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Low Latency Modified Multihop Broadcast Protocol for Asynchronous Duty Cycle in WSN

Jyoti Deepak Pundle
Dept of Electronics and Telecommunication
Pillai HOC College of Engineering and Technology
Rasayani, 410207
email Id: jyotipundle@gmail.com

Prof. Asokan S.
Dept of Electronics and Telecommunication
Pillai HOC College of Engineering and Technology, 410207
email Id: jep.asokan@gmail.com

Abstract—In this paper, we propose a low latency, energy efficient multihop broadcast protocol for asynchronous duty-cycled wireless sensor networks. This protocol uses knowledge of wireless link quality to avoid retransmission. It sends messages over links with as good quality as possible. This is asynchronous duty cycled protocol so each node independently wakes up according to its own schedule. This protocol provides reliable path which reduces redundant transmissions and collisions. A node transmits broadcast messages by using guided list to neighbor nodes. The guidance presents how the node forwards the broadcast message to neighbor nodes by using unicast transmissions. Low latency multihop broadcast protocol achieves lower message cost and significantly improves the energy efficiency in terms of both duty cycle and energy consumption. The simulation results show that this protocol broadcast in both sparse and dense networks.

Keywords—*Asynchronous duty cycle;multihop;latency;ADB*

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I. INTRODUCTION

Information accumulation is an essential utilization of remote sensor systems, where each sensor hub gathers information and after that advances information to the Sink hub through a multi-bounce way. Vitality proficiency is the fundamental class in WSN applications. Hubs in such WSN applications ought to work unattended for quite a while on restricted battery limit. WSN convention utilizes two sorts of rest planning calculations i.e synchronous and nonconcurrent. Numerous obligation cycling MAC conventions, for example, S-MAC,T-MAC, RMAC and DW-MAC expect synchronized obligation cycle plans among the sensor hubs. This methodology simplifies correspondence, as the transmitter and collector of a bundle are both effectively alert in the meantime, however it includes multifaceted nature and overhead for the fundamental clock synchronization. With nonconcurrent obligation cycling conventions, for example, B-MAC, WiseMAC , X-MAC , and RI-MAC, the hubs rather work nonconcurrently, each all alone obligation cycle plan. Such nonconcurrent conventions are especially alluring, as they require no synchronization overhead.

Offbeat rest booking approaches, be that as it may, are characteristically frail for supporting multihop telecast and troublesome in obligation cycled remote sensor systems where every hub stays wakeful just for a small amount of a period interim and neighborhood hubs are not all the while conscious to get information. To bolster multihop show in offbeat rest booking approaches, a hub ought to utilize autonomous unicast transmissions the same number of as the quantity of its neighbor hubs. This causes repetitive transmissions of the same telecast messages. Also, crashes as often as possible happen when a hub at the same time gets the same telecast messages from different senders. These vulnerabilities lead to noteworthy vitality dispersal and postponed engendering of telecast messages. Hence, the intricacy of multihop show in offbeat situations is significant. It is exceptionally testing to outline a proficient multihop show convention for nonconcurrent obligation cycled WSNs.

RI-MAC convention is recipient started convention in which a sender has information sits tight for a reference point from expected collector. At the point when the collector awakens sends signal for the transmission and sender sends the information subsequent to getting guide. On the off chance that the collector effectively gets information, it will transmit an ACK guide that assumes parts as both an affirmation and another welcome. This convention requires less time period which thus enhances vitality productivity and idleness. ADB convention depends on RI-MAC which upgrades recipient data on the show progress which keeps away from repetitive transmissions. This convention uses forwarder's direction and catching of telecast message and ACK's to minimize excess transmission.

II. DESIGN PROCEDURE

A. Existing Method

In ADB protocols the link quality and path is found in reactive approach means it forwards in an on demand manner.

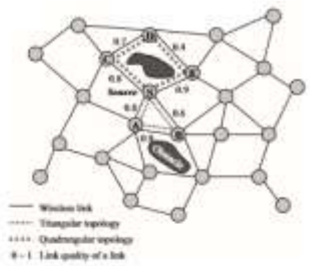

Fig. 1. A WSN which is composed of heterogeneous local topologies as triangles, quadrangles, and so on.

In Figure 1, node S is a source node and node A wakes up earlier than node B. Upon receiving node A's beacon, node S sends A a broadcast message including an ADB footer that indicates the broadcast progress and the link quality information of S. Looking into the footer, node A recognizes that the quality of the link between nodes S and B is poorer than that of link betweenitself and B. Node A decidesto forwardthe broadcastmessage to node B and inform node S of this fact by sending ACK with a new footer. Upon receiving this ACK, node S delegates handling of node B to node A.

For eg. In figure 1 nodes S, C, D, E propose quadrangular topology in which nodes C and E cannot communicate to each other. Therefore the link quality between S and C is useless to E and link quality between S and E is useless to C. Both the nodes will stay active and when node D wakes up both the nodes will send the message to D and collision will occur which in turn causes energy dissipation and reduces network life time.

