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RECHARGING OF WSN NODES BASED ON POLLING MAC PROTOCOL FOR LIFETIME MAXIMIZATION AND RELIABILITY

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Abstract--Wireless Sensor Networks are described with the help of Medium Access Control (MAC) protocol which supports the recharging of wireless sensor nodes . The technique used by MAC protocol is round robin scheduling. For simplicity it uses 1 limited services.

Wireless sensor nodes works by sensing and hence they are likely to run out of energy. For recharging they may request energy from the radio frequency devices. To reduce this outage of energy, we have derived a collaborative protocol in which when any node hears the energy request from any other node. it will repeat the request until the master node responds to it in the form of a recharging pulse. The performance of the proposed protocol can be determined with the help of probabilistic energy expenditure model. The results of collaborative protocol have shown that it can lead to an uninterrupted operation of network under varying values of various parameters.

Index terms -- Medium Access Control, round robin scheduling, collaborative protocol, probabilistic energy expenditure model, wireless sensor nodes, radio frequency devices, master node.

1. INTRODUCTION :

The technology of sensor nodes is considered as a yet another revolution in wireless technologies. The parameters of major concern of such sensor nodes include the node size, its low power consumption, better sensing ability, low cost communication, long battery life and its recharging. A WSN needs to be highly efficient and reliable to be used in harsh and challenging environments. Compared to the traditional charging methods which are accomplished with the help of cord, wireless charging methods introduces many benefits as follows:

- Initially, it improves user friendliness since the overhead of using(connecting) cables is vanished. Devices with different brands and different models can use the same charger.
- It also provides the design and fabrication of smaller devices with or without the attachment of batteries.
- It makes the devices more durable.(Eg.: water proof and dustproof)
- It adds on the flexibility of devices, especially those for whom replacing their batteries for charging is dangerous, costly or infeasible.
- Lastly, wireless charging is more flexible and efficient as it provides power to only those who request for it.

In this paper, where we have used MAC protocol for both data communication and recharging, nodes are not able to send data during recharging, however, the sensing process is still carried on. The ARQ procedure in MAC protocols ensures reliability in transmission of data packets via sending several erroneous packets several times. It, in turn ensures reliable recharging in the following way:

- The probability of the master node to hear the recharging request is increased by setting a particular threshold.
- It also makes path for other nodes that they can overhear the request and can rely on it. This also will increase the probability that the recharging request will not be left unheard.
- And lastly, the master node is also made to send the recharging pulse after a certain interval of time even if no node has asked for the same.

1.1 MAC Protocol:

Similar to all other shared medium networks, the technique which supports the successful and efficient operation of wireless network is the Medium Access Control (MAC). The basic job of MAC protocol is to avoid collisions. It takes care that the nodes should not transmit at the same time and if they do so, there should be no interference or collision in between them which may lead the network to a standstill. Many MAC protocols have been developed for wireless networks such as Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA) and contention protocol such as IEEE 802.11. In order to design a good MAC protocol for

wireless sensor networks, the attributes which are taken into consideration are energy efficiency, prolonged network lifetime, scalability, throughput and bandwidth utilization.

2. LITERATURE SURVEY :

Table 1

Sr no	Title	Author	Publication	Year	Approach
1	RF-based Power Transmission for Wireless Sensors Nodes	Guocheng Liu , Nezih Mrad , George Xiao , Zhenzhong Li and Dayan Ban	Institute for Micro structural Science National Research Council Canada	Nov 2011	A power and data transmission system for strain gauge sensors used for SHM and other applications.
2	Improving the Lifetime of Wireless Sensor Nodes Batteries by using SEMD (Single Energy Multi Data) and MEMD (Multi Energy Multi Data) Transmission Modes	Aarti Sharma and Dr. B.K. Sharma	International Journal of Electronics and Communication Engineering.	2013	The power patterns of different one dimensional and two dimensional topologies are simulated and analyzed.
3	Development Of Algorithm For Improving The Lifetime Of Wireless Sensor Nodes Batteries Using Matlab	Aarti Sharma, B.K. Sharma	International Journal of Industrial Electronics and Electrical Engineering	Feb.-2014	Multi hop charging
4	A Polling MAC with Reliable RF Recharging of Sensor Nodes	Mohammad Shahnoor Islam Khan, Jelena Mi˘ si´c and Vojislav B. Mi˘ si´ c	Wireless Communications and Networking Conference	2015	Modeled a simple MAC protocol which provides reliable wireless in-band recharging of sensor nodes in a network

3. EXISTING ARCHITECTURE

The wireless sensor networks consist of sensor nodes powered by a rechargeable RF energy source and a master node that is present with unlimited energy. This master node may communicate with existing nodes in the network by sending poll packets to them. The node in the Network listens to the poll packet by only the targeted node receives it. This poll packet may contain data ifits is available or else it is send as null packet. However, this packet may gent lost in the network due to noise or any other interference due to this the node may have to repeat the recharge request for a certain number of times. Hence, a threshold is set of each and every node (except master node) in the network so that it can repeat the recharge request for certain number of times. This case can prove as useless if the master node does not receive the recharge request after certain times of retransmission. Due to this the node may completely lost all its energy and stop operating. This condition is known as energy outage. Once this condition occurs, th node will be completely isolated from the network and as a result it will not be able to participate in subsequent activities of network. This energy outage situation can be avoided by collaborative relaying of recharge request by the neighbour nodes in the network as well as by making the master node to participate in proactive recharging. This is done using MAC protocol. In this the nodes will b able to listen the poll packets sent by master node as well as the response data packets sent by each and every node in the network.

In a network if any node sends a recharge request to master node of request other nodes will also come to know about this recharge request by reading the header of such packet. If the master node does not reply with the recharging pulse the other nodes that overhead the request may relay the request. Since the request is sent by multiple nodes, the master will eventually receive the request of will emit the recharge pulse in response.

4. PROPOSED ARCHITECTURE:

During recharging, we may assume that RF pulse is sent in the same RF band used for communication. This may disturb the pattern of regular communication in the network. The polling cycle is known as recharge cycle when recharge occurs. Clearly, the node that is located at the longest distance from the master node will receive least amount of energy as the recharge pulse has to cover long distance. Hence, if the node that is situated at the greatest distance from the master node is crucial in network i.e. if it is performing the most important task in the network and if gets out of energy then the whole working of network will be stopped. Hence, our proposed system determines the recharging of nodes based on their priority. This priority is determined on the basis the role of node in the network and the number of times it is used for any job, so that if the node of least requirement faces energy outage then also the network will not be interrupted. Hence, whenever the master node receives recharge request from any node in the network, it will first determine its priority and will respond accordingly.

CONCLUSION AND FUTURE WORK :

In this proposed system, we have introduced a technique for efficient recharging of WSN nodes based on a polling MAC protocol and replace it with priority based MAC protocol so that the nodes which are more important in the network and require frequent recharges can be polled faster and overall network efficiency can be improved. In future, we will be exploring the networks and other optimal charging techniques which will help the network to minimize energy outage and packet waiting timing.

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