AN APPRAISAL OF DIFFERENT TECHNIQUES OF DATA AGGREGATION IN WIRELESS SENSOR NETWORKS

M.D.Raju,
Associate Professor, Dept. of Electronics & Communication engineering,
Mahaveer Institute of Science and Technology, Hyderabad

Abstract : *Wireless sensor network (WSN) associated with a group of wireless sensor nodes using a high-speed network connection. All deployed sensor nodes will be used to efficiently detect and process data on the network. The importance of data aggregation is to eliminate redundant data that increases the life of the network; otherwise, they expand or retain the power of the sensor nodes to aggregate data into the WSN. Hence, it is need to add the data of the discovered information in high quality, and this is achieved through data agregation. In this document, you will look at the data aggregation approaches that WSN call centralized, tree, clustered, and intranet. Also review the comparison of several approaches to the aggregation of data latency, data accuracy, computational overhead, scalability, redundancy, and with the consumption of energy.*

Key words: *wireless sensor network (WSN), data aggregation, centralized, tree-like, cluster and intranet approaches.*

INTRODUCTION

A wireless sensor network (WSN) has wireless sensor nodes that are randomly distributed or spatially deployed in a real- world environment, as shown in Figure 1. Each node is assigned an initial amount of energy and bandwidth to the network. All nodes (sensors and receivers) in the network are assumed to be static or mobile, and the sensor nodes calculate the path through the network. Sensor nodes are used to be able to detect and transmit data through nodes in the network. Modernadvances in microelectronics and telecommunications technology have already led to the creation of small detection nodes that are capable of periodically collecting data from their respective environments. The collected data is processed by a single processor element connected, which transmits through the communication network among themselves. The placement of sensor nodes depends on the application [1] [2]. Sensors periodically detect data, process it and transmit it to the base station. The frequency of reporting data sensors as a rule, providing data dependent on the specific application.

There are several issues that affect the structure and performance of the WSN, namely 1) hardware and operating system DSNs, 2) communication characteristics, 3) access schemes between, 4) implementation, 5) localization, 6) synchronization, 7) calibration, 8) network layer problems, 9) transport layer problems, 10) data aggregation and distribution, 11) database and query orientation, 12) architecture, 13) programming model for sensor networks, 14) issues an intermediate software DSN, 15), communication and computation based on QoS, 16) control problem resiliency, 17) routing problems, 18) the problem of awareness of context sensor distributed n etworks,19) scalability, 20) authentication problems, 21) key management problems in DSN, 22) the sensor is very limited in terms of power, processing power, and memory, 23) limited bandwidth, variable capacity wireless links and limited power operation , 24) dynamic topologies, 25) security issues: key issues of creation, privacy and confidentiality, resilience to denial of service, routing and secure capture, nodes, and 26) sensors are very limited in power, computing power and memory.

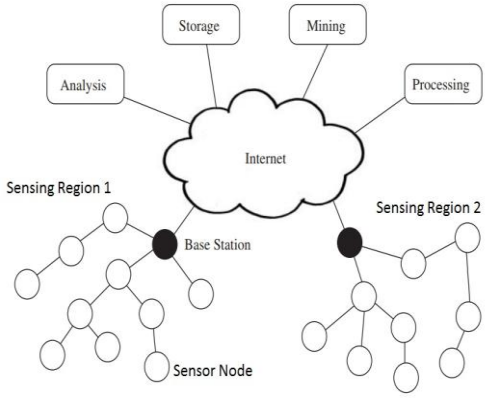

Figure 1. Typical wireless sensor networks.

Energy is a limited resource for calculating problems in the FSU. The number of nodes

increases, the complexity of the network increases. In this sense, energy consumption for calculating tasks increases. Therefore , one mechanism is required for aggregating energy efficient data in the WSN. Data aggregation is a mechanism or technique for removing redundant data or information from sensor node data to increase network life and sensor data accuracy. This paper discusses the problems of aggregation of data , such as delays, data accuracy, data redundancy and traffic load. Data aggregation includes the systematic collection of detected data from several sensors, their aggregation to suppress redundant data and the transmission of the aggregated data to the receiving node for further processing [5] [6]. Therefore, it is necessary to combine the detected data into high- quality information, and this is achieved through data aggregation.

The rest of the article is organized as follows. General
description in related work, which is discussed in section II. Section III describes the issues of data aggregation in WSN. Classification of data aggregation approaches and comparison of these approaches are discussed in Section IV and finally completed in Section V.

