Effective Transmission of Aggregated Data in Wireless Sensor Networks

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Abstract- *Wireless Sensor Networks (WSNs) are most widely useful in the situations where the human intrusion is not possible. The data that is retrieved from the nodes is efficient by the aggregation. There are several methods for the aggregation of data. The existing scheme uses the clustering method in which the data is not efficient and secure. The proposed scheme Velocity Energy-efficient and Link-aware Cluster-Tree (VELCT) forms the tree among the nodes in which the data is sent through that optimal path to the sink node. It also consists of the Data Collection Node (DCN) which sends the data to the sink. This scheme decreases the delay and traffic and increases the lifetime of the network. It also provides security.*

Keywords-Data Aggregation, Lifetime of Network, Security of data.

1. INTRODUCTION

Wireless Sensor Networks (WSNs) can be applied to the scenarios. They are used to observe the conditions of the environment. They are applied in the tracking the wildlife, conditions of the forest, and also to the supervising the defense people. The nodes are scattered densely in the environment and thereby the network is formed by the nodes in the environment [1].

The nodes are arranged in the environment where the observation is to be carried out. The nodes are scattered by the following methods in which they can be configured i.e., by the random and regular scattering. The problem with the WSN is the energy consumption of the nodes and then the lifetime of the network. The lifetime of the network is raised by the protocols imposed on it [2]. Most of the protocols are based on the Clustering approach in which the data is transmitted to the sink effectively. The network's topology is identified and then the transmission of data is carried out [10].

Managing the topology is important so that it can handle the problems like malfunctioning of the node; node with less energy, etc., the efficiency of WSN is dependent on the schemes of data collection. There are numerous data collection methods in order to collect the data. Among them are based on the topologies of the

networks such as chain, cluster, tree and hybrid [11].

The above techniques fall short to provide a network that is reliable in mobility, delay and traffic. The Velocity Energy-efficient and Link-aware Cluster-Tree (VELCT) scheme is projected for the collection of data to diminish the crisis in coverage, delay, traffic, end-to-end connection etc.

2. RELATED WORK

In paper [3], the authors suggest a novel method for the scheduling of data and target coverage. In collection of data, it requires scheduling the coverage area and the cumulative the data and it transmits to the sink. It utilizes the Coverage and Data Collection Tree (CDCT) which is constructed using the sensed information from the nodes and is broadcasted to the root and at last to the sink. It in addition gives attention to the area that can be covered by the nodes. It offers the greater lifetime of the network.

In paper [4], the authors recommend a new method for data aggregation, compressed data aggregation. It is one in which the collected from the node is compressed to attain the revitalization conformity in sink. It is appropriate to recuperate the data which is vanished during the data aggregation and it must be decompressed at the receiving end.

In paper [5], the authors clarify about the data optimization in the clustered environment. The clustering scheme is used to lessen the node's energy consumption. The Joint optimization is suggested to defend the CHs. It is appropriate for the sensor network that is large in number in which the disseminated clustering method is feasible.

In paper [6], the authors elucidate about the numerous methods for aggregation of data incorporating the security in it. It is proposed to mitigate the node's communication overhead. The node's security is given by the encrypted and the unencrypted protocols.

In paper [7], the authors have proposed a novel capable clustering method which is used for the nodes which are isolated. This clustering method uses Regional Energy Aware Clustering with Isolated Nodes (REAC-IN) protocol. The REAC-IN protocol is very helpful in merging the nodes which are isolated into the cluster, within the network.

In paper [8], the authors have proposed a novel Data Collection Algorithm i.e., Tree-Cluster-Based Data-Gathering Algorithm (TCBDGA) in which it uses the weight based construction of the tree and competently gathers the data. This TCBDGA lessens the consumption of energy of the nodes in the network and balances the entire network.

In paper [9], the authors have proposed a novel clustering method to save the energy of the nodes. The alternative clustering method uses Self-configurable Clustering method in which the Backup Cluster Head (BCH) is used to mitigate the malfunction of the CH in the

network. This method keeps up the node's energy in the network.

3. PROPOSED SYSTEM

The proposed scheme consists of the sections given by 3.1.Construction of the Network, 3.2.Formation of Cluster, 3.3.Formation of Tree and 3.4.Aggregation of Data.

