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MINIMIZING THE ENERGY CONSUMPTION OF WIRELESS SENSOR NETWORK USING CO-ORDINATED NODE FOR OPTICAL SYSTEM

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Abstract - *A wireless sensing element network (WSN) consists of an outsized variety of sensing element nodes to perform local computations supported data gathered from the environment. every node within the network is provided with A battery, however it's nearly terribly tough to alter or recharge batteries; so, the crucial question is: "how to prolong the network time period to such a protracted time?" therefore, maximizing the time period of the network through minimizing the energy is a very important challenge in WSN; sensors cannot be simply replaced or recharged as a result of their ad-hoc readying in unsafe atmosphere. Considering that energy saving acts in concert of the most well liked topics in wireless sensing element networks, we'll survey the most techniques used for energy conservation in sensing element networks. The main focus of this research paper is applying media access protocol for providing co-ordination between nodes. Random access protocol is proposed to avoid node congestion to improve energy consumption of sensor network.*

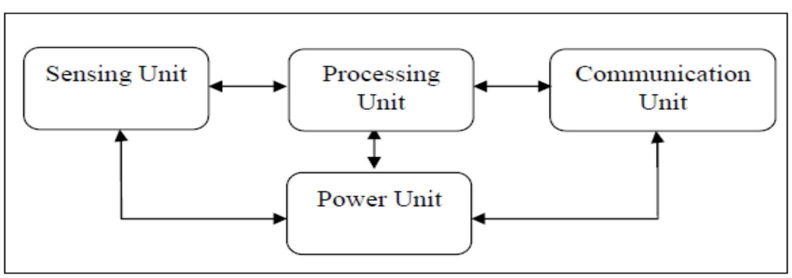
Keywords: *MAC Protocol, WSN, TDMA, RA protocol, initial probability.*

I. INTRODUCTION

A Wireless sensing element Network (WSN) may be a distributed network and it includes an oversized variety of distributed, self-reliant, and tiny, low powered devices known as sensing element nodes alias motes. WSN naturally encompasses an oversized variety of spatially spread, petite, battery-operated, embedded devices that are networked to supportively collect, process, and convey information to the users, and its restricted computing and process capabilities. Motes are the little computers, that work together to make the networks. Motes are energy economical, multi-functional wireless device. The wants for motes in industrial applications are widespread. A bunch of motes collects the knowledge from the setting to accomplish explicit application objectives. They create links with one another in numerous configurations to induce the utmost performance. Motes communicate with one another victimization transceivers. In WSN the quantity of sensing element nodes is within the order of a whole lot or maybe thousands.

Now a day's wireless network is that the hottest services utilized in industrial and business applications, attributable to its technical advancement in processor, communication, and usage of low power embedded computing devices. Sensing element nodes are accustomed monitor environmental conditions like temperature, pressure, humidity, sound, vibration, position etc. In several real time applications the sensing element nodes are performing arts totally different tasks like neighbor node discovery, good sensing, information storage and process, information aggregation, target trailing, management and watching, node localization, synchronization and economical routing between nodes and base station.

Wireless sensing element nodes are equipped with sensing unit, a process unit, communication unit and electromagnetic unit. Each node is capable to perform information gathering, sensing, process and human action with alternative nodes. The sensing unit senses the setting, the process unit computes the confined permutations of the perceived information, and also the communication unit performs exchange of processed info among neighboring sensing element nodes. The essential building block of a sensing element node is shown in Fig. 1.

