 Data aggregation model and Non data aggregation model

It can be the base station or sometimes an external user who has permission to interact with the network. Data transmission between sensor nodes, aggregators and the queried consumes lot of energy in wireless sensor network. Processing of data packet with the help of intermediate sensor nodes. The objective of this approach is increasing the life time of the network and also reduces resource consumption. There are two type of approach for in network aggregation. With size reduction and without size reduction .In network aggregation with size reduction. It is the process in which combine and compressing the data received by a sensor node from its neighbors in order to reduce the length of data packet to besent towards the base station. Example, in some circumstance a node receives two data packets which have a correlated data. In this condition it is useless to send both data packets. Then we apply a function like MAX, AVG, and MIN and again send single data packet to base station. With help of this approach we reduce the number of bit transmitted in the network and also save a lot of energy. In network aggregation without size reduction is defined in the process of data packets received by different neighbors in to a single data packet but without processing the value of data. This process also reduces energy consumption or increase life time of the network.

ADVANTAGE AND DISADVANTAGE OF DATA AGGREGATION IN WIRELESS SENSOR NETWORK

Advantage: With the help of data aggregation process we can enhance the robustness and accuracy of information which is obtained by entire network, certain redundancy exists in the data collected from sensor nodes thus data fusion processing is needed to reduce the redundant information. Another advantage is those reduces the traffic load and conserve energy of the sensors. Disadvantage: The cluster head means data aggregator nodes send fuse these data to the base station .this cluster head or aggregator node may be attacked by malicious attacker. If a cluster head is compromised, then the base station (sink) cannot be ensure the correctness of the aggregate data that has been send to it. Another drawback is existing systems are several copies of

the aggregate result may be sent to the base station (sink) by uncompromised nodes .It increase the power consumed at these nodes.

IMPACT OF DATA AGGREGATION IN WIRELESS SENSOR NETWORK

In this paper we discuss the two main factors that affect the performance of data aggregation methods in wireless sensor network, Such as energy saving and delay. Data aggregation is the process, in which aggregating the data packet coming from the different sources; the number of transmission is reduced. With the help of this process we can save the energy in the network. Delay is the latency connected with aggregation data from closer sources may have to held back at intermediate nodes in order to combine them with data from source that are farther away. Basically aggregation method based on the position of the sources in the network, number of sources and the network topology. If the examine the factors, we consider the two models of the source placement. The event radius (ER) model and random source model [14]. The modelling says us that where the source are clustered near each other or located randomly, significant energy gains are possible with data aggregation. These gains are greatest when the number of sources is large, and when the sources are located relatively close to each other and far from base station. The modelling through, also seems to the suggest that aggregation latency could be non negligible.

TREE-BASED APPROACH

The tree based approach is defining aggregation from constructing an aggregation tree. The form of tree is minimum spanning tree, sink node consider as a root and source node consider as a leaves. Information flowing of data start from leaves node up to root means sink(base station).Disadvantage of this approach, as we know like wireless sensor network are not free from failure .in case of data packet loss at any level of tree, the data will be lost not only for single level but for whole related sub tree as well. This approach is suitable for designing optimal aggregation techniques', Madden et al. in [6] data centric protocol know as Tiny aggregation (TAG) approach. The working of TAG is depending on two phases: distributed phase and collection phase.

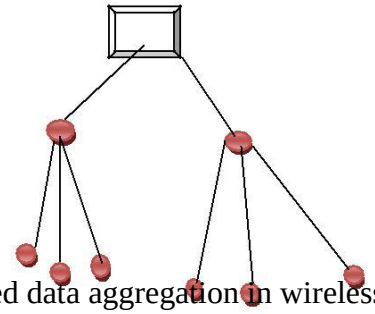


Figure 3 Tree based data aggregation in wireless sensor network

CLUSTER-BASED APPROACH

In energy-constrained sensor networks of large size, it is inefficient for sensors to transmit the data directly to the sink In such scenarios, Cluster based approach is hierarchical approach. In cluster-

(IJIASE) 2016, Vol. No. 2, Jan-Dec **e-ISSN: 2454-9258, p-ISSN: 2454-809X**

based approach, whole network is divided in to several clusters. Each cluster has a cluster-head which is selected among cluster members. Cluster-heads do the role of aggregator which aggregate data received from cluster members locally and then transmit the result to base station (sink). Recently, several cluster-based network organization and data-aggregation protocols have been proposed for the wireless sensor network. Figure 4 shows a cluster-based sensor network organization. The cluster heads can communicate with the sink directly via long range transmissions or multi hopping through other cluster heads.

Dasgupta et al. in [7] proposed a maximum lifetime data aggregation (MLDA) algorithm which finds data gathering schedule provided location of sensors node and base-station, data packet size, and energy of each sensor node. A data gathering schedule specifies how data packet are collected from sensors node and transmitted to base station for each round. A schedule can be thought of as a collection of aggregation trees. In [4], they proposed heuristic-greedy clustering-based MLDA based on MLDA algorithm. In this they partitioned the network in to cluster and referred each cluster as super-sensor. They then compute maximum lifetime schedule for the super-sensors and then use this schedule to construct aggregation trees for the sensors. W. Choi et al. in [1] present a two-phase clustering (TPC) scheme. Phase I of this scheme creates clusters with a cluster-head and each node within that cluster form a direct connects with cluster-head. Phase I the cluster-head rotation is localized and is done based on the remaining energy level of the sensor nodes which minimize time variance of sensors and this lead to energy saving from unnecessary cluster-head rotation. In phase II, each node within the cluster searches for a neighbor closer than cluster-head which is called data relay point and setup up a data relay link. Now the sensor nodes within a cluster either use direct link or data relay link to send their data to cluster head which is an energy efficient scheme. The data relay point aggregates data at forwarding time to another data relay point or cluster-head. In case of high network density, TPC phase II will setup unnecessary data relay link between neighbors as closely deployed sensor will sense same data and this lead to a waste of energy.

