Energy Efficient Opportunistic Routing Approach to Enhance the Network Lifetime

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Abstract- *MAC protocols of a wireless sensor network running asynchronously in the duty cycle, and its major source of energy consumption is when the sender has to wait for its receiver to wake up and receive the packets. Now the opportunistic routing comes into picture where it allows the participation of multiple candidate receivers. Since the waking time of these multiple packets are same they suffer from redundant packet forwarding. Hence, we have to control the number of forwarders to minimize the overall forwarding cost of both the sender's waiting time and the cost of the redundant packet forwarding. Also, for prolong network lifetime and for the balanced load among the nodes the candidate forwarders should be selected. Consequently, we propose ORR, an astute steering convention that tends to the two issues., the quantity of forwarders are computed in view of the estimation of the sending cost, which is gotten from the obligation cycle and the system topology. Furthermore, the metric utilized for choosing the forwarders considers lingering vitality so more activity is guided through hubs with bigger residual vitality.*

Keywords- MAC: -Medium access control, ORR: -Opportunistic routing protocols, WSN:-Wireless sensor network, ORW: -Opportunistic routing in wireless sensor network

I. INTRODUCTION

While designing the protocols for a wireless sensor network the most important thing to keep in mind is the efficiency of ENERGY. Let's take an example of nodes being deployed in the network which is deep inside the ocean, nodes nearby an active volcano or may be in the battlefield becomes very difficult or may be impossible to have control over the nodes thus energy becomes an important factor. Energy is also important because of adding new sensor nodes to the targeted area and the cost for exchanging the batteries are extremely high.

For the better and long network lifetime of WSN, MAC and routing protocols are designed with the support for application requirements. The network lifetime and the trading of packets in WSN are done by the method called Duty-Cycle. This duty-cycle helps in switching the modes in the nodes from active to sleep with the pre-defined interval. The nodes which are in sleep modes release less energy with respect to active mode and these nodes cannot send or receive the packets.

II. PROBLEM STATEMENT

As studied earlier the reason for the energy melt down is communication. Since there is no proper understanding between the source and destination nodes the dissipation of energy is caused. Sensor nodes of electronics like sensing units and probable Global Positioning System also have their significance on the energy use. For successful application of protocols running on the network must have properties like simple-structured, fast executable and have low power. In flooding, which is the fundamental method used to convey the information to the base station from the sensor nodes. Here the communication is done by broad casting. Flooding utilizes redundant energy and bandwidth while spreading data to all over the network and also to the base station.

In cases, where the topology is not decided the transport of data from the source to destination takes place by just forwarding to the neighbors which are one hop distance away and at last it reaches the destination. Since the existing method uses the concept of flooding, gossiping and direct communication to interact between the nodes causes inability in terms of delay, node failure, data redundancy and utilization of larger energy.

III. EXISTING SYSTEM

The protocols in the existing system do not worry about saving the energy but it processes in gathering the information. This system does not provide a trustworthy network in terms of mobility, traffic and end –to – end connection. To balance the node the path is selected based on their residual energy, it uses a tree-based routing protocol approach. In cluster-based protocol the cluster with the larger remaining energy becomes the cluster head these heads change dynamically. In case of a duty-cycling the residual energy issued to choose the duty-cycle where the nodes having a higher residual energy wakes up generally than the nodes with low residual energy.

Disadvantage: -

- No energy efficient
- No power savings
- More resource utilization

IV. RELATED WORK

In Wireless Sensor Network the routing protocol first selects the next hop and then the MAC protocol waits for the receiver to wake up and receive the data. Waiting for the hop to wake up causes delay in the network. Thus, ORW a practical opportunistic routing is used where the duty cycle addresses the packet to the group of potential receivers and the forwards them to the neighbor that wakes up first and receive the packet. Since it uses all the neighbor the delay and energy consumption are reduced.

V. PROPOSED METHODOLOGY

For asynchronous duty cycled WSN we suggest ORR, an opportunistic routing protocol. ORR is same as ORW, but better in this condition i.e., based on the estimation of the forwarding cost, ORR determines the best number of forwarders. These best calculated number of forwarders can change with respect to the network environment as a result it needs to be evaluated on line during the performance. The anticipated senders waiting time and the anticipated generation of redundant packets leads to the evaluation of the forwarding cost. Secondly, after the selection of the forwarder set by the nodes, the residual energy is determined. In ORW the expected waiting time determines the forwarders, the nodes which have a huge number of neighbors have a greater opportunity in becoming the forward candidate. Hence traffic load is caused in less number of nodes and they lose their energy faster than other nodes. In ORR, forwarders are often calculated based on larger residual energy. It consists the following modules

