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Maintaining Reliability and Time in the Message Transfer within Wireless Sensor Network

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ABSTRACT: One of the active research area for the researchers is the Wireless sensor networks Wireless sensor networks (WSNs) have been widely used for remote monitoring with an emphasize on energy-efficient operation. When transferring the data through the WSN,The time-critical applications have additional requirements of strict data delivery in which data must be reliably forwarded to a sink within a delay bound In order to fulfill these requirements, a common approach is to develop a real-time capable protocol, which in most cases is based on a medium access control (MAC) protocol. The variations of MAC protocol can maintan the requirement of reliability and delay. In this papr we review the concept of SNC-MAC protocol, which uses the network dimentioning method with existng MAC protocol.

KEYWORDS -Medium Access Control (MAC) Protocol, Time-critical Applications, Wireless Sensor Networks

I. INTRODUCTION

The Wireless Sensor Network (WSN) is a network which is made up of hundreds or thousands of small, resource constrained, inexpensive nodes that can sense a phenomenon, process and transmit the data that sensed, over a wireless medium. The most important requirement for many Wireless Senor Networks (WSNs) is the reliability of the message that has been transfer. The sensor nodes consume more energy at the time of data transmission as compare to the data sensing. the redundant data means the duplicate data increase the energy consumption, latency and reduce reliability during data transmission in Wireless sensor network Therefore, it is important to support reliable and energy efficient data transport in WSNs. In Wireless sensor networks Several researchers have led to many new protocols which are specifically designed for different kinds of applications where reliability and energy efficiency is an essential consideration. Most of the the time Medium Access Control (MAC) protocols are used as they pay an important role in wireless communications.There are two kinds of wireless nodes In Wireless sensor networks; sensor and base station nodes. The base station's main function (also referred to as sinks) depends on managing the actions which are executed to provide reliable and efficient sensing support. It provides a gateway to other networks or behave like a data storage processing data in a powerful way.

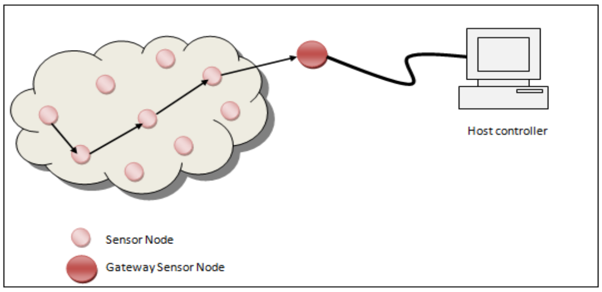

Figure 1. - Example of a Wireless Sensor Network[9].

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II. LITERATURE REVIEW

In the WSN, to support time critical applications and reliability in message transfer A number of solutions have been proposed. Most of them are MAC protocols which are used to reduce message transfer delay but not many protocols can guarantee the delay . this section describes the protocols that are in the minority group and related to our work.

Vehbi C. Gungor, Ozgur B. Akan(2006) DST: "Delay Sensitive Transport in Wireless Sensor Networks" describes the working of delay sensitive transport (DST) protocol which is presented for wireless sensor networks (WSN). The aim of the Delay Sensitive Transport protocol is to provide the timely and reliably transport from the sensor field to the sink with minimum energy consumption. The DST protocol simultaneously addresses congestion control and timely event transport reliability objectives in WSN [3]. it incorporates the Time Critical Event First (TCEF) scheduling mechanism to it's efficient congestion detection and control algorithms,to meet the application specific delay bounds at the sink node.[7].

Muhammad AdeelMahmood and Winston Seah (February 8, 2012)" Reliability in Wireless Sensor Networks: Survey and Challenges Ahead"describes Most of the existing research usess retransmission mechanisms to achieve reliability,and to enhance event reliability, ignores the use of redundancy schemes. We review the data transport reliability schemes to support the event and packet reliability using retransmission or redundancy mechanisms. The packet or event reliability can be achieve in terms of recovering the information the has been lost at the hop-by-hop or end-to-end level is by using the retransmissions or redundancy mechanism. **Umesh Kumar Singh*1, Kailash Chandra Phuleriya*2,LokeshLaddhani*3, "Study and Analysis of Reliable MAC Protocols for Wireless Sensor Networks"(IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 3 (3) , 2012** describes- reliable delivery of data with minimum latency and energy consumption is the basic requirement of a sensor network . For achieving reliable data communication ,There are two basic methods, forward error correction (FEC) and retransmissions. FEC schemes having relatively low complexity may be used,Since a sensor node typically has low processing power and a small memory.Consequently, to achieve reliable transmission of information between remote nodes over multiple hops despite channel errors, collisions and congestion most of the existing schemes use retransmissions or transmission of multiple copies packets [6].