II. Related work

Here are some of the related work: Work featured in [7] provides an overview of data aggregation methods in WSN. This document also analyzes clustering based on data collection and routing protocols in WSN. The data aggregation algorithm based on dynamic message lists in the FSN is proposed in [8]. In this article, I propose an energy efficient structure free data aggregation and delivery (ESDAD) protocol that aggregates repeated data at intermediate nodes. Simulation results show that it out performs existing non-framework protocols in terms of energy efficiency, reliability, and on-time delivery. The work presented in [9] describes a power-constrained cluster-based routing protocol for WSN. This document describes the following objectives of the proposed work in terms of minimizing overall energy consumption and ensuring fairness in energy consumption between nodes. An overview of the data aggregation techniques in WSN is presented in [10]. This document discusses the different types of data aggregation issues in terms of latency, redundancy, accuracy, and traffic load. It also compares data aggregation methods Vs performance parameters such as latency, redundancy, average power consumption, and traffic load.
The work presented in [11] describes secure data aggregation using authentication and access control (SDAACA) for WSN. Existing cryptographic algorithms are used to make it difficult to detect Sybil receivers and attacks. This paper presents two new algorithms for detecting such attacks using SDAACA.

A protocol such as Secure Data Fragmentation (SDF) and Host Attach

Authorization (NJA). Finally, it shows the efficiency and comparison of secure data aggregation protocols in WSN. Data aggregation based on secure energy efficient clusters in WSN is discussed in [12]. This article is about how to provide secure communication thrgh sensor nodes on the network. It consists of five stages, the formation of groups, the selection of group leaders, the route of opening a group of heads, aggregation data and a maintenance phase for communication.

The choice of cluster heads based on fuzzy data in the WSN is presented. This article discusses narrowing down the rule set by including an association rule along with fuzzy logic to predict a head from a group. Comparison of various methods of data aggregation in distributed sensor networks. It demonstrates the effectiveness of the proposed method in sensor networks in terms of power consumption, data latency, and accuracy . Aggregation of context-sensitive data in distributed sensor networks . In this article, you highlight four different contexts in the DSN when considering a scenario of forest environments, such as: temperature context, air pressure context , communication energy aware ness, and object context awareness. It is believed that two layers of data aggregation processes (cluster head and sink) minimize redundant data for transmission. And finally, evaluate the performance parameters according to the proposed scheme. In it, he discussed the security issues of aggregation algorithms in the network. He also introduced a lightweight verification al gorithm that would allow the base station (BS) to check if the computed aggregate was valid.

III. DATA AGGREGATION ISSUES IN WSNs

The following are the issues when aggregating data:

- *Redundancy:* This is one of the problems with data aggregation in the WSN, as the number of nodes increases, the data redundancy in the network increases. In which some of the sensor nodes detect the same type of data that is sent to the receiving node over the network. This leads to a waste of energy to eliminate redundant data at the receiving node. Consequently, there is a need for some techniques to eliminate redundancy in order to increase network life and performance. The following are methods for removing redundant data during data aggregation in WS N: 1) at the intermediate node level, 2) at the cluster head level, and 3) at the sensor node level.

- *Latency:* As the number of nodes increases, the aggregation time in the WSN increases. This is the time it takes to aggregate the data at the W SN nodes .
- *Compute overhead :* As the number of nodes in the network increases, the percentage of compute overhead increases to process data on the network during data aggregation.

- *Accuracy: at* the time of aggregation node (may be an intermediate node, the cluster head node or the receiving node) performs the task of aggregating data and sends the result to the aggregated data to the recipient node via the network in terms of data accuracy. Since some of the nodes repeatedly sending redundant data to its corresponding node, the data in the WSN in accurate.

IV. CLASSIFICATION OF DATA AGGEREGATION TECHNIQUES

Figure 2 shows the classification of data aggregation methods in WSN. Four classifications of data aggregation methods are described below:

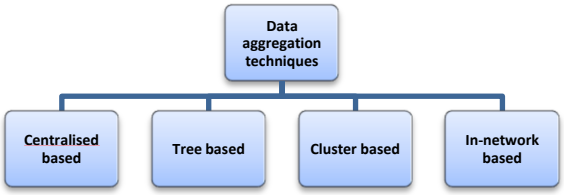

Figure 2. Classification of data aggregation methods.

A. *Centralized approach to data aggregation*

Figure 3 shows data aggregation using a centralized approach in WSN. Each node sends data to the central node via the intermediate node , using the shortest possible path in the network. The hub collects and combines datafrom the sensor and finally sends the data to the receiving node or base station in the WSN.

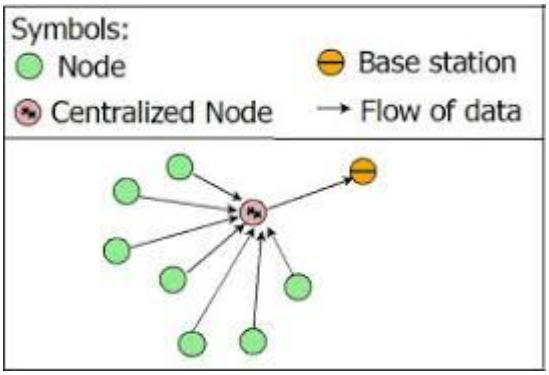

Figure 3. Data aggregation using a centralized approach.

B. *Aggregating data based on trees*

Aggregation of data based on a tree is shown in Figure 4. In this approach, the network is organized in a tree structure. This approach includes a collection of source nodes or leaf nodes, an intermediate node, and the root node of the tree. Each source node sends data to the corresponding intermediate node. The staging node collects and merges data from its source nodes, transfers the data to the next level of the staging node in the tree, and so on.

