Research Article

Energy Efficiency In Wireless Sensor Network Using Dynamic Duty Cycle Based Sensor Mac

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Abstract: Wireless Sensor Network is created by a huge number of sensor nodes normally powered by batteries and may not easily recharged. To extend the lifetime of the sensor node is a vital issue while designing a protocol in WSN. However, lowering the energy consumption may result in higher latency. To address on such trade-off issues, this paper proposes Sensor MAC (SMAC) dynamic duty cycle to improve SMAC fixed duty-cycle. S-MAC adjusts the duty-cycle based on dynamic utilization and average sleep delay. The proposed topology which is distributive in nature, controls the technique to schedule the nodes to wakeup time slots, and design a SMAC protocol to get benefitted from this topology control for improving the energy-efficiency, delay, and efficiently handling the spatially-correlated contention. Compared to Fixed SMAC the Dynamic SMAC lowers the Energy consumption in Fixed SMAC and performs very good Energy saving in circular, grid and random topologies.

Keywords- WSN, SMAC,Topology, NS2

1. INTRODUCTION

To monitorthe physical and environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants and to cooperatively pass their data through the network to a main location, using spatially distributed autonomoussensors in Wireless Sensor Networks.Sensor Nodes are normally the suitable devices that are used inprecision applications. This paper discusses about the way Fixed SMAC lowers the Energy consumption than Dynamic SMAC and performs very good energy saving in circular, grid and random topologiesthrough the NS2 simulations. On increasing the sensor nodes, identifies the topology that can save high energy than the fixed SMAC. We have plotted the simulation Graph based on performance of Dynamic SMAC which overcomes the Fixed SMAC duty cycle.

IISMAC

It is a MAC protocol specially designed for controlling the nodes in Wireless Sensor Networks.[1]S-MAC is a low power RTC-CTS based MAC protocol that makes use of loose synchronization between nodes to allow for duty cycling in sensor networks. Energy savings in S-MAC depends on duty cycle. This protocol [2] uses three duty-cycle techniques to achieve low power namely, periodic sleep, virtual clusteringand adaptive listening. It also manages local synchronizations and periodic sleep-listen schedules.

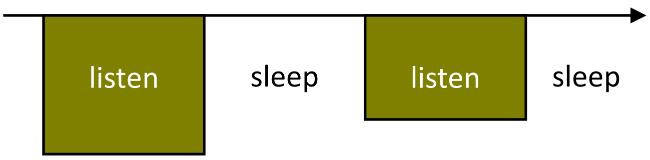

Fig.1 Working Scheme of SMAC

Neighbouringnodescan form a virtual clusterto set up a common sleep schedule. If two adjacent nodes reside in two different virtual clusters, then they will wake up at listen intervals of both clusters. Collision avoidance is achieved by carrier sense and RTS/CTS packet exchanges as in IEEE 802.11 standards in unicast communication. Periodic sleep may result high latency specially for multi-hop routing algorithms, because all immediate nodes have their own sleep schedules. The proposed adaptive listening technique will improve the sleep delay, and in turn the overall latency.

A. SLEEP-BASED TOPOLOGY CONTROL

- Motivation and Requirements

Our sleep-based topology control [1] is designed to support an efficient wakeup scheduling that achieves significant energy-savings, high throughput under spatially correlated contention, and low, bounded end-to-end delay. Since wakeup scheduling schemes are usually incorporated in a MAC, our topology control can also effectively improve MAC protocol's performance.

- Energy-efficiency

In typical sensor applications, all the kind of events do not happen frequently, duty cycle is normally used to in the energy consumption, that leads to low duty cycle design. But a longTsleep can adversely affect the delay and throughput.