MULTI PATH APPROACH

The drawback of tree based approach is the limited robustness of the system. To overcome this drawback, a new approach was proposed by many researchers .in which sending partially aggregated data to single parent node in aggregation tree, a node could send data over multiple paths. In which each and every node can send data packets to its possibly multiple neighbours. Hance data packet flow from source node to the sink node along multiple path, lot of intermediate node between source node to sink node so aggregation done in every intermediate node. Using this approach we will make the system robust but some extra overhead. The example of this approach like ring topology, where network is divided in to concentric circle with defining level levels according to hop distance from sink.[3]propose a new strategy have both issues : energy efficiency and robustness. In which single path to connect each node to the base station it is energy saving but high risk of link failure. But on the other head multipath approach would require more nodes to participate with consequent waste of energy. Authors present a clever use of multi-path only

when there is loss of packet which is implemented by smart caching of data at sensor nodes. Authors also argue that in many practical situation data may be gathered only from a particular region, so they use a different approach that relies on a spanning tree and provides alternative paths only when a malfunctioning is detected. Algorithm adopts a tree-based approach for forwarding packets through the network. In the ideal situation when no failures occur, this is certainly the best choice, as the minimum number of nodes is engaged in the transmission phase. In the presence of link or node failures, the algorithm will discover alternative paths, so as ensure the delivery of as many packets as possible within the time constraints. The problem with this approach is that it may cause the arising of hot spots and nodes along preferred paths will consume their energy resources quickly, possibly causing disconnection in the network.

DATA AGGREGATION FUNCTION IN WIRELESS SENSOR NETWORK

Many effective type of data aggregation function is needed in wireless sensor network. These functions are closely related to sensor network application. Such as mean quantile, medium, count, average, max, and min.

Lossy and lossless

Data packet can be aggregated with the help of lossy aggregation or by lossless aggregation. Lossy aggregation approach does not follow a perfect reconstruction but lossless aggregation ensures a complete recovery of all individual sensor data at base station (sink) [2].

DATA REPRESENTATION IN WIRELESS SENSOR NETWORK.

Data representation is the effective way to representation the data. Wireless sensor network is consisting a large number of small sensor nodes. These are resource constraint, due to limited resource constraint it needs to decide whether to store, compress, discard and transmit data. All this requirement wants a suitable way to represent the information any type of structure are common to all sensor node in the network.[14]

SECURITY ISSUES IN DATA AGGREGATION FOR WIRELESS SENSOR NETWORK

There are two type of securities are require for data aggregation in wireless sensor network, confidentiality and integrity. The basic security issue is data confidentiality, it is protecting the sensitive data transmission and passive attacks, like eavesdropping. If we talk about hostile environment so data confidentiality is mainly used because wireless channel is vulnerable to eavesdropping by cryptography method. The complicated encryption and decryption operations such as modular multiplication.

(IJIASE) 2016, Vol. No. 2, Jan-Dec **e-ISSN: 2454-9258, p-ISSN: 2454-809X**

CONCLUSION

In this paper we present wireless sensor network is consist a large number of sensor node. And these nodes are resource constraint. 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. In this paper we discuss the data aggregation are one of the important techniques for enhancing the life time of the network.

REFERENCES

[1] I. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, "A Survey On Sensor Networks", *IEEE CommunicationsMagazine*, Volume 40, Number 8, pp.102-114, 2002.

[2] T. Arampatzis , J. Lygeros, and S. Manesis, "A Survey Of Applications Of Wireless Sensors And Wireless Sensor Networks", *In Mediterranean Conference On Control AndAutomation MED05*, Nicosia, Cyprus, 2005.

[3] L. Gatani, G. Lo Re, and M. Ortolani, "Robust and Efficient Data Gathering for Wireless Sensor Networks", in *Proceedingof the 39th Hawaii International Conference on System Sciences – 2006*

[4] K. Dasgupta, K. Kalpakis, and P. Namjoshi, "An Efficient Clustering-based Heuristic for Data Gathering and Aggregation in Sensor Networks", IEEE 2003

[5] E. Fasolo, M. Rossi, J. Widmer, and M. Zorzi, "In-Network Aggregation Techniques for Wireless Sensor Networks: A Survey", IEEE Wireless communication 2007.

[6] S. Madden *et al.*, "TAG: a Tiny Aggregation Service for Ad-hoc Sensor Networks," *OSDI 2002*, Boston, MA, Dec. 2002.

[7] K. Dasgupta et al., "Maximum Lifetime Data Gathering and Aggregation in Wireless Sensor Networks", In *Proc. of IEEENetworks'02 Conference*, 2002.