NETWORK MODULE:- This area contains portrayal of usefulness of the contents utilized as a part of building topology. This module includes building Wireless Network topology, topology comprising of versatile hubs, every hub working with various channels. This module consists of following steps:

- Setting up Wireless Network Topology: This incorporates ecological settings, hub setup, and topology creation.
- Setting the bandwidth and threshold: Every single hub in the system topology will be relegated with certain data transmission and topology.
- Identifying the neighbors: To distinguish the neighbors for a specific hub Euclidian separation idea is utilized.
- Specifying the data transmission through single and multi-hop: From which hub the information must be sent and which hub must get the information will be indicated. Additionally, how much measure of information must be sent alongside the time interim of sending the information will be indicated.
- Specifying the simulation start time and end time: In NS 2 the whole exchange happens inside part of seconds. The exchange can be seen through the NAM window whenever. For this the reproduction begin time and end time will be indicated.

ENERGY MODULE:- The energy level in the host is given by energy module. The level of energy in the energy model at the beginning of the simulation has the initial value called initial energy. The energy model keeps only the details about the total energy but does not keep the information about the radio states.

OPPORTUNISTIC ROUTING: - There are two types i.e.,

1. Optimal Energy Strategy

Keeping in mind the end goal to gain the base vitality utilization amid information transmission in entire system, we acquaint the idea of EEN with direct vitality ideal technique at the position in light of the ideal transmission separate for example, on account of bounce by-jump transmissions toward the sink hub, the hand-off hubs lying nearer to the EENs have a tendency to exhaust their vitality speedier than the others.

2. Forwarder Set Selection for Optimal Energy Strategy

In potential hub that the vitality utilization capacities is arched concerning the quantity of jumps n. We can accomplish ideal vitality procedure by picking ideal jumps to decide ideal transmission separate. Furthermore, factors, for example, vitality adjusted of a system and the leftover vitality of hubs are likewise considered while choosing the accessible next-bounce forwarder.

PERFORMANCE ANALYSIS MODULE:- This module performs preparing of yield result set to register the different execution measurements required to dissect the execution of stream cut based steering.

VI. PERFORMANCE EVALUATION SIMULATION AND RESULTS

Table 1. Simulation Parameters required for Performance Evaluation

Simulation Area	500*500 m2
No of nodes	50
Mac	802.11
Antenna	Omni antenna
Transmission Range	550

Few parameters are considered in this project which yield in estimating the system performance and also which provides proof for network lifetime improvement.

- **Throughput:** Number of packets sent and received per unit of time. It is expressed in terms of kbps.

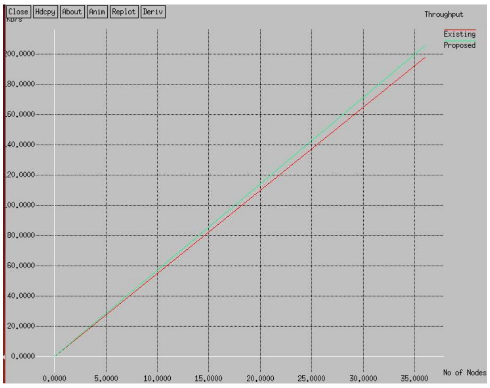

Figure 1. x axis :-no of nodes y axis :-kb/s

- **Packet delivery ratio:** It is the measure of ratio of number of packets transmitted by source and the number of packets acknowledge by destination.

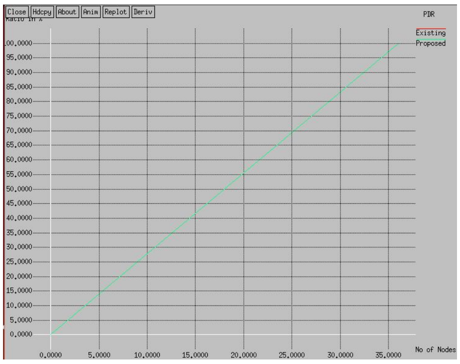

Figure 2. x axis :- no of nodes y axis :- ratio in %

- End-to-End Delay: Delay can be calculated by sent time of packet by source–received time of packet by destination. It is expressed in mili seconds (ms).

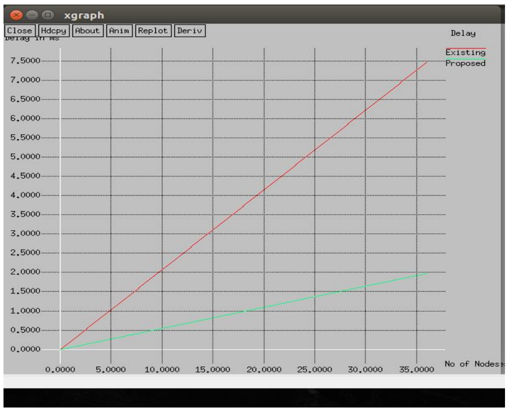

Figure 3. x axis:- no of nodes y axis:-delay in ms

- **Overhead:** It is the number of routing packet processed.

