Cluster Based Secure Data Aggregation in WSN

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***Abstract*—In Wireless Sensor Networks data aggregation is an important technique which not only reduces the communication overhead but also aims at achieving the power efficiency in the sensor network since sensor nodes have limited battery power data aggregation becomes an efficient technique which reduces the amount of energy consumption by the senor nodes and it also eliminates the redundant transmission of data.This paper addresses the data aggregation and its type called as cluster based data aggregation in which cluster head plays the role of aggregator.The last part of the paper is focussed on the simulation results which shows that the secure data aggregation approach namely sign share has faster aggregation processing time compared to the other approaches**

***Index Terms*—Wireless Sensor Network,Data Aggregation,Cluster Based Data Aggregation,Secure Data Aggregation Approch.**

I. INTRODUCTION

A wireless Sensor Network is an adhoc network composed of small nodes called sensor nodes which are deployed in numerous numbers for sensing the physical environment [1].A WSN comprises of extensive collection of sensor nodes with one or more base stations or sink. These sensor nodes are deployed in vast area ,they work with each other to form a network which has the capacity of reporting the gathered information to the base station. sensor nodes interact with each other or they interact by making use of the intermediate sensor nodes.The sensor nodes have the capability of measuring the parameters like pressure, vibration, temperature, motion, humidity, sound [2].The applications of Wireless sensor network are in various fields like forest monitoring, manufacturing, forecast systems, military surveillance, health, home, office monitoring and many intelligent and smart systems.

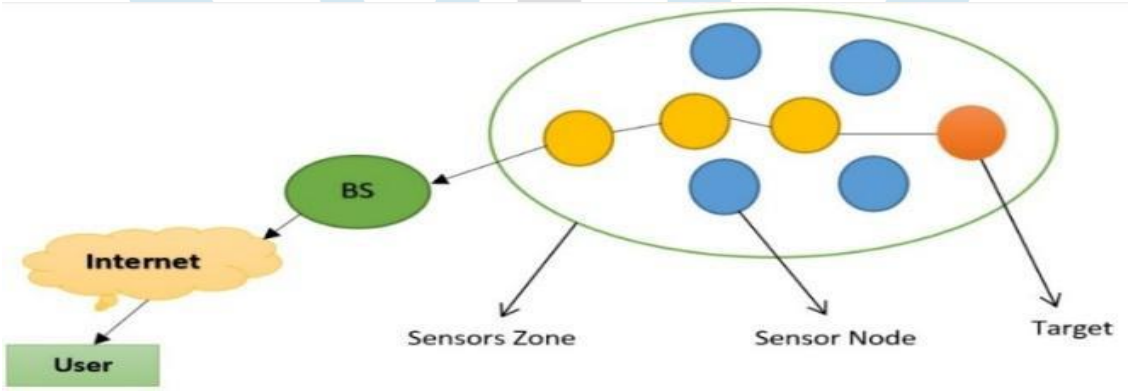

Figure 1: Architecture of the Sensor network

II. DATA AGGREGATION IN WSN

Data aggregation is the process of collection of data and presenting the data in the summarized form which can effectively reduce the size of the data.Data aggregation can also reduce the amount of energy consumption that is required while transmitting and receiving the data [3].Data Aggregation process helps in the reduction of the data packets that has to be transmitted to the base station,this is illustrated in the following figures 2 and 3.Without data aggregation four packets are transmitted from aggregator node to the base station,with data aggregation only one packet is transmitted from aggregator node to the base station [4].

There are many attacks in WSN among them are selective farwarding and modification attack.In selective farwarding attack malicious node drops the packets which results in packet loss and in modification attack malicious nodes modify the data and transmits false data packets to the base station.In order to avoid these kind of attacks secure data aggregation scheme is much needed.

