AN APPROACH FOR MAC-PROTOCOL IN WIRELESS SENSOR NETWORK - THE GROUP SPLIT PROPERTY (GSP) -

Mohammad Abd-Allatef Al-Shalabi, Majd Osama Al-Shalabi

ABSTRACT: Wireless Sensor Networks (WSN) are collections of sensors that are equipped with a radio and form a wireless network together. In this work we look at communication protocols, which have an obvious effect on the energy within the network, The energy issue is important in WSN, it is generally hard or impractical to charge/replace the exhausted battery, which gives way to the primary objective of maximizing network life time, so that we focused in our Protocol on MAC, consume this protocol the most part of energy from the sensor. In this protocol we proposed an approach for MAC protocol called GSM protocol.
In this Protocol, cluster-heads change on a regular intervals To ease the load on the sensors in the network ,the sensors send average of data to avoid large bit of the message, we used own simulation to get the comparison results with "Direct Communication with the base station", we proposed GSP protocol expected to become more effective in reducing energy consumption , by split the cluster into two part that is the default and use the timers for organizing the operations in cluster and avoid the Collision.

1. Introduction

Sensor networks are the focus of significant research efforts on account of their diverse applications, including disaster recovery, military surveillance, health administration and environmental monitoring. The main advantages of wireless sensor networks are fast and easy deployment, and low maintenance cost. A wireless sensor network is comprised of a large number of limited power sensor nodes which collect and process data from a target domain and transmit information back to specific sites. A Medium Access Control (MAC) protocol specifies how nodes share the channel, and hence plays a central role in the performance of a sensor network. Network protocols must be designed for sensor communication patterns and focus on low energy consumption.

2. Motivations

There are several cases that made many researchers interested in wireless sensor networks. As the development of these networks is useful in several areas, such as wars to monitor the movements of enemies and their number and positions, And also in the field of medicine in which we can Diagnose diseases and monitor the status of the patient and the development of the disease, and in the field of research will help us in the work of several statistics such as knowing the amount of air pressure and temperature and wind speed. And also help us in carrying out operations in inaccessible areas.

3. Methodology

We implemented GSP protocol in VB.6 language, GSP protocol is a way to save energy consumption to as much as possible by splitting the main group into sub-groups.
Which we have done here in our way is as follows:
We assumed that the sensor nodes distributed in the form of packets (Group) each packet contains a set of these nodes and is divided into two sub-groups A and B and each sub-group have a head, we show that in Figure 1.

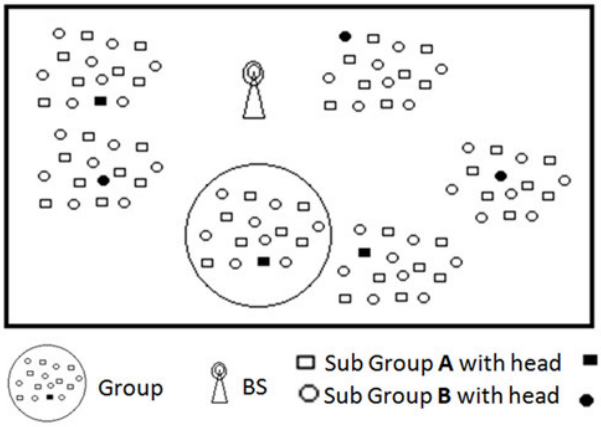

Fig.1 WSN Area

BS and each node contains the timer is the same as in the rest nodes in the sub-group working simultaneously, the sub-group "A" will be active during the timer, while the sub-group "B" in case of sleeping and vice versa.
But when the head of sub-group A begins sending the data to BS, the sub-group B will begin the activity, at Specific point stopped the sub-group sensing and start sending the average of data to the head of the sub-group, while the other sub-group go to start its activities, Figure 2.

