A Centralized Energy Balancing In Clustering Process for WSN

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ABSTRACT
Wireless sensor networks consist of small battery powered. Devices with limited energy resources optimization of energy consumption is one of the most important challenges in WSNs due to the limited energy capacity of the network nodes. Several studies have been done in order to design energy efficient routing mechanism to increase the network lifetime. Clustering is one of the best used methods. This work proposes a centralized routing protocol used a CH selection by considering the remaining energy of sensor node in CH selecting process. Simulation results show that the proposed scheme reduces the energy consumption and prolong the network life-time of network compared to the well-known clustering algorithms LEACH.

Keywords
Wireless Sensor Networks (WSNs); Energy consumption; Life-time; Clustering*;* CH; LEACH

1. INTRODUCTION
We ask that authors follow some simple guidelines. In essence, we ask you to make your paper look exactly like this document. The easiest way to do this is simply to download the template, and replace the content with your own materi Wireless Sensor Network (WSN) WSN consists of several sensor nodes deployed in a region to sense various types of physical informations [1]. The collected information is relayed to the base station (BS).

The major constraint of this type of network is the limitation of the energy resources of the nodes. Therefore, energy efficiency is a very crucial issue [2-3] and Energy-efficient protocols must be designed and developed to maximize network lifetime.

Many routing protocols have been proposed to improve the performance of the network, in particular the lifetime and energy consumption [2-11].

Transmission is the most energy consuming operation. Clustering is the most widely used method [5-9]. It consists in organizing the nodes as a group (cluster). Each cluster has a cluster head (CH).. The process of cluster formation consists of two phases, CH election and assignment of nodes to cluster-heads. In order to minimize the transmission distance the nodes send the collected data to their own CH which sends it to the BS.

However, CH consumes much more energy than normal nodes. It is very important to take into account the residual energy of each node in the CH selection phase and to exchange the role of CH between the different nodes in order to balance the energy of the network.

In this paper, a centralized routing protocol has been proposed to improve network lifetime of WSN by balancing the energy consumption among nodes.

The rest of the paper is organized as follows. Section 2 presents the used radio energy dissipation model. Section 3 gives brief description about proposed protocol. Section 4 present simulation results and finally Section 5 concludes the paper.

2. RADIO ENERGY MODEL DISSIPATION
The energy required by the transmit amplifier $T_{Tx}(l,d)$ to transmit l bit message between a transmitter and receiver over a distance d is [5-9] :

$$E_{Tx}(l,d)=\begin{cases} l\times E_{elec}+l\times\varepsilon_{fs}\times d^2 & if\ d\le d_0 \\ l\times E_{elec}+l\times\varepsilon_{mp}\times d^4 & if\ d\ge d_0 \end{cases} \quad (2)$$

Where $d_0 = \sqrt{\varepsilon_{fs}/\varepsilon_{mp}}$ is the threshold distance, Eelec represents the energy consumption in the electronics for sending or receiving one bit. The terms $\varepsilon_{fs}\times d^2$ and $\varepsilon_{mp}\times d^4$ represent respectively the amplifier energy consumptions for a short and long-distance transmissions.

3. PROPOSED WORK
In this work we make some assumptions:

- There are N sensors nodes, which are randomly deployed in square field within a MxM square region
- The nodes are The normal nodes transmit data to CH.
- All nodes start with the same energy Eo.
- The cluster CH the aggregated data to the BS directly. -
- The BS position is predetermined and located outside the sensing area
- Nodes are are immobile

The base station (BS) initiates the routing process. The CH selection is based on residual energy level of the nodes with respect to average energy of network.
In order to balance the energy consumption among all nodes, we introduce a new cluster head selection threshold based on proposed cluster head selection probability, residual energy of a node. The improved threshold in this paper is given by (1).

$$T(i)=\begin{cases} \dfrac{p}{1-p*(r \bmod \frac{1}{p})}\dfrac{E_{av}}{E_i} & \text{if } i\in G \\ 0 \quad \text{otherwise} \end{cases} \quad (1)$$

In eq. 1, *p* is the optimal cluster-head probability, *r* is the number of the current round, G is set of nodes that have not been cluster heads in last 1/p rounds. E_{av} is the average energy of the network.
In CH process each node having residual energy great or equal E_{av} generates a uniform random number in the interval [0, $E_{av/Eo}$], if this number is less than the threshold T(s), then this node is candidate to become a CH.

