A Review on Various Approaches of Data Aggregation in WSN

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Abstract-Wireless sensor network has been used for sensing information from sensing Sink nodes collect information and transmit this information to base station for decision making process. Sink nodes act as data aggregation points in WSN that store information and transmit information to base station. The main issue in data aggregation is that due to redundancy of information storage as well as bandwidth of the network gets affected. All the nodes available in the network that store information consumes some amount of energy for data aggregation. Due to redundant information huge amount of energy in WSN get wasted. Energy consumption affects network life time.

Keywords- Wireless Sensor Network, Data Aggregation, Energy, Information Centric Network, **Tree-based Data Aggregation**

I.   INTRODUCTION

1.1 Wireless Sensor Network
A wireless sensor network is a gathering of specific transducers with a correspondences foundation for observing and recording conditions at diverse areas. Generally checked parameters are temperature, humidity, weight, wind direction and velocity, enlightenment force, vibration power, sound force, force line voltage, substance focuses, pollutant and basic body capacities. A sensor system comprises of various detection stations called sensor hubs, each of which is little, lightweight and versatile. Each sensor hub is outfitted with a transducer, microcomputer, handset and force source. The transducer produces electrical signs focused around sensed physical impacts and phenomena. The microcomputer courses of action and stores the sensor yield. The handset gets charges from a focal PC and transmits information to that PC.
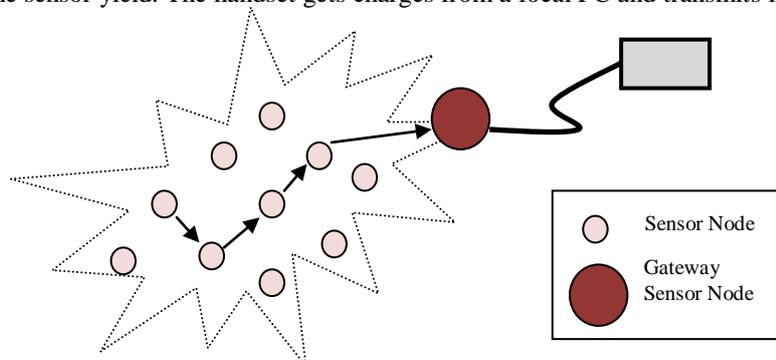

Figure 1.1: Wireless Sensor Network [2]

The power for every sensor hub is gotten from a battery.A Wireless Sensor Network Mobile communications and wireless networking technology has seen a third time advancement. In technological advancements and also in application demands various classes of communication networks have combined like Cellular networks, Ad hoc Networks, Sensor Networks and Mesh Networks. Cellular network depend upon infrastructure. Ad hoc networks are comes in the category of wireless networks that organize multi hop radio relaying when the nodes are dynamically and arbitrarily located. Ad-hoc network are does not depend upon network. Nodes measure the ambient conditions in the environment surrounding them. These measurements include signal transformation that can be processed to show some characteristics about the phenomenon. The data collected is routed to sink node which is very special node .Then by using internet or satellite the sink node send data to user, through a gateway.

1.2 Clustering
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 is known as clustering. The way of combing data and compress data belonging to a single cluster called data fusion (aggregation).

1.3 Data Aggregation

Data aggregation is any process in which information is gathered and expressed in a summary form, for purposes such as statistical analysis. A common aggregation purpose is to get more information about particular groups based on specific variables such as age, profession, or income. The information about such groups can then be used for Web site personalization to choose content and advertising likely to appeal to an individual belonging to one or more groups for which data has been collected. For example, a site that sells music CDs might advertise certain CDs based on the age of the user and the data aggregate for their age group. Online analytic processing (OLAP) is a simple type of data aggregation in which the marketer uses an online reporting mechanism to process the information [1].
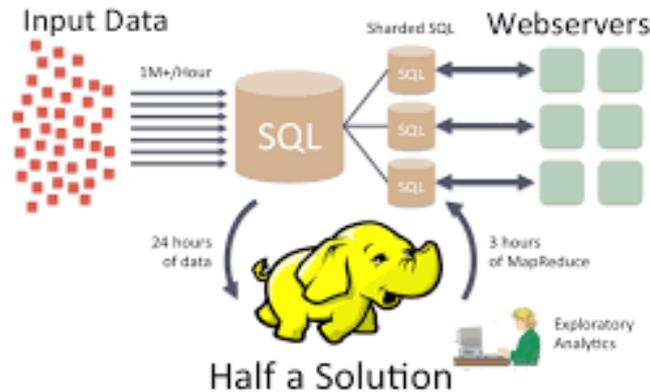

Fig 1.1: Data Aggregation [10]

Data aggregation is the process of transforming scattered data from numerous sources into a single new one. The objective of data aggregation can be to combine sources together as such that the output is smaller than the input. This helps processing massive amounts of data in batch jobs and in real time applications. This reduces the network traffic and increases the performance while in progress.