III NETWORK TOPOLOGIES

A.CIRCULAR TOPOLOGY

The circular network[4]depicted is considered in this work. Nodes are placed at equidistant points on the periphery of a circle. The topology with a Boolean connectivity model we use a channel model that includes pathloss, fading, and noise

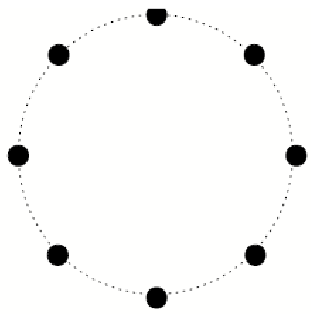

Fig. 2 Circular Network

The circular topology consisting of n = 8.The energy consumption in a wireless sensor node as consisting of the energy for transmission and reception, where reception also includes idle listening. As this is common for a large class of Wireless Sensor Networks (WSNs), we assume that power drawn in transmission and reception mode is essentially equivalent, i.e. Ptx = Prx = Pelec. The overall energy consumption per node for the all-to-all broadcast transmission is then defined as E = Pelec* (Ttx + Trx), where Ttx is the overall time spent in transmit mode and Trx is the time spent in reception mode, respectively.

B. RANDOM TOPOLOGY

In this section, the uniform-distribution assumption and extend our topology control algorithm to realistic WSN whose nodes are randomly deployed. In a WSN with random deployment, we can use a similar method as in a uniform WSN to assign potential forwarders and synchronize their wakeup time slots. In particular, we organize the whole WSN as a set of rings with the optimal width p, as in a uniform WSN since it minimizes the delay in a general sense, and assign each node an index according to its position angle. We let the nodes in each ring to be sequentially synchronized. For a node n>j, we require its potential forwarders to be at ring M -1 and within the transmission range of ni 's outer projection, but do not bound potential forwarders' position angles as in the uniform WSN due to the irregular network density.

C. GRID TOPOLOGY

Wireless sensor nodes in a situation where the nodes respect the places of an array. They are placed manually at certain locations where the distance between two neighbouring nodes is the same (d). The sensor network has a MXN dimension and is similar with the one presented. Each sensor is identified by its bi-dimensional coordinates, (i, j), where i represents the horizontal index of the sensor with values between 0, M-1 and j represents the vertical index of the sensor taking values between 0, N-1. For the implicitly of the presentation, we choose to select the network sink t the point (0, 0). The sink also acts like a sensor and it has unlimited energy.

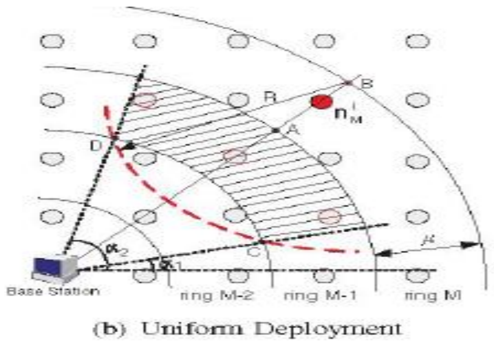

Fig. 3 Grid network with a 5x4 dimension

Each node placed in the interior of the grid has 4 neighbours: two high neighbours, node (i, j + 1) and node (i + 1, j), and two low neighbours, node (i - 1, j) and node (i, j – 1). The nodes located on the edge of the grid can have two or three neighbours. A node can transmit only through the smallest paths, to his low neighbours. This way the nodes closer to the sink are more used.

IV SYSTEM MODEL

A. EXISTING SYSTEM

WSN is formed by a great deal of sensor nodes, which are generally battery, powered and may not recharge easily. Consequently, to prolong the lifetime of the node is an important issue when designing protocol in WSN. However, lowering the energy consumption may result in higher latency. To address on such trade-off Fixed SMAC duty cycle is used. And we distributed a topology control technique to schedule nodes wakeup time slots, and design a SMAC protocol to benefit from this topology control for improving energy-efficiency and delay, and efficiently handling spatially-correlated contention, and by using different topology such as circular, grid and random topologies, calculate which topology can perform high energy saving on by increasing the number of sensor nodes. The main problem of Fixed SMAC is having some Energy loss and high latency. So, to lowering the energy consumption, the proposed system called Dynamic SMAC is used.