4. SIMULATION RESULTS

The propsed protocol is simulated and its performance is compared with ar clustering protocols LEACH. Performance of proposed protocol is measured in terms of network lifetime, energyefficiency, and stability period.

The used simulation are listed in Table I according to the radio basic energy dissipation model [4-6].

Table 1: Simulation Parameters

Parameters	values
Number of nodes	100
Field simulation	100m x 100m
Base station position	(50,175)
Initial energy (Eo)	0.5 J
Transmitter Electronics (Eelec)	50 nJ/bit
Receiver Electronics (Eelec)	50 nJ/bit
Length of data packet (Bytes)	3000
Transmitter Amplifier (ε_{fs}) (If $d < d_0$)	10 pJ/bit/m^2
Transmitter Amplifier (ε_{mp}) (If $d > d_0$)	0.0013 pJ/bit/m^4

Figure 1 show clearly that the proposed algorithm extends network lifetime compared with LEACH. The network becomes completely off after the round 1605 and 2500 for both protocols LEACH and proposed algorithm. Also the proposed algorithm enhance the stability period (also known as a number of rounds after which death of first sensor node occurs). The results are summarized in table 2.

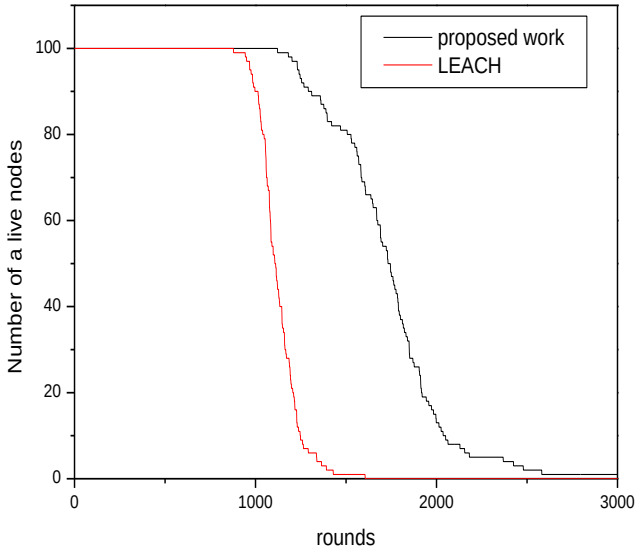

Fig. 1: Simulation result of network lifetime.

Table 2: Comparison of Network Parameters

	LEACH	proposed
First node die	879	1120
Last node die	1605	2500

The dissipated energy of the entire network for the proposed protocol compared to LEACH protocol is shown in Fig. 2. It is shown clearly that the proposed protocol reduce average dissipated energy than LEACH.

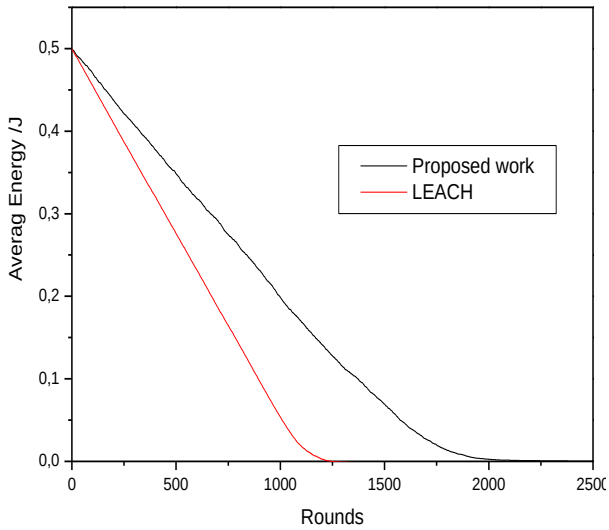

Fig. 2: The energy consumption

5. CONCLUSION

This paper proposed a new clustering scheme to improve network lifetime and stability period for WSN. A new centralized CH algorithm based on the nodes residual energy and the average energy of the entire network.

The simulation results showed that the proposed protocol is more energy efficient and enhanced the network lifetime and period stability as compared to LEACH.

6. REFERENCES

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