1.4 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. These performances are highly dependent on the desired application. Energy Efficiency: By the data-aggregation scheme, we can increase the functionality of the wireless sensor network. In which every sensor nodes should have spent the same amount of energy in every data gathering round. A data aggregation scheme is energy efficient if it maximizes the functionality of the network. Network lifetime, data accuracy, and latency are some of the significant performance measures of data-aggregation algorithms.

II. LITERATURE REVIEW

V. Vaidehiet. al. [1] "Secure Data Aggregation in Wireless Sensor Networks" Data aggregation is a widely used technique inwireless sensor networks to reduce the power consumed inWSN. In a bid to reduce the power consumption during datagathering, cluster heads are elected to gather data from every node in the WSN. There are various challenges that areinvolved in the process of data aggregation like checking ofduplication of data after encryption, overhead due to encryption etc. This paper proposes a novel scheme to secure the process ofdata aggregation by providing a light-weight security schemecalled Combinatorial Key Distribution (CKD) mechanism thatconsumes less power and its performance is improved usinghashes of data that is sent across the network. The proposed scheme minimizes the power usage and maximizes thesacredness of data in the wireless sensor network. The proposed security scheme is compared with other existing security solutions and the results are reported.

Fei Yuanet. al. [2] "Data Density Correlation Degree Clustering Method for Data Aggregation in WSN" One data aggregation method in a wireless sensor network (WSN) is sending local representative data to the sink node based on the spatial-correlation of sampled data. In this paper, we highlight the problem that the recent spatial correlation models of sensor nodes' data are not appropriate for measuring the correlation in a complex environment.Based on this correlation degree, a data density correlation degree (DDCD) clustering method is presented in detail so that the representative data have a low distortion on their correlated data in a WSN. In addition, simulation experiments with two real data sets are presented to evaluate the performance of the DDCD clustering method.

Rabia Noor Enamet. al. [3] "An adaptive data aggregation technique for dynamic cluster based Wireless Sensor Networks",This affects the data aggregation mechanism on the cluster heads such that in a large sized clusters the

collected data cannot be placed in small and fixed size packets without incurring significant losses. Therefore, we have developed a novel and an adaptive method of data aggregation that exploits the spatial correlation between the sensor nodes. The main feature of our proposed aggregation method is that in addition to reducing the cost of redundant data transfer in the network, it also optimally utilizes the available space in a packet at each cluster head. The simulation results have shown that in the proposed aggregation method the payload size requirement decreases to almost 25% of the non compressed payload. Also, the distortion percentage in the proposed aggregation method decreases by 16% to 41% as compared to the mean aggregation method.

KalyanSasidharet. al. [4] "A WSN lifetime improvement algorithm reaping benefits of data aggregation and state transitions", Wireless sensor networks consist of different subsystems such as sensing, transmission, reception, power and processing systems. Battery power of sensor nodes is one of the important factors to consider in a wireless sensor system.This paper introduces state transitions for cluster head nodes to further reduce energy. The algorithm basically combines data aggregation and state transition to improve the overall life time of the network. To validate the algorithm, we apply to a landslide monitoring and detection system and obtain 33% energy savings for leaf node and 30% energy saving for cluster head node when compared to naive algorithms that do not apply state transitions.

Manish V. Bhosleet. al. [5] "An Energy Efficient and Reliable Location wise Data Aggregation In WSN" A wireless sensor network is a group of specialized transducers devices that uses radio to monitoring and sensing physical or environmental conditions at different location .Commonly monitored parameters are pressure, temperature, humidity, wind direction and speed, vibration intensity, sound intensity, power-line voltage, chemical concentrations and vital body functions. However, Energy efficiency is an essential design issue is a challenging task. In this simulation we focused on energy parameter which is work on an energy efficient and reliable location wise data in wireless sensor network called as EERLA and compare with two DRINA.

Nandini. S. et. al. [6]"Data Aggregation in Wireless Sensor Network", Sensor networks are collection of sensor nodes which co-operatively send sensed data to base station. As sensor nodes are battery driven, an efficient utilization of power is essential in order to use networks for long duration hence it is needed to reduce data traffic inside sensor networks, reduce amount of data that need to send to base station. The main goal of data aggregation algorithms is to gather and aggregate data in an energy efficient manner so that network lifetime is enhanced. Wireless sensor networks (WSN) offer an increasingly Sensor nodes need less power for processing as compared to transmitting data. It is preferable to do in network processing inside network and reduce packet size. One such approach is data aggregation which attractive method of data gathering in distributed system architectures and dynamic access via wireless connectivity. Wireless sensor networks have limited computational power and limited memory and battery power, this leads to increased complexity for application developers and often results in applications that are closely coupled with network protocols. In this paper, a data aggregation framework on wireless sensor networks is presented. The framework works as a middleware for aggregating data measured by a number of nodes within a network. The aim of the proposed work is to compare the performance of TAG in terms of energy efficiency in comparison with and without data aggregation in wireless sensor networks and to assess the suitability of the protocol in an environment where resources are limited.

