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ACCDA: Adaptive Cost-value based Cluster Data Aggregation in Wireless Sensor Networks

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Wireless sensor network consist of spatially distributed and dedicated sensor nodes which are responsible for monitoring physical and environmental condition. The aim of Quality of Service provisioning in wireless sensor networks is reducing delay, energy consumption and obtaining high packet delivery ratio. The term Quality of Service in Wireless Sensor Network refers to transfer of guaranteed amount of data from source node to destination node or sink node. Adaptive cost is to be minimal in order to achieve Quality of Services in Wireless Sensor Network. Cost in wireless sensor networks is measured in terms of less energy consumption, less delay and obtaining high delivery ratio when packet is transmitted from source node to destination node. Data aggregation is a technique which enables aggregating of data at single point before transmitting to the base station or gateway level. This work proposes an Adaptive Cost value based Data aggregation technique, which is an efficient method to conserve energy by reducing packet transmission and extends the network life. The best and efficient routing algorithm with low energy consumption are needed to prolong the lifetime of sensor network. Adaptive cost value based clustering technique is implemented for the data aggregation. Entity node performs the aggregation and measures the different quality of service parameters in order to adapt to the better network performance.

1. INTRODUCTION

Wireless Sensor Network (WSNs) are made up sensor nodes capable of inspecting physical or environmental conditions, such as temperature, sound, pressure, etc. The sensed data is then passed on to the main location called as base station or sink. These networks possesses the bi-directional communication pattern thus enabling the sensor node controlling. The high security issues in military applications lead the invention of wireless sensor networks. Figure 1 shows the data transmission from sensor field to end user or application. Above sensor field contains number of sensor nodes. Gathered information or data is sent to the sink through intermediate nodes. Sink node or gate way node is responsible for sending information to end user.

1.1. Overview of Data Aggregation Process in WSNs

The main objective of Data Aggregation process in wireless sensor networks is filtering of redundant data transmission and thus improving the communication overhead involved in the network. In wireless sensor networks the transmission of data follows multi hop fashion. Where the nodes send data to the neighbor nodes from where the data can reach the sink.

The sensor nodes are deployed densely in the area of deployment, dense deployment of nodes causes sensing of same or redundant data which leads to energy wastage in the networks. To overcome this problem in literature there exists many clustering solutions. There exists numerous advantages of clustering. Few of the advantages are listed below:

- The size of the routing table is reduced through clustering approach.
- Through clustering the bandwidth usage among the nodes is saved.
- Energy is balanced among the nodes and thus helps in prolonging the network lifetime.

Table 3
Simulation Parameters used in ACCDA

Network Architecture	Homogenous, Flat
Area Size	500 * 500
Number of Nodes	18 – 120
Deployment Type	Random
Transmission Range	212mtrs
Intial Energy	1J
Transmission Rate	8kbps
Channel Type	Channel/ WirelessChannel
Radio Propagation Model	Propagation/ TwoRayGround
Network Interface Type	Phy/ WirelessPhy
MAC Layer	Mac 802_11
Interface Queue Type	Queue/ DropTail/ PriQueue
Link Layer Type	LL
Antenna Model	Antenna/ OmniAntenna
LUI	0.1 seconds
MUI	10 seconds
Application Type	Event-Driven
Packet size	30 bytes

environment and consumes energy when packet transmission happen. In order to achieve QoS in WSNs, sensor nodes must be deployed efficiently and at proper coordinates in order to achieve less energy consumption. Energy consumption plays an important role in wireless sensor networks. Energy consumption is measured as the average energy consumption for all nodes in sending data, receiving data and forward data operations.

Figure 4 shows the comparison of Nodes versus Energy. Energy consumption of ACCDA is compared with AEEFDAT scheme. The energy consumption of sensor nodes is reduced in ACCDA scheme thus enhancing the QoS of the network. In ACCDA scheme the sensor nodes consume less energy, because the *EN* node avoids the number of retransmissions and packet drop. *EN* is responsible for incrementing the forward node count set to maximize the packet delivery ratio and thus controls the packet drop.

(iii) Packet Delivery Ratio : It is the ratio of the number of packet received successfully by the sink node to the total number of packet transmitted from the source node.
Figure 5 shows the comparison of Nodes versus Packet Delivery Ratio (*PDR*). The number of packets delivered to the destination node is increased in our ACCDA Scheme. The QoS performance metric *PDR* is higher, *EN* node checks the loss ratio before forwarding the packet to the destination. If loss ratio of a cluster is greater than the defined threshold value the packet is not forwarded. Feedback to the source node is sent to the source node, to appropriately increment the forward node count of the cluster which leads to the less no of retransmissions and drops. Hence the *PDR* of ACCDA scheme is bit high by 10%.

7. CONCLUSIONS

This work proposed efficient data aggregation technique which provides better QoS in Wireless Sensor Network considering delay, energy consumption and Packet delivery Ratio while transmitting packet from source to base station or sink node. In each cluster, cluster head is selected based on their cost value. Entity node is assigned to individual cluster that is responsible of collecting data from cluster head and perform parameter calculation. *EN* receives data from cluster head and calculates delay, energy consumption and delivery ratio during transmission. This efficient data aggregation technique leads to better QoS and increase network lifetime.

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