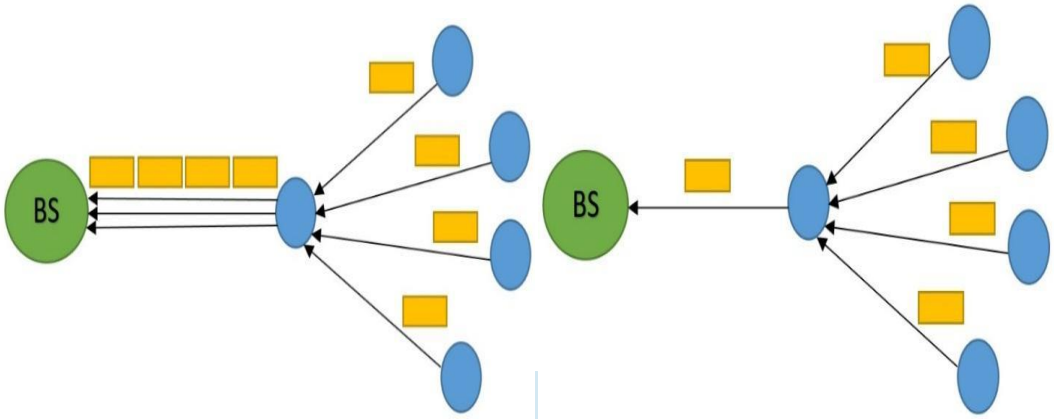

Figure 2: Without DA

Figure 3: With DA

III. CLUSTER BASED DATA AGGREGATION

In the cluster based approach entire network is split into clusters with each cluster having the CH(cluster head) in it.The cluster head acts as aggregator node and performs the aggregation process by gathering the data from its cluster members and then farwards the result to the BS(Base Station) [5].

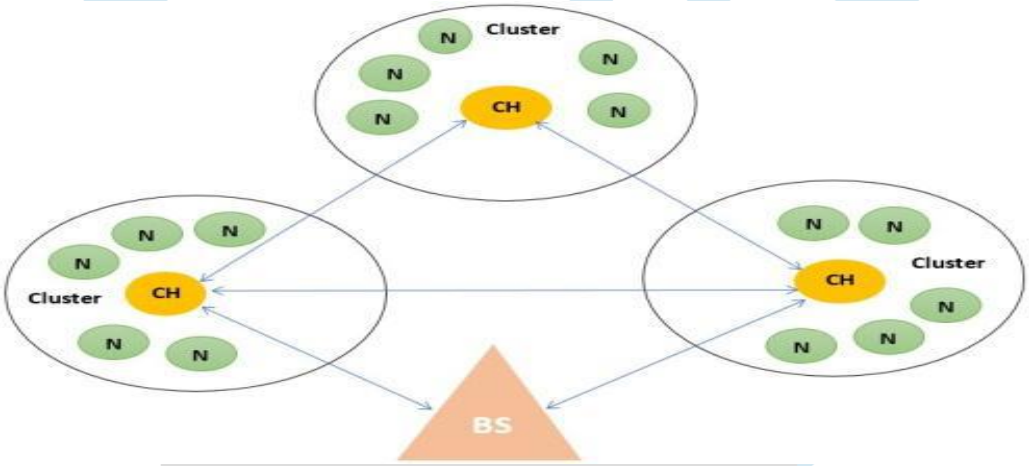

Figure 4: Cluster Base Data Aggregation

IV. RELATED WORK

[6] IPHCDA (Integrity Protecting, Hierarchical Concealed Data Aggregation) has four major steps namely key generation,encryption, aggregation, and decryption.IPHCDA has better performance when compared to other schemes like privacy homomorphic data aggregation but suffers from overhead due to encryption and decryption process.

[7] The main aim of DAA (Data Aggregation and Authentication) is to provide secure data aggregation and false data detection .The DAA protects the aggregator node from being compromised and there by providing protection to the network.

[8] PIP hides the detail of one node from the other node and focuses to provide privacy and integrity in data aggregation.PIP prevents the aggregator node from understanding the contents after the receiption of all the shares.

[9] CPDA(Conflict-free Periodic Data Aggregation) technique in wireless sensor networks supports conflict free data aggregation where in which a delta time is maintained between two successsive data packets.Some of the sensor nodes may suffer from less amount of energy when CPDA is made to work in heterogeneous networks.

[10] RCDA(Recoverable Concealed Data Agrregation) incorporate aggregate signature scheme to assure data integrity and authenticity.Base station can recover the individual sensor data even if the data has been aggregated by the sensor node.

[11] RSDA(Reputation based Secure Data Aggregation) aims to increases the life time of the network and accuracy of the data aggregation process. In RSDA the area is divided into tiny cells which are equal sized,every sensor nodes investigates its cell's behaviour by observing neighborhood's activities inorder to filter out the unstable data.

V. FLOW CHART

A diagram which gives the sequence of actions carried out in a complex system is called as flow chart.The first step is to deploy the nodes then we start selecting the neighbouring nodes after the selection of neighbouring nodes cluster formation is done if the nodes are within in the range else eliminate nodes which are away from the range from cluster formation,then cluster head is elected.After this step secure data aggregation approach can be carried out to make the data aggregation process a successfull one.

