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Robust and Dynamic Data Aggregation in Wireless Sensor Networks

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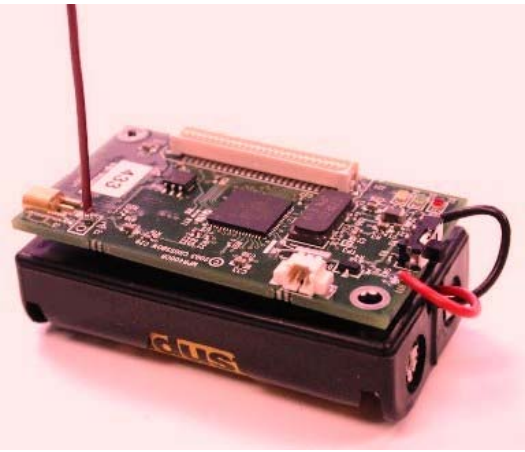
Abstract: *Wireless Sensor Network(WSN) consist of several energy prone nodes which runs on the battery power. The whole network is least proficient in terms of Energy, lifetime etc .In this paper, a new MAC Protocol Called DA-MAC is designed to serve the purpose of Robustness and the Dynamic mechanism of the Network .Moreover in this paper there is a term Clear Channel Assessment(CCA) through which MAC must accurately determine if channel is clear or busy so that there must be a possibility to find when and where to do Data Aggregation*

Keywords: *DA-MAC, CCA, NACK, CSMA*

1. INTRODUCTION

As an advancement in this technological era, sensor networks consist of very small and cost efficient sensing devices which.



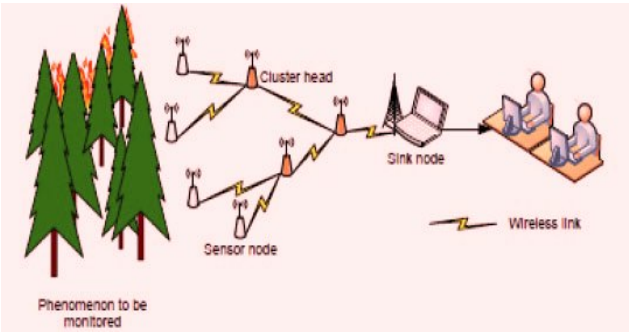
1.1 Fig.Shows the sensor node

Are equipped with wireless radio transceivers for environment sensing and monitoring.

The main advantage of using these small devices for sensing the environment is that they does not need any specific infrastructure for example electrical main station for power supply and wired station with lines for Internet connections to gather data, Neither they need an human interference while deploying. These sensor nodes can seeking the surroundings by gathering information from their environment in which they deployed, and work collectively to send the data to a main station(BASE STATION) , or sink, for analysis and processing. The main aim of data aggregation algorithms is to collect and aggregate data so that the energy consumption should be saved and the whole network lifetime is enhanced. Wireless Sensor Network leads progressively striking method for data collecting in scattered system architectures and active access via wireless connectivity.

2. DATA AGGREGATION

Data Aggregation is defined as “The process of collecting or gathering the data which is sensed by the sensor nodes deployed in the environment”. Data Aggregation is the method which is used to enhanced the lifetime of the wireless sensor network. The reason is that with this technique the reduction of communication of all the nodes takes place and only the intermediate results of the collected data passed to the nearby nodes of the base station(powerful node).so we can say that data aggregation is also helpful to save the energy consumption. Simple data aggregation techniques mainly used the average of data collection information whereas the powerful data aggregation techniques used the process of counting the frequencies of the nodes which sensed the data[1].