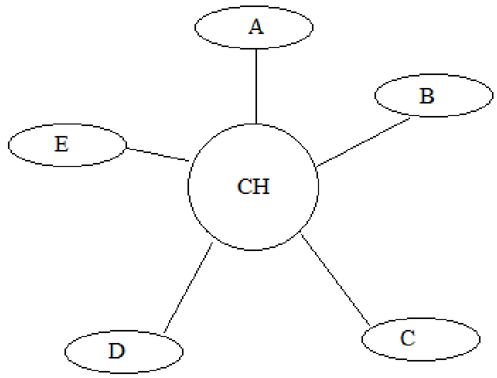


"Figure 1. Basic Building Blocks of Sensor Node"

The primary shoppers of energy in wireless networks are the RF communications [1], that are terribly pricey compared to different electrical hardware functions as well as process so on, the efforts of energy-minimization techniques are targeted on the subsequent approaches: coordinative the transmission vary dynamically technique is termed as "power control" [2], [3]. Reduced transmission power conjointly promotes the spatial recycle by maintaining property at very cheap level; but, it lengthens the routes which might have an effect on the end-to-end responsibility of flows.
Reducing the degree of knowledge that must be transmitted: rather than end-to-end traffic model in different networks, it's potential to showing intelligence mix or mixture knowledge into tiny set of data and create contribution towards energy savings [4], [5]. Moreover, by combining these unreliable readings, it will turn out a lot of correct signal by rising the common signal and reducing the noise.
Powering down the nodes' antennas throughout times of inactivity: Such inactive states will be explored in numerous ways: from the area perspective, there are topology management techniques [6], [7], that trade network density for energy savings whereas protective the information forwarding capability of the network. Moreover, by assuaging the restriction of network capability preservation, [8] trades off the in depth energy savings for AN exaggerated latency to line up a multi-hop path; from the time perspective, there are TDMA-based schemes, which permit nodes to travel to sleep or standby throughout explicit time-slots of a preset schedule [9]. Moreover, some variant techniques [10-13], combined with TDMA-based programming, alter nodes to stop working their antennas once they don't seem to be concerned in any traffic within the following slotted time periods.
The higher than up-to-date styles for energy-efficient protocols in wireless detector networks reveal that to be adaptive is that the key to attain economical usage of energy that sometimes has 2 forms:
1) Topology adaptive: It employs the minimum range of nodes and power levels to construct the communication system that consumes very cheap energy.
2) TraDc adaptive: It needs the communication system to be offered only if there's traffic.
Furthermore, these two completely different mechanisms are orthogonal and might be combined to attain the energy savings to the most important extent.
Reduce the per packet energy consumption: This tech- during this paper, specializing in the raincoat layer, we tend to solely explore the latter principle to gift AC-MAC protocol for wireless detector networks. Following the essential periodic listen and sleep programming planned by S-MAC [12], AC-MAC introduces adaptive duty cycle technique to adapt its behavior to the traffic masses. Compared to its forerunner S-MAC, that achieves energy-efficiency by sacrificing different vital attributes, like outturn and latency so on, AC-MAC is meant to supply a lot of optimized trade-offs among energy, outturn and latency.

II. RELATED WORKS

There are various studies on broadcast in wired networks and in wireless circumstantial networks [15][16][22]. Whereas the unremarkably used flooding and conversation stay basic approaches for wireless sensing element networks, substantial revisions are required to accommodate the challenges from this new network setting [14]. AN example is wise Gossip [19] that extends the essential gossip to attenuate forwarding overhead. To see the forwarding chance for every sensing element node, the algorithmic program keeps chase previous broadcasts and adaptively adjusts the chance to match the topological properties among the sensing element nodes. In [18], a temporal arrangement heuristic named FDL (Forwarding-node Declaration Latency) is projected to scale back redundant message forwarding within the basic flooding. The concept is to let a node defer a forwarding with a latency proportional to its residual energy. A more modern work is RBP (Robust Broadcast Propagation) [19] that extends the flooding-based approach and targets for reliable broadcast. It lets every node flood the received broadcast message just once, and so by overhearing and specific ACKs, the node could perform retransmissions for native repairs. Each the retransmission thresholds and also the variety of retries rely on the node density and topology data gathered from previous rounds of broadcast.
There are different connected works on code distribution and update propagation in WSNs, like Trickle [20].