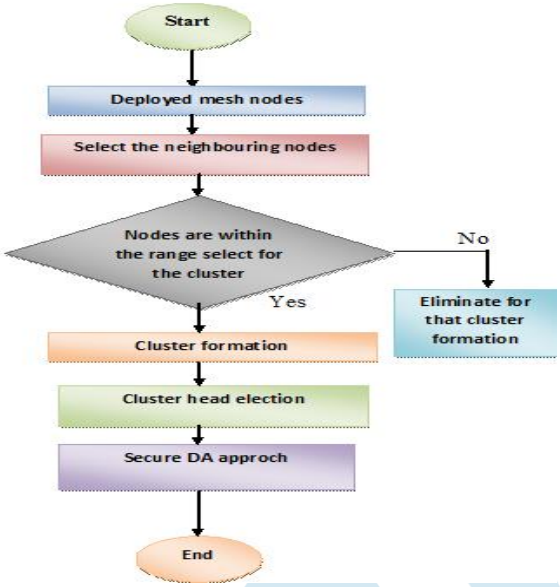

Figure 5: Flow Chart

VI. SECURE DATA AGGREGATION

For carrying out the data aggregation process in a secure manner we can follow the following steps
a) Network Deployment :- Proper deployment of node not only reduces the redundancy of the node and cost of the network but can also extend the network life [12].
b) Cluster Formation :- Clustering is the process of grouping the network nodes into small groups such small groups are called as clusters.The advantage of cluster formation is ,it can reduce the consumption of energy by the sensor nodes and can increase the life time of the network [13].
c) Cluster Head Selection :- Cluster Head is a node which has highest cumulative credit point. Cumulative credit point can be earned based on three parameters namely residual energy level of the node, degree of the node, and mobility level of the node [14].
d) Data Aggregation :- Data Aggregation is a technique which is used for aggregating the data from several sensor nodes which can abolish the transmissions that are redundant and has the ability to provide combined information or data to the sink or base station [15]
e) Secure Data Aggregation Scheme :- This can be done using sign share approach which has the following phases

- Sensor nodes senses the environment and prepares its data that has to be sent to its aggregator node and does the following
  - Sensor node encodes the data.
  - Sensor node then Splits the encoded data into shares,for example b0,b1,b2...bn.
  - The bytes or the shares b0,b,b2...bn is then encoded with key set.
  - Finally each byte is signed using a hash.
- The aggregator once received with the data does the following
  - Aggregate the Signatures.
  - Aggregate all the shares.
  - And then farwards the concatenated data to the base station.

- The Base station when received with the data does the following
  - Extracts the bytes that are received from the aggregator.
  - Recovers the data of each sensor nodes.
    - Decoding each byte using a key set.
    - Then merges the decoded byte.
    - Decipher the data.