B.PROPOSED SYSTEM

To improve Energy efficiency, MAC dynamic duty cycle is used. S-MAC adjusts duty cycle dynamically based on utilization and average sleeping delay. In this system different topologies such as circular, grid and random topologies is used. Then by increasing the nodes we calculate which topology can perform high energy saving than the fixed SMAC. And plot the simulation Graph based on performance of Dynamic SMAC which overcomes the Fixed SMAC duty cycle.

V EXPERIMENTAL RESULTS

Energy saving for Fixed SMAC on Circular and Random topology is better than that of the Grid topology on increasing the number of nodes. And energy saving in Dynamic SMAC is higher for Grid and Random Topology than the Fixed SMAC but it is difficult for Circular topology on minimum number of nodes. Thus the comparison of fixed SMAC and Dynamic SMAC is shownas

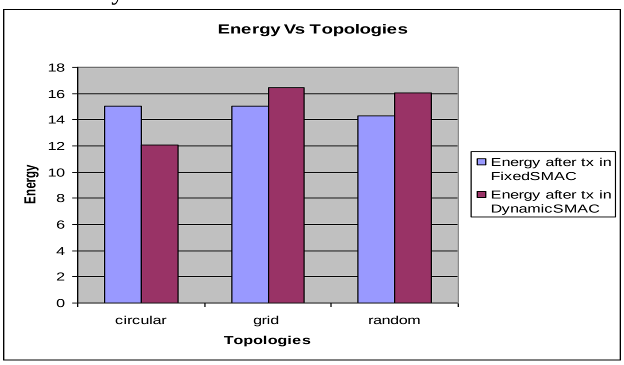

Fig. 4 ENERGY SAVING GRAPH FOR FIXED SMAC Vs DYNAMIC SMAC FOR 10 NODES

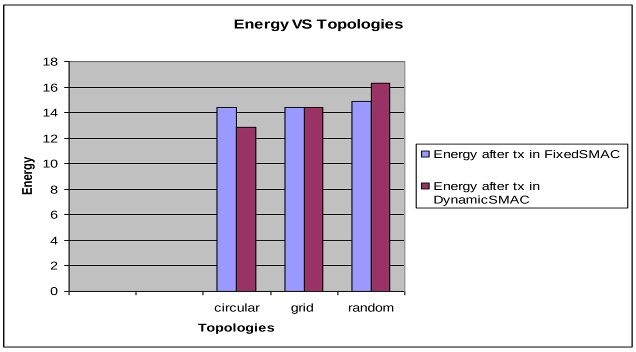

Fig. 5 ENERGY SAVING GRAPH FOR FIXED SMAC Vs DYNAMIC SMAC FOR 20 NODES

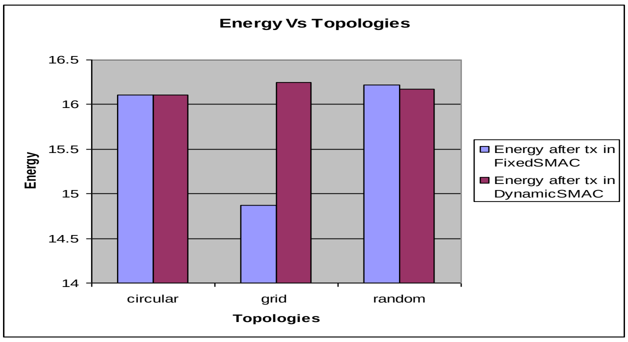

Fig. 6 ENERGY SAVING GRAPH FOR FIXED SMAC Vs DYNAMIC SMAC FOR 40 NODES

VI CONCLUSION &FUTURE WORK

For Fixed SMAC the Energy consumption for Circular and Random topology is better than that of the Grid topology on increasing the number of nodes. But the Energy consumption on Fixed SMAC is high. Hence to lowering the Energy Consumption and to increase the life time the Dynamic SMAC is used. In Dynamic SMAC the Energy saving is higher for Grid and Random Topology than the Fixed SMAC but it is difficult for Circular topology on minimum number of nodes and their results are shown.The Dynamic SMAC is used to reduce the energy consumption. And for future work the energy consumption can be calculated dynamically based on other standard MAC protocol such as DMAC and TMAC and their performance has been calculated.

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