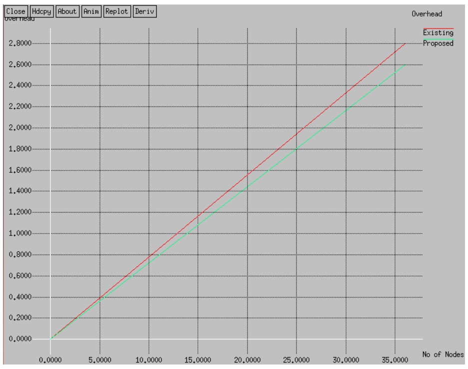

Figure 4. x axis:-no of nodes y axis:-overhead

- **Energy:**

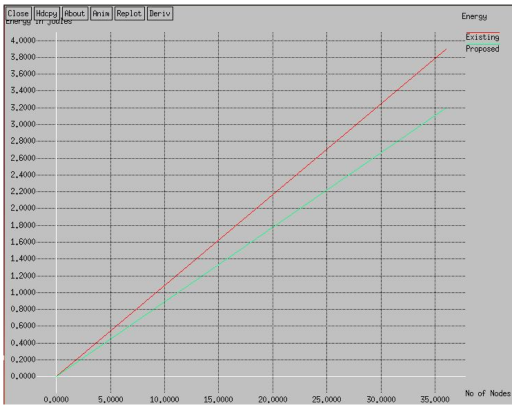

Figure 5. x axis:-no of nodes y axis:-energy in joules

VII. CONCLUSION

Opportunistic routing protocol work great with asynchronous MAC protocol, here the sender has to wait until the receiver wakes up. Here energy consumption becomes the major problem hence we allow multiple candidate receivers. By allowing multiple receivers to wake up at the same time and collect the packets causes redundant forwarding which leads to degrading of energy efficiency in the networks. Sometimes even when the load is not balanced causes loss of energy faster than others this also leads to losing the coverage and connectivity. These issues are tended to in ORR convention, by incorporating lingering vitality factor in the forwarder choice calculation and controlling number of forwarders in light of sending cost estimation. Thus ORR can genuinely accomplish the advantages of sharp steering by diminishing the negative impacts caused by excess bundle sending.

REFERENCES

[1] L. Cheng, J. Niu, J. Cao, S. Das, and Y. Gu, "QoS aware geographic opportunistic routing in wireless sensor networks," IEEE Trans. Parallel Distrib. Syst., vol. 25, no. 7, pp. 1864–1875, Jul. 2014.

[2] Y. Gu and T. He, "Data forwarding in extremely low duty-cycle sensor networks with unreliable links," in Proc. 5th Int. Conf. Embedded Netw. Sensor Syst., 2007, pp. 321–334

[3] M. Buettner, G. Yee, E. Anderson, and R. Han, "X-MAC: A short preamble MAC protocol for duty-cycled wireless sensor networks," in Proc. 4th Int. Conf. Embedded Netw. Sensor Syst., 2006, pp. 307–320.

[4] Chipcon AS, SmartRF CC2420 Preliminary Datasheet (rev 1.2),Dallas, Texas, USA, 2004.

[5] D. Moss and P. Levis, "BoX-MACs: Exploiting physical and link layer boundaries in low-power networking," Stanford Univ., Stanford, CA, USA, Tech. Rep. 08–00, 2008.

[6] O. Landsiedel, E. Ghadmi, S. Duquenoy, and M. Johansson, "Low power, low delay: Opportunistic routing meets duty cycling," in Proc. ACM/IEEE 11th Int. Conf. Inf. Process. Sensor Netw., 2012, pp. 185–196.

[7] A.Bachir, M. Dohler, T. Watteyne, and K. Leung, "MAC essentials for wireless sensor networks," IEEE Commun. Surveys Tuts.,vol. 12, no. 2, pp. 222–248, Apr. 2010.

[8] W. Ye, J. Heidemann, and D. Estrin, "An energy efficient MAC protocol for wireless sensor networks," in Proc. IEEE INFOCOM, 2002, pp. 1567–1576.

[9] P. Lin, C. Qiao, and X. Wang, "Medium access control with a dynamic duty cycle for sensor networks," in Proc. IEEE Wireless Commun. Netw. Conf., 2004, pp. 1534–1539.

[10] C. Merlin and W. Heinzelman, "Duty cycle control for low-power- listening MAC protocols," IEEE Trans. Mobile Comput., vol. 9,no.11, pp. 1508–1521, Nov. 2010.