VII. RESULTS

Implementation is done using the latest version 3.26 of NS 3

a) Node Creation

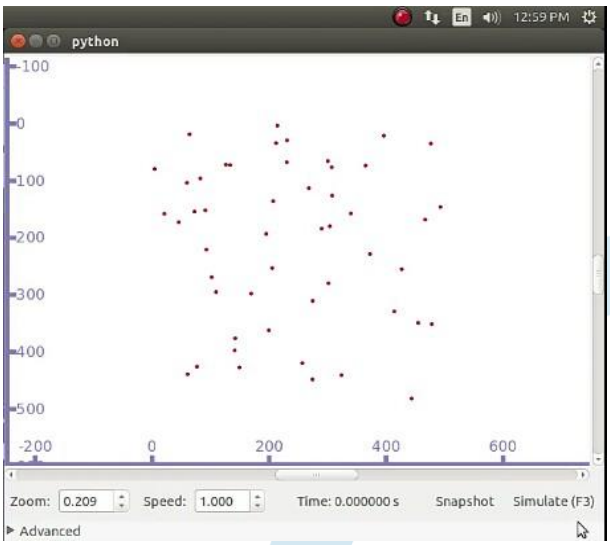

Figure 6 : Node creation

b) Cluster Formation

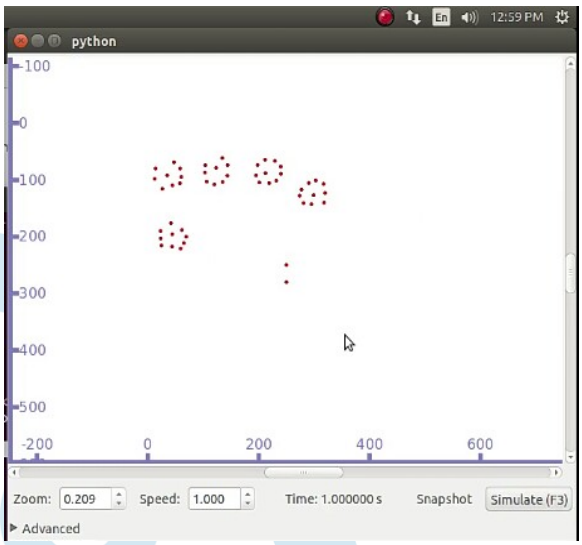

Figure 7 : Cluster Formation

Figure 6 shows the creation of network consisting of fifty nodes and figure 7 shows the formation of cluster in which the nodes are grouped together

d) Data Aggregation

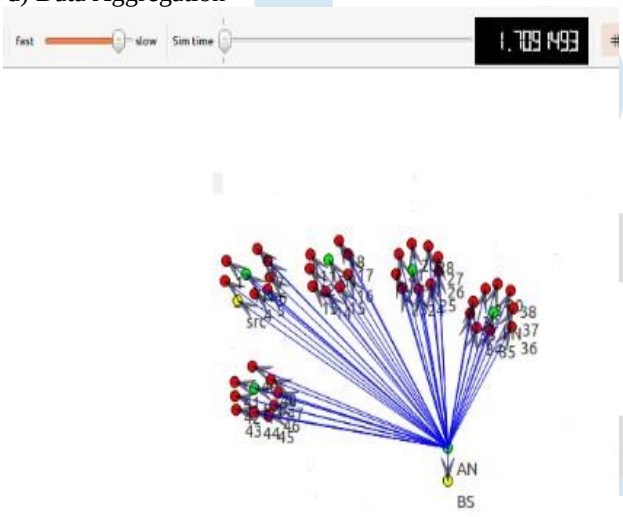

Figure 8: Data Aggregation

e) Graph of aggregation processing time

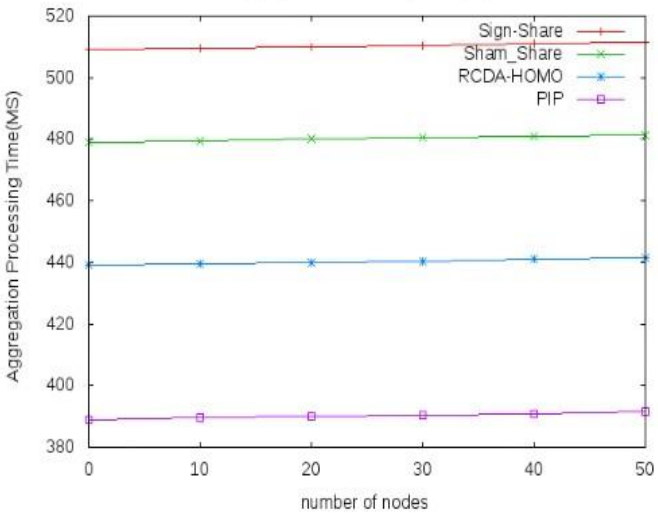

Figure 9 : Graph of aggregation processing time

Figure 8 shows that AN is the aggregator nodes which performs the aggregation process and sends the result to the BS that is the base station.Figure 9 shows that the aggregation processing time of sign share approach is faster than that of the other three approaches.

VIII. CONCLUSION AND FUTURE ENHANCEMENT

In data aggregation,the data or information is presented in the summary form which can effectively reduce the data size ,data aggregation also results in the decreased amount of energy consumption by sensor nodes.Cluster data aggregation is a data aggregation approach in which the cluster head is elected which plays the role of the aggregator node.The results shows the node creation process in a network which consists of fifty nodes ,cluster formation of the nodes and the aggregator node performing the aggregation process and sending the results to the base station or sink,the graph shows that the aggregation processing time of sign share approach is faster when compared with other approaches.Several attacks in WSN's like selective farwarding,modification attacks can be abolished if data aggregation process is carried out in a secure manner .The future work can be done on data aggregation using iterating filtering technique and privacy preservation technique for data aggregation.

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