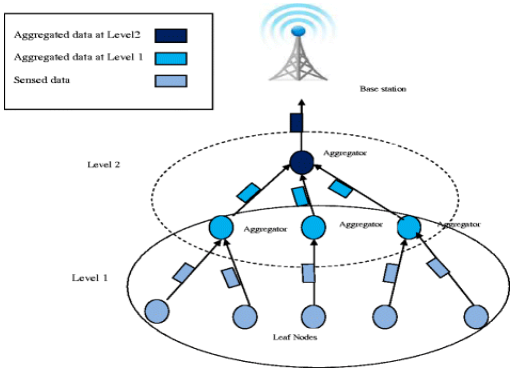

Figure 4. Data aggregation using a tree-based approach.

C. *Data aggregation based on clusters*

Figure 5 illustrates data aggregation using the cluster approach in WSN. Static or randomly deployed WSN requires a clustering protocol to partition the network into clusters for increased network life, scalability, load balancing, and node sensor capacity optimization. When grouped, sensor nodes are grouped into groups on the network. Each group has a group header (CH) to the data by sending data directly to the base station (BS) node of the server . Selection from a CH node is based on the highest probability of energy between cluster nodes. After selecting a channel from all groups, the remaining nodes are associated with the corresponding channels.

There are two types of connection to the proposed network, such as a : inter-cluster communication and connection within the cluster. Communication between nodes

and the members of their respective IB, called intra - cluster communication, in while the connection between the IB and the receiving node is inter- cluster communication. The network is built using network configuration parameters. Each node detects data and periodically sends it to the CH node, the CH node transmits data to the receiving node via the IB. Finally, the sink node receives in action on recei ve information from sensor nodes. A node consists of a cluster that sends data to the appropriate CH through links from one or more hops. CH receives data from its member nodes in each group to transmit data to the receiving node. A node grouping that prevents long distance data transmission from sensor nodes to a receiving node or BS.

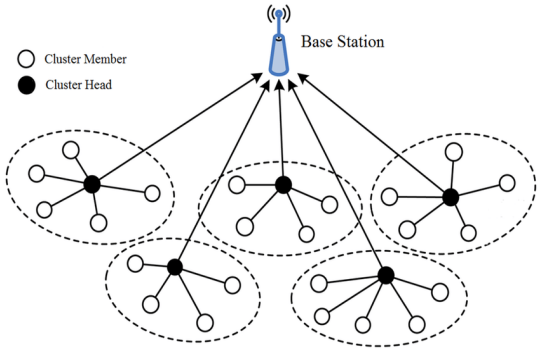

Figure 5. Cluster-based data aggregation.

D. *In- Network data aggregation*

Figure 6 shows data networking in a WSN. The intermediate node collects data from its source nodes in the internal communication.

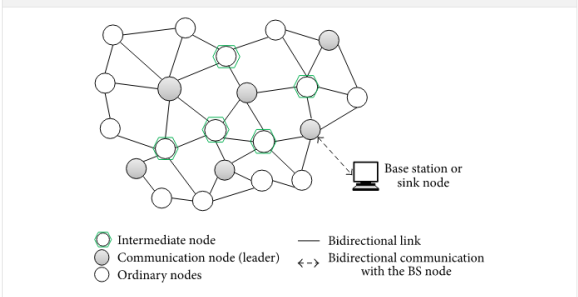

Figure 6. Data aggregation using an in-network method

The intermediate node aggregates data using some algorithms or methods (i.e., it compresses or merges data), the result of the aggregated data is transmitted to the receiving node through intermediate nodes to reduce power consumption in the network. There are two types of in-network approaches to aggregating data in WSNs as follows : (1) c DOWNSIZE: describes the process of combining and compressing data packets received at a node from its neighbors in order to reduce the length of the packet to be transmitted drain node . And (2) no size reduction: it does not process combined data packets received from different neighbors as a single data packet, but without processing the data value. The following Table 1 shows a comparison of the various data aggregation methods in WSN.

Data aggregation methods	Parameters					
	Accuracy	*Latency*	*Redundancy*	*Scalability*	*Computation overhead*	*Energy consumption*
Centralised based	Average	Average	High	Less	High	High
Cluster based	High	Less	Less	High	Less	Less
Tree based	Average	Less	Less	Average	Less	Less
In-network based	Less	Average	Average	Less	Average	Average

Table 1. Comparison of different methods of data aggregation.

Based on a comparison of different approaches to data aggregation in WSN, cluster-based data aggregation is a more suitable approach due to load balancing, lower power consumption for data computation, increased network life, and scalability.

V. CONCLUSION

This paper discusses a broad introduction to data aggregation approaches in WSN, covering issues and concerns, and classification of data aggregation approaches followed by a comparison of data aggregation approaches. As far as we know, on the

basis of cluster aggregation is the best approach to all approaches to wireless networks of
sensors , how to maximize computational efficiency of energy data, the best network of life, accuracy, scalability, load balancing, and lower computational cost.

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