III. PROPOSED WORK

We review the framework that uses the SNC- MAC prtocol to maintain the reliability and the delay bound of the message transfer in WSN, It uses the network dimensioning method which exploits the forwording behavior of the SNC-MAC which is used to calculate the upper bound of delay of the message before the network deployment. the sent data are received within the calculated delay bound .SNC is the method to calculete the delay bound of the message which can be used with existing MAC protocol then we latter called SNC-MAC prtocol.
In this framework each node of the Wireless sensor network requires only transceiver ,and here a tree topology is used. this framework involves the steps as slot management,error control,routing and network dimentioning method.
*A] Slot assignment***-**
SNC-MAC is based on a time division multiple access (TDMA) scheme. The time axis is divided into fixed-length base units called epochs. Then Each epoch E is subdivided into m = k . n time slots for a network of at most n nodes.It is a tree like structure . Tree structure has the Sink as a root node the messange is transfer hop by hop .Hop by hop the message is transfer at rate 1message per epoch E.
E=M.Ts=K.n.Ts time units
K is the number of attempt /epoch the node has, to deliver the messange to next hop. If these all atempts get fail then the message is discarded. the message interarrinval time between two neighbouring nodes or node to node delay dn is influenced by value of K and the epoch size E.
The bound of node –to- node delay dn in worse case or Dn is calculated as-

$$\mathrm{dn} \leq \mathrm{Dn} = \begin{cases} \mathrm{E} & \mathrm{k} = 1 \\ (2.\mathrm{E} - \mathrm{Ts}) & \forall \mathrm{k} > 1 \end{cases}$$

Eq.(1)

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B] Error Control-

When the message the sent by sender to the reciver then the acknowldgement of received message is must.If the sender doesn't get the acknowldgement of the message then the sender will retransmitt the message within the next slot assigned to it, if the next hop receiver does not receive the message at expected next slot, It will start to checking the message arrival on the next slot assign to it . Within the epoch the number of transmission k can be calculated as

$$k=\left\lceil \frac{\log(1-R^{\frac{1}{H}})}{\log(1-(1-BER)^{8.1})} \right\rceil$$

Eq.(2)

Where H is the maximum height of tree topology.

C] Routing-

The network is acts in a tree structure and rooted in the sink . Routing is performed by SNC-MAC protocol.In the tree like structure , Each node is awre about the position and knows the number of slots assign to it's child nodes to handle the sensor data messages and the parent node's responsibility is to handle the sink data messages. In this way the routing is performed by SNCMAC protocol in tree structure.

IV. NETWORK DIMENTIONING METHOD

In this section, we explain a new network dimensioning method that exploits the forwarding behavior to calculate an upper bound Dmax of message transfer delay from a node to its final destination. The network dimensioning method is a worst-case analysis of a wireless sensor network which can calculate the worst-case bound Dmax of message transfer delay in the dimensioned network. To perform the delay bound calculation, assumptions regarding the worst cases of network topology, network traffic and node forwarding capabilities are specified as the following. Firstly, the worst-case network topology is a tree that is rooted at the sink. This tree topology is described by three parameters. -

The first is the number of branches or child nodes of the sink B.

The second is the maximum hop distance H.

The third is the total number of nodes N in the network and N is calculated as

$$N=1+\sum_{j=1}^{B} Nj$$

Eq.(3)

where Nj is the total number nodes in branch Bj just below the sink .

we can determine the worst-case delay bound Dmax as explained below.

A worst-case end-to-end delay occurs at a leaf node in a branch of the sink. The delay depends on the number of nodes sharing that branch and the node distance from the sink. Additionally, a packet from this leaf node is the last one received at the sink after the reception of packets from other nodes in this same branch. The worst-case delay bound is the maximum of the end-to-end delays in all branches. This bound is determined as follows:

$$Dmax = maximum\{\forall^{B} j = 1 (Nj - 1). E + hj. Dn\}$$

Eq.(4)

where Nj is the total number nodes in branch Bj just below the sink, and hj is the hop distance of a leaf node in this branch. Again, the epoch size is E = m . Ts time units. Finally, the delay bound Dmax is also used to define the minimum time before a new data packet can be generated in a node. In other words, we assign T min = Dmax, which leads to the node sensing rate of 1/ Dmax as a maximum.

Other Possible Dimensioning Outcomes

The dimensioning process allows us to balance network topology , network traffic and node forwarding capabilities such that the required application delay Dapp can be met. However, an outcome of the process might be the conclusion that it is impossible to reliably support an intended application scenario. For instance, the worst-case delay Dmax

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determined by our dimensioning method may be higher than the required application delay, i.e., Dmax > Dapp. In that case, different assumptions regarding network topology, network traffic and node forwarding capabilities are needed to recalculate the delay bound in order that

Dmax ≤ Dapp

PERFORMANCE EVALUATION

The aim of the evaluation was to explore whether data were transported reliably within a delay bound that had been calculated via the dimensioning method.In WSN data must be sent to the sink within the end-to-end delay bound Dmax. The packet reception rate of all transmitted data has to be relatively high. The energy consumption should be reasonably low.

V. CONCLUSION

From this review, we can say that the reliability and the delay bound are two most important requirements in the message transfer within WSN.and these requirements of reliability and delay bound can be achieve by using MAC protocol,and also achieve by using existing MAC protocol with the simple dimentioning method which is called as SNC-MAC framework.

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BIOGRAPHY

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