The architecture given in the fig. 1 consists of the node collection that creates the network. After the construction of the network, the formation of the cluster is initiated with selecting the head. After the formation of cluster is over, the formation of the tree is initiated throughout the network. The tree discovers the optimal path in the network and transmits the data to the sink node during the aggregation.

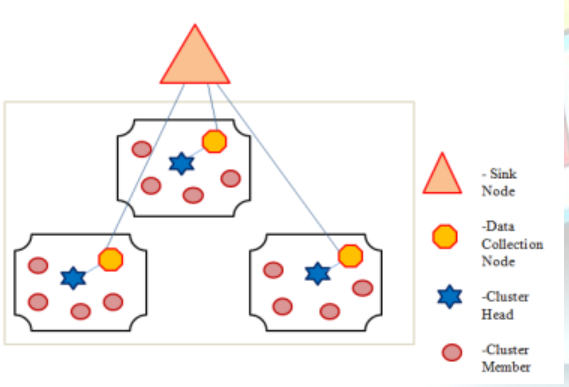

Fig.1. Architecture of System

3.1. CONSTRUCTION OF THE NETWORK

The nodes are scattered in the area that is to be sensed which forms the network. After the scattering of the nodes in the region, the network boundary is formed. The construction of the networks is given in the fig.2.

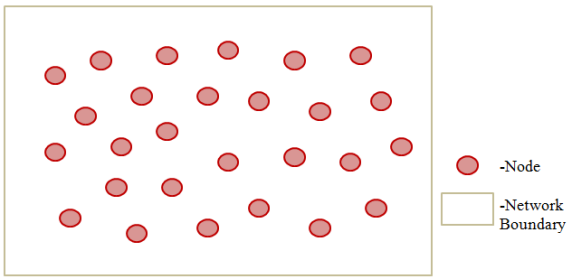

Fig.2. Construction of the Network

3.2. FORMATION OF CLUSTER

The sensor node chooses the Cluster Head (CH) with the threshold value throughout the network, and the formation of cluster is initiated, and the communication is by the intra-cluster which is given in fig. 3. The Cluster Members (CM) transmits the data to the CH throughout the network. The Tree formation is initiated after the formation of the cluster in the network.

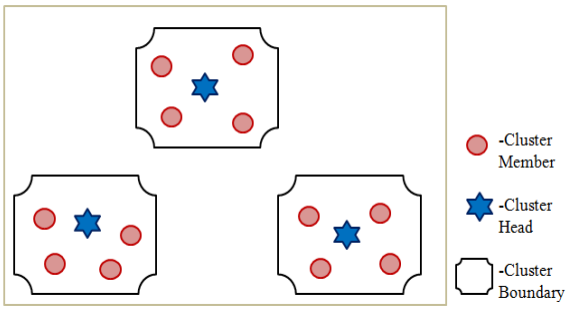

Fig.3. Formation of Cluster

3.3. FORMATION OF TREE

The aggregated data from the CM is sent to the CH. The Data Collection Node (DCN) in the tree transmits the data to the sink from

the CH. The Tree formation Diagram is given in fig. 4.

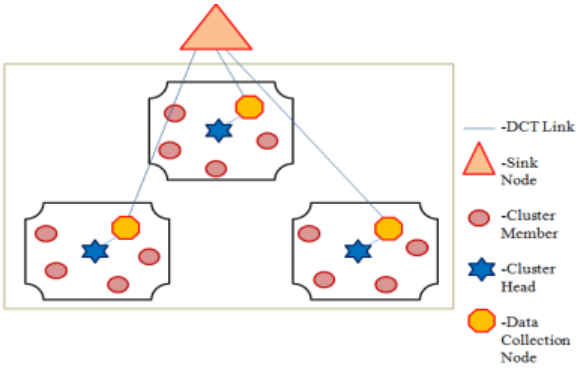

Fig.4. Tree Formation

The tree is formed by choosing the nearby Neighbor Node from the sink and then identifying the DCN throughout the entire network. If the Neighbor Node from the sink is not the CH then that node's identity is stored in an array and the best value in the array is chosen as the DCN. The data is transmitted through the DCN node to the sink which is the optimal path.

3.4. AGGREGATION OF DATA

After all the process is over, the aggregation of data is initiated which is given in fig. 5. The data from the Cluster Member (CM) is sent to the Cluster Head and then from the Cluster Head (CH) to the Data Collection Node (DCN). Here, the communication of the tree is commenced by the usage of the Direct Sequence Spread Spectrum (DSSS) in order to transmit the data to the sink node from the CH to DCN. The process of aggregation of data is repeated till all clusters transmit the data to the sink node. After the transmission of data is over, the performance is evaluated.