B. Proposed Method:

Low latency multihop broadcast protocol uses proactive approach means it allows nodes to periodically exchange link quality information with neighbour nodes. In network transmission of message will be unsuccessful when it is sent over a poor link. If this happens retransmission is required which causes more energy consumption and increases cost of transmission of message. To avoid retransmission, a node should send a message over a good link which should be a reliable path. If the message is sent over a reliable path then it avoids collision, flooding and increases the network life. Low latency and low message cost is achieved by using reliable path.

Creation of Guided list:

This protocol uses guided list to avoid collision of message. This guided list consists of covered and uncovered nodes.

Each node maintains a 1-hop neighbor table that consists of a 1-hop neighbor list and quality information of links between itself and each of its neighbor nodes. We denote the neighbor list of node s as N(s) and we denote the link quality between s and a neighbor node r as LQ(s,r). Node s generates an advertisement message including the sequenced pairs of N(s) and LQ(s,r). The node s then exchanges this advertisement message with its neighbor nodes to share the link quality information. We refer to this as the advertisement procedure. Advertised information helps for a node to decide either to take responsibility for covering of an uncovered neighbor node or to delegate this transmission to another node that has a better link. The advertisement procedure is periodically conducted.

$$N(s) = N_{cov}^{i}(s) \cup N_{ucov}^{i} \quad \ldots\ldots(1)$$

$$N_{Obligated}^{i} = N_{ucov}^{i} - N_{Delegated}^{i} \quad \ldots\ldots(2)$$

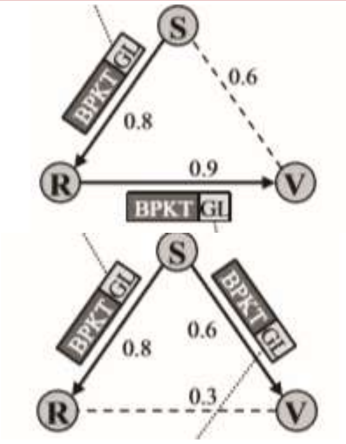

Fig. 2 Preparation of Guided List

In the above figure node S sends broadcast message to node R with guidance list. If the link quality between node S and R is better than that of node S and V then S gives obligated guidance to node R to cover node V. If the link quality between S and V is better than R and V then node V will be delegated. In dense network triangular topology is used which avoids redundant transmission and effectively reduces message cost.

C. Results:

Figure 3 shows the results of performance of comparison in simulation. The graph is plotted for 50 random networks. As shown in table 1 network density increases, message cost increases for ADB protocol. But 90% it remains constant for low latency modified multihop protocol (LLMMP).

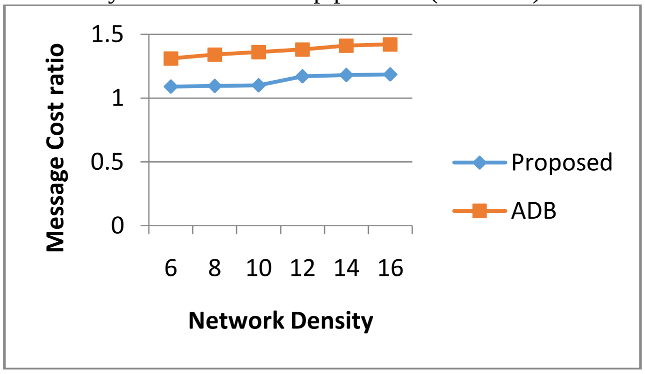

Fig. 3 Message cost ratio (MCR)

	LLMMP	ADB
6	1.09	1.31
8	1.095	1.34
10	1.1	1.36
12	1.17	1.38
14	1.18	1.41
16	1.185	1.42

Table 1. Comparison Message cost ratio

Figure 4 and table 2 shows the comparison of broadcast latency which is little smaller than ADB protocol. This is possible because of asynchronous duty network.

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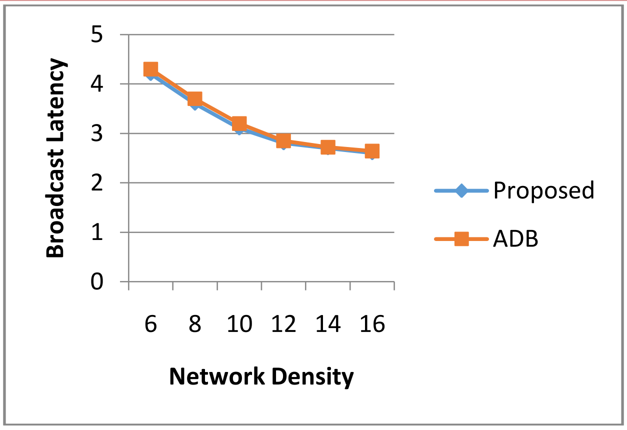

Fig. 4 Average broadcast latency

	LLMMP	ADB
6	4.2	4.3
8	3.6	3.7
10	3.1	3.2
12	2.8	2.85
14	2.7	2.72
16	2.6	2.64

Table 2 Comparison of broadcast latency

CONCLUSION

Low latency modified multihop protocol (LLMMP) provides collision free reliable path for message transmission which gives low message cost and low latency in both sparse and dense network. This protocol always gives reliable path so retransmission of message is not required which gives 100% delivery of message.

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