International Journal of Research in Advent Technology, Vol.7, No.5S, May 2019
E-ISSN: 2321-9637
Available online at www.ijrat.org

Data Aggregation Procedures in Wireless Sensor Networks

A. Agnes Saleema
Assistant Professor,
Department of Computer Applications, Ayya Nadar Janaki Ammal College, Sivakasi
agnessaleema09@gmail.com

Abstract : - In recent years an efficient intention of a Wireless Sensor Network has become a prominent area of research. A Sensor is a device that responds and identifies some type of input from both the physical or environmental conditions, such as pressure, heat, light, etc. The output of the sensor is commonly an electrical signal that is transmitted to a controller for further processing. Wireless sensor networks (WSN) offer an increasingly Sensor nodes need less power for processing as compared to transmit data. It is desirable to do in network processing inside network and reduce packet size. One such methodology is data aggregation which gorgeous method of data gathering in distributed system architectures and dynamic access via wireless connectivity. In this paper, a data aggregation techniques on wireless sensor networks is presented. The main objective of data aggregation methods is to collect and aggregate data in an energy efficient manner so that network lifetime is enhanced.

Keywords- WSN, Data aggregation, LEACH, TAG

1. INTRODUCTION

Presently, Wireless Sensor Network (WSN) is the most standard services employed in commercial and industrial applications, because of its technical development in a processor, communication, and low-power usage of embedded computing devices. The WSN is built with nodes that are used to observe the surroundings like temperature, humidity, pressure, position, vibration, sound etc. These nodes can be used in several real-time applications to implement various tasks like smart detecting, a discovery of neighbour node, data processing and storage, data collection, target tracking, monitor and controlling, synchronization, and effective routing between the base station and nodes. Currently, WSNs are beginning to be organized in an enhanced step. This technology is stimulating with infinite probable for several application areas like medical, environmental, transportation, military, entertainment, homeland defence, crisis management and also smart spaces.

2. WSN ARCHITECTURE

The architecture of WSN follows the OSI architecture Model. The WSN architecture includes five layers and three cross layers. Mostly in sensor n/w we require five layers, namely application, transport, network, data link & physical layer. The three cross planes are named as power management, mobility management, and task management. These layers of the WSN are used to accomplish the network and make the sensors work together in order to raise the complete efficiency of the network.

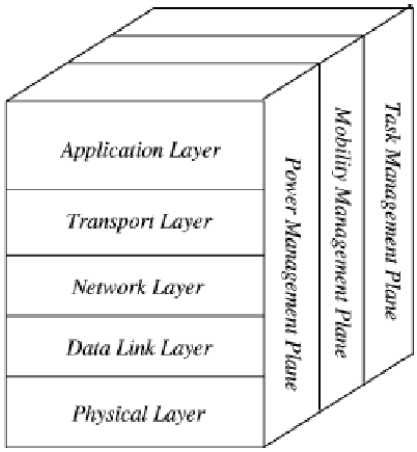

Fig 2.1: Architecture of WSN

- *Application Layer*: The application layer is responsible for traffic management and offers software for numerous applications that convert the data to find positive information. Sensor networks arranged in numerous applications in different fields like agricultural, military, environment, medical, etc.
- *Transport Layer:* The main function of the transport layer is to transport congestion avoidance and reliability where a lot of protocols projected to offer this function are either practical on the upstream. These protocols use different mechanisms for loss recognition and loss recovery. The transport layer is accurately needed when a system is planned to contact other networks.

- *Network Layer:* Routing is the main function of the network layer, it has a lot of tasks based on the application, but really, the main tasks are in the power conserving, partial memory, and sensor don't have a universal ID and have to be self-organized.
- *Data Link Layer:* The data link layer is responsible for multiplexing data frame detection, data streams, MAC, & error control, confirm the reliability of point to point (or) point to multipoint.
- *Physical Layer:* An edge for transferring a stream of bits above the physical medium is provided by the physical layer. This layer is liable for the selection of frequency, generation of a carrier frequency, signal detection, Modulation & data encryption. IEEE 802.15.4 is proposed as low rate particular areas & wireless sensor network with low cost, power consumption, density, the range of communication to improve the battery life. CSMA/CA is used to support star and peer to peer topology.