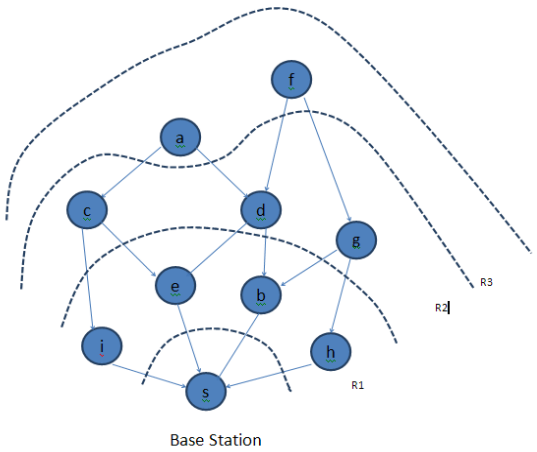
2.1 Fig. Shows the sensor node

Data aggregation techniques which uses the method of continuous sensing mainly suffered from power loss issues. and also they are vulnerable methods because the packet loss is more due to continues transmitting and receiving the data packets from one place to another i.e. from source to sender. So this paper mainly focus on two issues first is the Robustness in data aggregation and second is dynamicity.

3. ROBUSTNESS IN DATA AGGREGATION

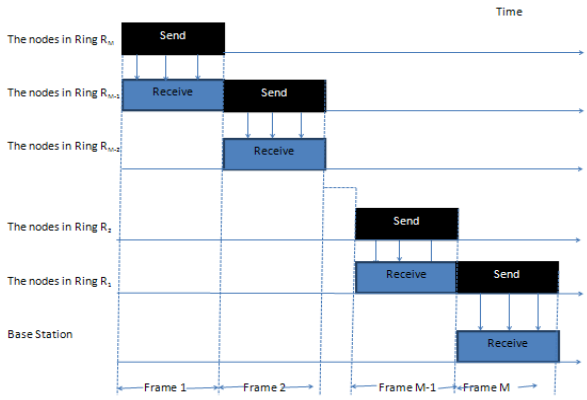
Within the wireless sensor network, the loss of packets is a common issue,but with the use of data aggregation, the sender must suffer the loss of such packets in which the information is come from various sensed nodes. Hence the robustness is the prime issue in this technique of aggregating the data.This issue can be achieve by various popular techniques like sketch based or synopsis based data aggregation.[2,3].A sketch is a very small coded value i.e. digest of the whole measure of the data.The final result can be measured only on the basis of those sketches. There is a restriction of counting the data values or sketches only once even if the synopsis getting more than once from different routes in the network.So the sketch is send many times and from different paths to prevent the issue of packet losses.

In this paper,we take the concept of Virtual Overlay called Rings in Order to achieve robustness with the help of which the single data packet is forwarding to several data nodes in order to save the lossy packets.



3.1 Fig. Shows the sensor node

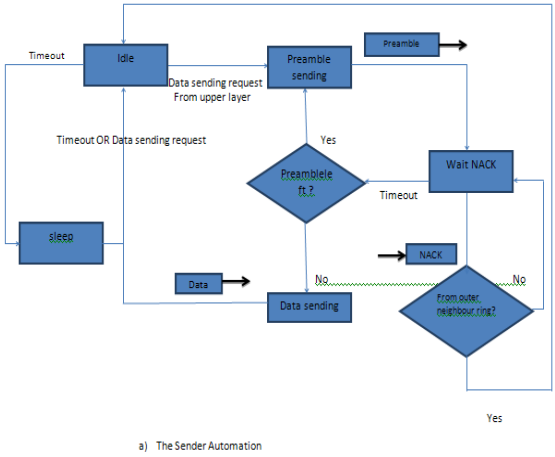
R1,R2,R3 are the rings ,a-h are the Nodes and S is the Base StationRings overlay is a class of multi-path routing structure that exploits the broadcast nature of wireless communication to handle with communication failures And Packet Loss[3] .
In the Rings overlay, all the sensor nodes are structured into a set of rings R1,R2and so on,All around theBase station.They are freely time harmonized topublicize data level to level. Mainly the nodes in each ring Ri listen to the transmissions of their children in ring Ri+1,gathered their nearby acquired data with the data received from their children, and then broadcast collected data to their parents in ring Ri-1. This propagation and aggregation process continues until the base station receives the aggregated data from the nodes in ring R1. As shown in Fig. below ,a round of data collection proceeds in M time frames if the rings overlay has M rings R1,R2…RM. Each node turns on its radio for two frames: one frame for transmitting data to its parents and one frame for receiving data from its children. The length of the time frame is determined on the basis on the density of deployment so that all nodes get enough time to broadcast their data atleast once[6]