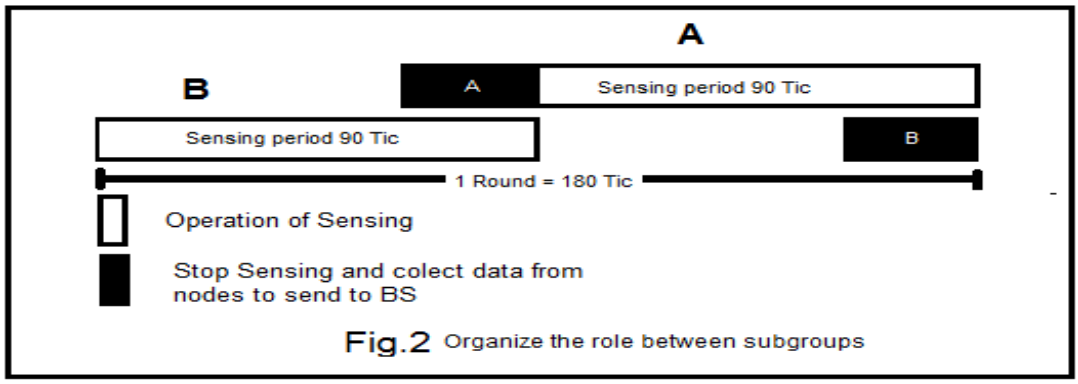

Fig.2 Organize the role between subgroups

The process of exchange of roles in this way helps to maintain the energy group, which leads to the longevity of the networks life.
While the node is the head of the sub-group is not acting in sensing, only collect data and send it to BS, Data is collected at a specific point of the sub-groups time activity, when the node in the sub-group process of sending data it has a specific time for transmission and the head receiving data from the node in his specified time to avoid collision with the rest nodes, this action is good to reduce consumption of energy which wasted due to collisions the Fig.3 shows this action .

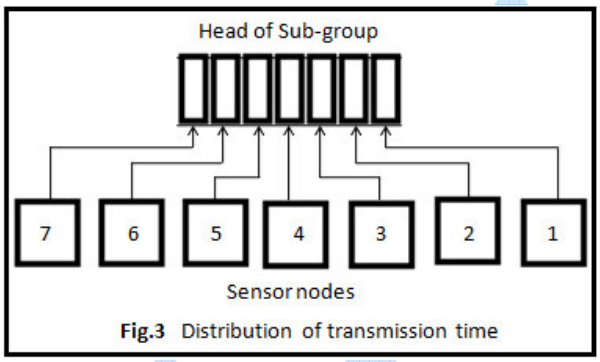

Fig.3 Distribution of transmission time

For each sensor node in the sub-group specific time to send its data if it has to head of sub-group , and the head of sub-group Receives the data and make processing if this requires then send it to BS , the nodes send if only the data sensed match the condition (ex. a temperature of 40°) This feature works to reduce energy consumption at the sending, and the BS has several ports to receive data from the head of sub-group , after the (Transmission and receiving) operations if any node has low energy that cannot allow to be the head of sub-group , this node must send notification to its sub-group tell him "I cannot to be the head of sub-group" to ignore this node when choose the head of sub-group , select the head of sub-group is not randomly, there is a counter in all the sub-group nodes and it increases before go to sleep mode To be the head of the sub-group specific when it returns to the activity again , and the BS Know who is the head of sub-group later.

4. System and design overview

In our protocol we used a simulation program that is programmed in VB.6 programming language. This simulation program is working to calculate the wasted of energy in the process of sending and receiving of data within the network and with BS, and sensing process.
In our simulation we interested to get results of the "Direct Communication with BS" Protocol and the results of our protocol "GSP", in this simulation the energy and the life time appeared for each sensor, and the information of when the first sensor node die to the last sensor node, in other hand appear the round number .
In the simulation we will show the node which makes sensing now and the sensors information state. The network Protocol GSP work in rounds, every round = 180 Tic, every Tic < 0.2 Second.
At the end of round period in step 1, the head cluster takes (4 Tic) to collect data from his nodes, then step 2 takes (2 Tic) to send the data to the BS, the step 3 Takes (2 Tic) to check the next sensor in cluster if his energy and state allows him to be CH or no, if no check the next sensor, at the last step 4 select the CH for the clusters.
We assumed that the energy consumption of a sensing process is 0.0001 when the sensor node makes a sense, and assumed that the node will die when it cannot send data, when its energy low.
In this work, we consider sensors networks where:

- The BS is fixed and located far from the sensors.
- The communication is direct between CH and The BS in GSP Protocol.
- The communication is direct between each sensors and The BS in Direct protocol.
- All Sensors in the network are homogeneous and energy constrained.
- We also assumed that all sensors sense the environment at a fixed rate.
- We implemented "event-driven" simulation, where sensors only transmit data if some event occurs in the environment.

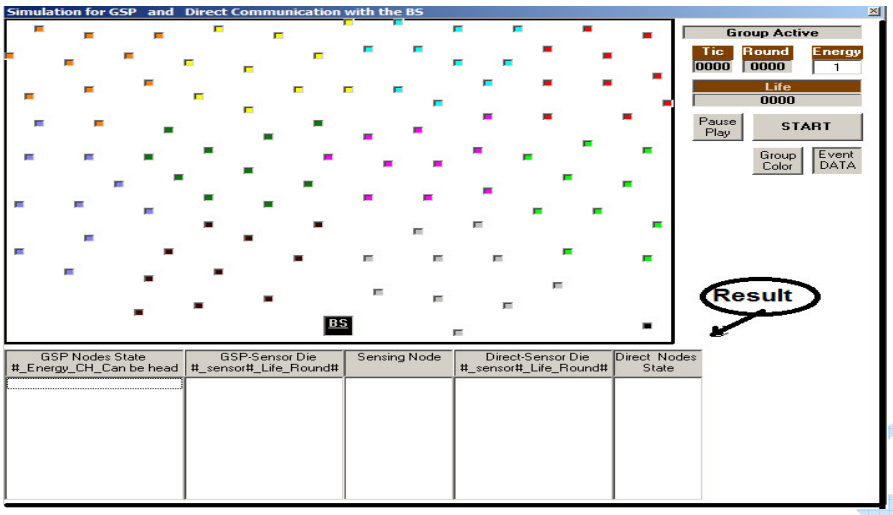

Fig. 4 Part Of Simulation interface

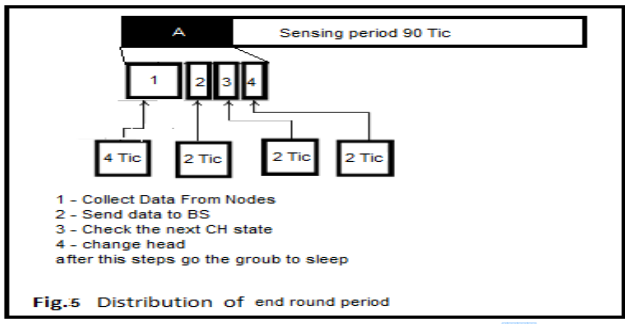

Fig.5 Distribution of end round period

In our simulation we used the variables and equations in table below:

Table 1. Radio characteristics.

Operation	Energy Dissipated
$(E_{Tx-elec} = E_{Rx-elec} = E_{elec})$	50 nJ/bit
Transmit Amplifier (ϵ_{amp})	100 pJ/bit/m^2

$$\text{Send:} \quad E_{Tx}(k,d) = E_{elec} * k + \epsilon_{amp} * k * d^2 \qquad (1)$$

$$\text{Receive:} \quad E_{Rx}(k) = E_{elec} * k \qquad (2)$$

where: n = Nano =10 ^ -9
p= Pico =10^ -12

We assumed that, the node will die when the energy is less than 0.015, in this value, the node cannot send the data to another sensor or BS.