"Figure 2. Sensor Network Architecture"

Their stress is on the distribution of the latest version of the code; the update frequency is way not up to that of a generic broadcast service operating for several higher-level operations.

Our work, totally different from said, considers a lot of realistic state of affairs with sensing element nodes alternating between active and dormant states to save lots of energy. During this state of affairs, previous works might fail or suffer from poor performance because of the breakup of the all-node-active assumption.

There are recent works work low duty cycle wireless sensing element networks [21][17]. Among them, PBBF (Probability-Based Broadcast Forwarding) [21] offers associate degree ultralow duty-cycle MAC protocol with schedule channel polling. The MAC layer but considers operations of abundant shorter time-scales, and it doesn't involve several network-wide interactions, either. DSF (Dynamic Switch-based Forwarding) [17] considers information forwarding in low duty-cycles, however focuses on unicast from a knowledge supply to a sink. Our work enhances them by considering the state of affairs of providing a network-wide broadcast service that requires novel solutions to confirm messages square measure with success delivered to all or any destinations.

III. DESIGN ALGORITHM

Two sorts of OW systems were developed: the CH and also the detector node. Each the CH and also the detector node area unit self-contained systems that may generate, modulate, transmit, and receive packets. In point-to-multipoint networks, multiple nodes may have to transmit at any given time, which may result in packet collisions at a destination node. To keep up organized communication, RA protocols area unit needed. we tend to developed our OW DMAC protocol by modifying and mixing 3 standard spatial relation RF raincoat protocols: dynamic time division multiple access (D-TDMA) [23], carrier-sense multiple access with collision turning away [24], and slotted acknowledgement [25,26]. The mixture of those protocols formed the premise for the DMAC protocol utilized in this short-range, low-power wireless sensor network.

The CH broadcasts a stop transmission request (STR) signal to the entire FOV telling all sensor nodes that network traffic will be temporarily halted for the purpose of rebuilding the D-TDMA scheme. Upon detecting the STR signal, all sensor nodes that had time slots enter sleep mode. The sensor nodes that were contending for channel access stop transmitting but remain awake.

After transmitting the STR signal, the CH waits for a specific time interval to pass. During this interval, the CH does not expect to receive any signal because all sensor nodes are supposed to stop transmitting. If the CH does detect a signal, then it rebroadcasts the STR signal to the entire FOV and waits for the time interval to pass. This process continues until the time interval passes without the CH detecting any signal.

Next, the CH broadcasts a RA synchronization signal to the entire FOV. Within the RAS signal, the CH transmits a probability value, p, to all the sensor nodes.

The nodes use this value of p to generate a possible reply back to the CH. After the CH transmits a RAS signal, it waits for a specified time interval time for a reply back from the sensor nodes.

If only one sensor node replies, then the CH successfully detects its DMAC address and transmits back a time slot ACK. This particular sensor node now has a time slot and can enter sleep mode. If multiple sensor nodes reply, the CH detects a collision, and if no nodes reply, the CH detects a timeout. In either of these latter cases, no slot is transmitted back to the nodes. Transmission of RAS signals continues till all detector nodes are given a slot. The CH determines that each one detector nodes are given time slots once it transmits a worth of p =1 among a RAS signal and detects a timeout. The worth of p is updated in associate degree economical manner throughout every RAS signal to attenuate the prospect of police investigation a collision or timeout and maximize the prospect of police investigation a in transmission.