4. DYNAMICITY IN THE DATA AGGREGATION

For achieving this, we use asynchronous data Duty Cycles with two main states *Sleep and Awake*

With the Channel Contention information obtained by DA-MAC, a node can animatedly determine where and when to do aggregation, so that dynamic sensing and collecting with respect to event occurrence can be realized.



a) The Sender Automation

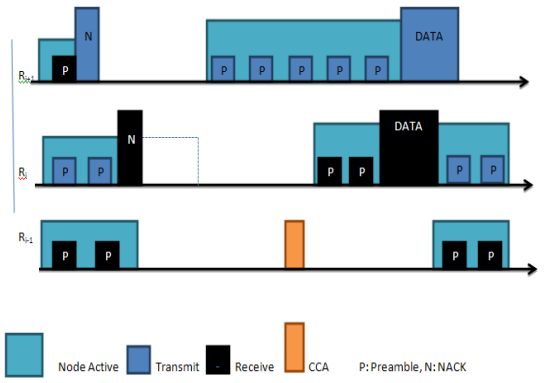
Process Works as Follows

4.1 Transmission of Preamble

Like other series of MAC protocols X-MAC, DA-MAC also uses tiny preamble packet series. Each short preamble packet contains the ID of the ring of the sender. After the broadcast of each preamble, there is a small pause, during which the senderwill pay attention towards the medium[4]. The pauses between preambles facilitate the nodes in the outer ring to send NACK (Negative acknowledgement) packets. The number of preambles in one series is resolute by the sleep period of Si's near by nodes in R i-1 and Ri+1..Same as in other preamble based other MAC protocols The preamble series should last longer than the slumber period of all near by nodes, so that each neighbor node canreceive at least one preamble packet. Upon the reception of a preamble packet, the neighbor nodes in Ri-1.will remain conscious for the remainder of the preamble series, which will be followed by the data packet.

4.2 Transmission of NACK

When a node in Ri+1 received the preamble packet, it will check whether itself also has data to transmit or not. If the answer is yes, the node will transmit a NACK packet during the recess between two preamble packets.Otherwise, it rejects the preamble received and turns tosleep. Similar to preamble packets, the ring ID of the sender will be included in NACK packets. Please notice thatif two or more nodes concurrently want to transmit the NACK,with the essential Carrier Sense Multiple Access(CSMA) technique, at most one of themwill obtain the channel at any moment, that is, collision isavoided by CSMA.When the transmitter of preamble Si a got NACK from some node in the outer ring, it will stop transmitting preambles because Si requires to receive data form outer ring before it sends the current data packet. Therefore, it interrupt the attempt to transmit data and turns to sleep[4].



4.2.2 fig shows the preambling process

4.3 Transmission of Data.

If no NACK is sent to Si during the transmitting of a series of preambles, there is no pending data at nodes in outer ring. Therefore, Sican transmit thedata packet after the last preamble[4]. Please notice it is notnecessary to insert pause between preamble and data because the receiver must have been waiting for the data. Ifthe attempt of sending is interrupted by some outer ringnode (i.e. NACK is received), sineeds to wait and retry afterreceiving the data from outer ring[8]

5. CONCLUSION

This Paper supports both the Dynamicity and the robustness of Data aggregation in WSN.The Robustness is achieved with the help of Virtual Overlay method called Rings in which the data packet send to many sensor nodes which help in prevention of data losses.On the other side the dynamicity is achieved with the help of Clear Channel Assessment obtained from DA-MAC protocol which help the node to get the information when and where to send the suitable data.

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