5. Results and Analysis

The GSP protocol is more efficient than Direct protocol, We assumed that the energy equals (0.3) and depends on the simulation results. We show that:
The first sensor die in Direct protocol at round (2) life (256) but the first sensor die in GSP protocol at round (16) life (2795) and the last sensor die in Direct protocol at round (18) life (3355) but the last sensor die in GSP protocol at round (715) life (128720) these results assure that, the GSP protocol reduces the energy consumption which mean a long life time than Direct protocol.

Table 2.

Energy(E)	Protocol	Round/Life 1st node dies	Round/Life last node dies
0.3	GSP	16/2795	715/128720
0.5	Direct	2/256	18/3355

And in the Table.3 we can show the rounds period and how sensors will die in this period, all sensors nodes in Direct protocol are die before completing the round 20 , at another side the nodes of GSP protocol still working.

Table 3.

Rounds	Number Of node dies E=0.5	
	GSP	Direct
10	0	84
20	12	100

6. RELATED WORKS

The number of MAC protocols for Wireless Sensor Networks which have been proposed in the last years shows that the interest of this field has acquired. Most of them mainly focus on energy saving, which is often achieved by trading-off for packet delivery latency, usually considered of secondary importance.
WSN MAC protocols can be classified into the classical categories of contention based protocols and time division protocols. Classical contention based protocols are simple, scalable and flexible but at the expense of high idle listening time, that is,

high waste of energy. WSN protocols based on Carrier Sense Multiple Access (CSMA) are designed with mechanisms to avoid overhearing and idle listening and, thus, decrease energy consumption.
The most used approach is to make nodes turn off their radio during inactivity, S-MAC protocol [YHE04] is the first which propose to organize nodes in periodic cycles of activity and sleep (listen/sleep), This mechanism makes nodes activate for a short time interval (listening time) and put them to sleep (turn off the radio) during the rest of the time (sleep time). The ratio of the listen time and sleep time is called duty cycle. Decreasing duty cycle results in an education of the energy consumption. A new class of radio diversity techniques called cooperative communication derived from diversity techniques using co-located antennas has received lot of interests. Cooperative communication scheme for distributed wireless network like: ad hoc networks or sensors networks. Their respective works has paved the way for a lot of studies using cooperative transmission on a real Mac layer framework. Ji et al. [JZ06] and Lin et al. [LP05] proposed different framework for Cooperative MAC protocol. These solutions are based on network-assisted diversity multiple access (NDMA).
These authors present a novel throughput-efficient medium access scheme for WSN. This scheme enables a node to retrieve a packet from many previously received packets (MPR). the first cooperative MAC protocol called "CoopMac" based on the well knows IEEE 802.11 protocol. They defined two alternative solutions CoopMAC I and CoopMAC II. In CoopMAC I, a new frame HTS (Helper ready To Send) is added to the IEEE 802.11, to inform others that an alternative node (a relay node) will help the sender to transmit more efficiently. Then, in CoopMAC II, HTS frame is not used; instead they used the RTS header to advise which node should act as a relay node.

CONCLUSIONS

The GSP protocol is a good technique for WSN to apply at the real environments, when we compare the result of our protocol with the Direct protocol, we show large different in life time between the two protocols this proves the effectiveness of this protocol more than others.
In this work we used the idea of dividing the group into sub-groups and each one worked until the timer end and begin the other sub-group its activity, here we assume it has two sub-groups, expected in GSP protocol to save much of the energy waste and we have distributed the time on the nodes to avoid collision between them and the data send to BS related with condition, which would lead to avoid transmission, which has no importance, this contributes to the conservation of energy.
In GSP protocol we assume that, there was one BS and the number of group nodes is static and the send operation of data during single-hub between the BS and the head of sub-group.
At the Future we look to add Special sensor node to make this protocol work on multi hop routing.

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