IV. RESULTS & DISCUSSION

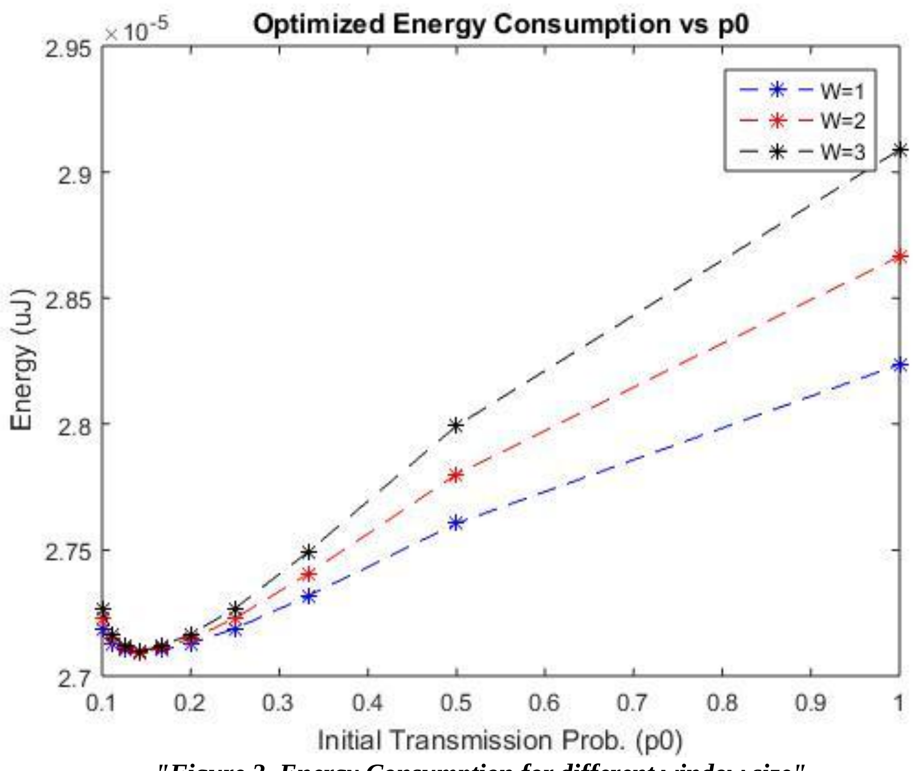
Simulation of proposed wireless sensor network model is done on MATLAB software. Parameters taken for system is shown in table 1.

"Table -1: Simulation Parameters"

S. No.	Parameter	Value
1	LED wavelength	1.6um
2	Transmission Power	2uJ
3	Distance between Rx & Tx	1m
4	Total No. of Nodes	10
5	Voltage	5v
6	Data Rate	100Kbps
7	Current	9mA
8	No. of Photodiode	1
9	Sleep Mode Energy Consumption	1pJ

Now energy consumption is calculated in terms of initial probability p_0 and displayed on fig. 3 for three different window size. Taking this into account, each parameterization was tested using po values of 1/7, 1/3, 1/2, and 1. These values were selected because they are either separated in value by a distinct amount or they are separated by an M value of 2 or more. In this manner, the RA protocol could be tested from different initial points, and any visible effect on the experimental results could be clearly attributed to that particular po value.

Energy consume to listen signal is 8.5nJ. Probability of transmission is taken 0.1 to 1 at 0.1 interval. Hence energy consumption is calculated for ten different values. Number of node contending is taken 10 nodes.



"Figure 3. Energy Consumption for different window size"

To improve the performance of the network energy consumption, random access protocol is used to handle the congestion problem. In this research paper three different window sizes are taken into consideration w=1, w=2 & w=3. With increase in window size number of synchronization frames required to assign time slot to individual motes became higher. Hence higher window size consume more energy. From the above graph it can be observe that if selected value of p_0 is unexpected then energy consumption became very high. And if selected value of p_0 is as per expectation then energy consumption is lowest 2.72uJ.

V. CONCLUSION

This research paper concludes that the performance of wireless sensor network for optical communication is dependent on initial probability p_0. It is observe that for p_0 = 1/7 energy consumption in minimum 2.705uJ and is same for all three window sizes. As window size increases number of synchronization frames required to remove contention also increases, due to which energy consumption increases drastically. Hence it can be conclude that initial probability of congestion is key parameter.

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