3. DATA AGGREGATION: AN OVERVIEW

In typical Wireless Sensor Network, sensor nodes are frequently resource-constrained and battery-limited. In order to avoid wasting resources and energy, data must be aggregated to avoid overwhelming amounts of traffic in the network. There has been in depth work on data aggregation schemes in sensor networks.

Data aggregation procedures aims at removing redundant data transmission and therefore improve the lifetime of energy controlled wireless sensor network. In wireless sensor network, data transmission appropriated place in multi-hop fashion where each node forwards its data to the neighbour node which is nearer to sink. The process of Data aggregation is to aggregate the sensor data using aggregation approaches. Generally the data aggregation algorithm works as shown in the below figure. The rule uses the sensor data and then aggregates the info by exploitation some aggregation algorithms like centralized approach, LEACH (low energy adaptive clustering hierarchy), TAG (Tiny Aggregation) etc. The aggregated data are transferred to the sink node by selecting the efficient path.

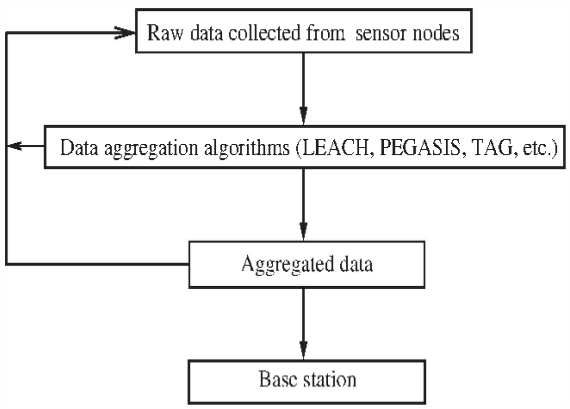

Fig: 3.1 Architecture of Data Aggregation Algorithm

4. DATA AGGREGATION TECHNIQUES

a. *Centralized Approach:*

This is AS address central approach wherever every node sends information to a central node via the shortest potential route employing a multi-hop wireless protocol. The device nodes merely send the information packets to a pacesetter that is that the powerful node. The leader aggregates the information which may be queried.

Every intermediate node must send the information packets self-addressed to leader from the kid nodes. Thus an out sized range of messages ought to be transmitted for a question within the best case up to the total of external path lengths for every node.

b. In-Network Aggregation [6]:

In-network data aggregation deals with the distributed processing of data in sensor network. In this data aggregation the data size reduction shall not hide statistical information about the monitored event.

There are two methods for in-network aggregation, which are with size reduction and without size reduction. In-network aggregation with size reduction refers to the approach of mixing the information packets received by a node from its neighbours so as to scale back the packet length to be transferred or forwarded towards sink. In-network aggregation without size reduction refers to the method merging data packets received from completely different neighbours in to a single data packet but without processing the value of data.

c. ***Tree-Based Approach [7]:***
The tree-based approach perform aggregation by constructing an aggregation tree that can be a minimum spanning tree, embedded at sink and supply nodes are considered as leaves. Each node encompasses a parent node to forward its data. Flow of data starts from leaves nodes up to the sink and in that the aggregation done by parent nodes.

d. ***Cluster-Based Approach [5]:***
In cluster-based approach, the entire network is divided in to various clusters. Each cluster incorporates a cluster-head that is chosen among cluster members. Cluster heads do the role of aggregator which aggregate data received from cluster members locally and then convey the result to sink.

5. CONCLUSION

In this paper we have given the elaborate insights for method of knowledge aggregation and its totally different techniques of doing. Wireless sensor networks are energy constrained network. Since most of the energy consumed for transmission and receiving knowledge, the process of data aggregation becomes an important issue and optimization is needed. Efficient data aggregations not solely give energy conservation however conjointly take away redundancy data and thus give helpful data only.

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