KiranMaraiya et al [7]"Wireless Sensor Network: A Review on DataAggregation" Data aggregation is very crucial techniques in wireless sensor network. Because with the help of data aggregation wereduce the energy consumption by eliminating redundancy. W hen wireless sensor network deployed in remot e areas or hostile environment. In the wireless sensor network have the most challenging task is a life time so with help of dat a aggregation we canenhance the lifetime of the network .In this paper we discuss the data aggregation approaches based on the routing protocols, thealgorithm in the wireless sensor network. And also discuss the advantages and disadvantages or various performance measures ofthe data aggregation in the networ k.

III. APPROACHES USED

3.1 Tree-based Data Aggregation

In a hierarchical network, Tree-based Data Aggregation is the most efficient method. Many types of data aggregation such as cluster, chain, tree-based data aggregation put several data aggregators in the network. To construct an aggregation tree in multiple sinks, a multiple-sink-based compressive data aggregation technique. For determining the routing structure towards the sinks, they used the Link Reversal Algorithm. The main objective of this algorithm was to construct and maintain links to multiple sinks to seamlessly aggregate data. Another important function of this protocol is the information exchange between sinks. Due to the wide coverage, difficulty is generally faced in developing treebased routing protocols. But, due to the merge of independent sink-oriented trees, this protocol has wider coverage compared with the single-sink case. [8].

3.2 Information-Centric Network

An Information-Centric Network communicates with information identifiers such as names, in contrast to IP. An IP-based network detects which information has to be served through an IP address and then transmits equivalent information. The communication protocol in an IP-based network is used to propagate packets to a host, which possesses information. In contrast, an Information-Centric Network concentrates on the purpose of communication rather than the procedure. We can apply this notion in a wireless sensor network. As a result, Information-Centric Networks like CCN in Wireless Sensor Networks are being researched. A design for a CCN-WSN protocol and implementation has been suggested.[1].

3.3 Cluster-Based Data Aggregation

In cluster-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 sink.

3.4 In-Network Aggregation

In-network aggregation is the global process of gathering and routing information through a multi-hop network, processing data at intermediate nodes with the objective of reducing resource consumption thereby increasing network lifetime. There are two approaches for in-network aggregation: with size reduction and without size reduction. In-network aggregation with size reduction refers to the process of combining & compressing the data packets received by a node from its neighbors in order to reduce the packet length to be transmitted or forwarded towards.

3.5 Data Cube Aggregation

It is a multidimensional approach for data aggregation. The values arestored in separate cell of a data cube, each phase of cube is divided into separate rows & columnsand each value & node such as consumption, bandwidth, MRIC, RSSI etc are represented at thebeginning of rows.

Sr. No.	Author Name	Algorithm Name	Advantages/ Disadvantages
1	V. Vaidehi	Tree-based Data Aggregation	Advantage: It construct and maintain links to multiple sinks to seamlessly aggregate data. Disadvantage: difficult to construct due to wide coverage.
2	Fei Yuan	Information-Centric Network	Advantage: reduce resource consumption. Disadvantage: size reduction refers to the process of combining & compressing the data packetsreceived by a node from its neighbors in order to reduce the packet length
3	Rabia Noor Enam	Cluster-Based Data Aggregation	Advantage: reduces the energy consumed and it helps to increase the network lifetime. Disadvantage Cluster members send the data only to its corresponding local cluster head.
4	Nandini. S	In-Network Aggregation	Advantage: cluster heads can communicate with the sink directly via long range transmissions or multi hopping Disadvantage: it is inefficient for sensors to transmit the data directly to the sinkdue to large size.
5	KiranMaraiya	Data Cube Aggregation	Advantage: it is more scalable. Disadvantage: it is time consuming.

IV. CONCLUSION

Data aggregation is any process in which information is gathered and expressed in a summary form, for purposes such as statistical analysis. Sink nodes act as data aggregation points in WSN that store information and transmit information to base station. The main issue in data aggregation is that due to redundancy of information storage as well as bandwidth of the network gets affected. As the network life decreases cost from deployment of WSN get increases. In WSN these data aggregation, security and lifetime are three major issues that must be carried out for enhancement in performance of WSN. To remove this issue dynamic clustering has been utilized that select cluster head on the basis of energy every iteration so that each node can get a chance to act as a cluster head.

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