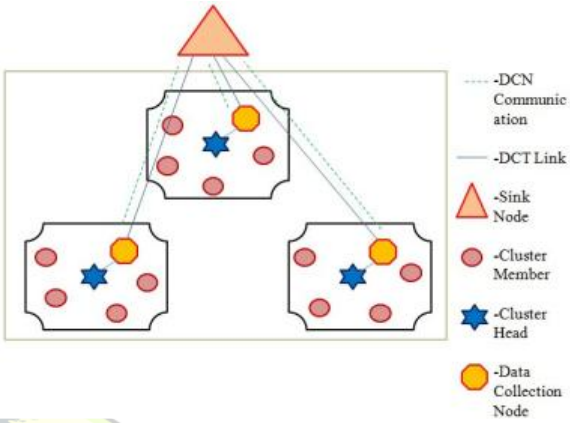

Fig.5. Aggregated Data Transmission

4. SIMULATION RESULTS

The simulation result is given by the simulation scenario taken and the performance is given by the packet delivery ratio among the nodes.

The simulation of the VELCT finds the malicious node in the network and by the malicious node, the packet loss is increased or decreased is given by the analysis.

4.1. SIMULATION SCENARIO

The simulation is done by the Network Simulator (NS-2). The workspace consists of 900 x 600 m^2. The speed is given as 0 m/s to 90 m/s. The nodes are deployed inside the workspace and the network is formed. Then the formation of cluster with the CH and then the tree is constructed. The transmission of data is given as 1Mb.

4.2. PACKET DELIVERY RATIO

The packet delivery ratio is the ratio of the packets within that particular time. The X-axis consists of the time and the Y-axis consists of the Packet losses. It also shows the packet loss occurring in particular time of the transmission.

Using the VELCT scheme, the packet delivery ratio is at the maximum. Whenever there is a malicious node in the network, the packet delivered is withstand able and then the network lifetime is increased by avoiding the cluster formation often. The simulation result is given below in the fig.6.

The packet loss in the network occurs when there is the transmission between the malicious nodes. Here the packet delivered is successful with all the nodes in the network. The thick line in the graph indicates that there is a packet loss in the network due to the malicious node. The thin line in the graph indicates that the packet delivery is successful among the nodes in the network. The network is withstood in terms of energy consumption of the nodes.

5. CONCLUSION

The VELCT scheme helps in the transmission of the aggregated data in a well-organized manner through the best possible path by the construction of the Tree. This scheme sends the aggregated data through the best path in the network. The analyzed Packet delay ratio shows that there is less delay during the transmission of data through the recognized shortest path by the Tree and the VELCT scheme is secure in discovering the malicious node during the data transmission.

In future, secure transmission of aggregated data between the CH and sink in the presence of collusive attack is discussed. Then, the throughput, performance, packet loss ratio and also other security parameters are analyzed with the previous work. Future work concentrates on the robustness of the network, even if there is more number of collusive nodes.

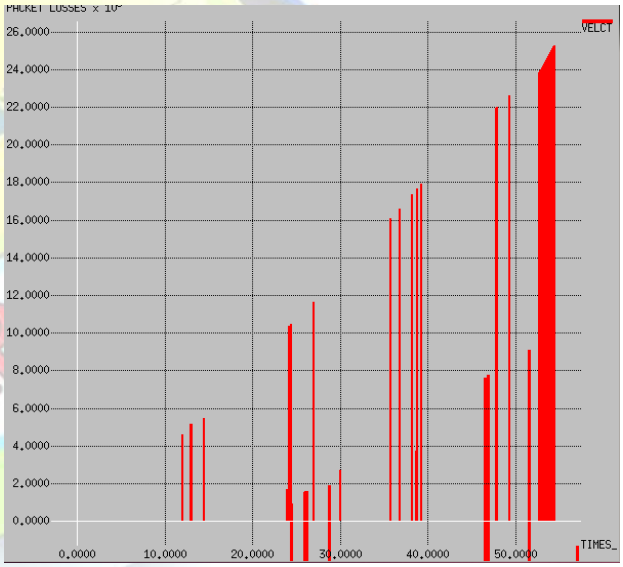

Fig.6. Packet Delivery Ratio

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