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Research Article

A NOVEL ROUTING ALGORITHM TO OPTIMIZE ENERGY CONSUMPTION IN WIRELESS NETWORKS

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ABSTRACT
Wireless networks are the systems with source limitation which are in large scale and high settlement density for gathering data. They are used smartly. In this article, we consume the concept of energy efficiency that increases length of wireless network life. In routing protocols, we have studied about wireless networks and we have presented one category of different techniques for energy efficiency consume. In addition, we presented a routing protocol which is improvement of previous routing protocol. Therefore, it uses special techniques for energy efficiency consume then simulate this suggestion protocol and compares their performance with the last routing protocols and we saw that the suggestion routing protocol increases the length of wireless network life significantly.

Keywords: *Routing Protocols, Wireless Networks, Energy Efficiency Consume, the Length of Wireless Network Life*

INTRODUCTION
With the latest developments in technology of wireless networks, using these networks in surveillance, and business, military and industrial applications have been increased significantly. Wireless networks contain small nodes able to do the actions same as receiving information, their process and making a connection by wireless. These networks contain many limitations such has consuming power (Estrin *et al.*, 2001; Estrin and Govindan, 1999). For economy in consume energy and increase length of the network life, sequence routing protocols like direct dispatch, and the minimum energy for dispatch. Different protocols of clustering have been presented (Akyildiz *et al.*, 2002). In direct dispatch, the nodes send their data to the base station directly, actually in algorithm, the minimum energy for dispatch, the nodes send their data by several steps to destinations in both protocols having the problem of energy unbalance consume between the nodes (Jiang and Manivannan, 2002). They influences on running out of the energy of nodes which are far away from the base station in direct dispatch model and the near nodes to the base station in model sending the minimum energy. In comparing two previous protocols, clustering protocol enhance the performance of network in this protocol (Ettus, 1998). All the data of the nodes into a cluster will gather by the top leader of cluster and will send to the base station after gathering. The relationship between the top leaders can be directly or multi steps. So in this protocol, there is problem of energy unbalance consumption between the top leaders (Heinzelman *et al.*, 2002; Heinzelman *et al.*, 2000). In wireless networks, one of the most famous routing protocols is based on clustering that's leach protocol. In this protocol, top leaders are in a relationship with the base station that directly influences on energy unbalance consume in the middle of them and the energy source of top leaders. As they are away from the base station, they will be empty earlier than the other top leaders (Younis and Fahmy, 2004). Heed protocol is also one of the other famous routing protocols which are based on a cluster and it doesn't use the distance problem obviously (Soro and Heinzelman, 2005). LNCA introduces the new clustering algorithm that approving the same sensed data as a main case of cluster creation happens there. This algorithm contains four levels of fetched data exchanging. Wireless grade exchanging is announcing of top cluster and cluster creation (Younis and Fahmy, 2004; Xia and Vlajic, 2007). In EE-SPEED, routing will do according weight function which contains three cases: lag, energy and speed (Kordafshari *et al.*, 2009). MCBT introduces the distributed algorithm that node with more energy or more grade will be choose as a top cluster there (Shin *et al.*, 2009). First of all we have to understand some basic conceptions.

Routing: The structure of network does the important role in performance of routing protocol. The protocols of this category are divided to flat routing, hierarchical, based on the structure.

- **Flat Routing:** In flat networks, role of all the nodes such as data gathering or relation with small hole are the same. It means all of the gathered data in far province can be frequency or similar as a form it seems similar wireless nodes work together. Cause of number of many nodes, It's possible to give the global identity to the nodes; therefore, it uses pivot data routing. Number of these protocols includes: wireless protocol for information by conversation, directed distribution, gossip routing, routing algorithm with the lowest payment
- **Hierarchical Routing:** In hierarchical architecture, we use the nodes with more energy for process and information dispatch and the node with low energy for sense the environment. Hierarchical routing is a useful way for lower energy consumption in cluster by performing the gather and combination of data for decrease the number of transfers to the base station. Two samples of these protocols contain LEACH and PEGASIS protocol.
- **Routing Based on Place:** In this way, wireless by their place will be addressed. The distance between the neighbor nodes according the power of received signal will be approximated. For store the energy in some of these ways, when there is not any activation, the nodes will go in asleep. The sample protocols of this category includes: GAF protocol, GEAR protocol and SPAN protocol.

In previous researches, sequence mechanisms have been presented for providing quality services. As same time, the items like energy store (choose the most economy way for sending the packages by the lowest priority) and provide the warning stainable completely. In this article, we have tried to present the algorithm which is able to answer to the whole of these requirements, the suggested algorithm van provide for different request according to application. In the rest of article, in part.2, we explain suggested protocols and in part 3 analyze suggested ways. Part 4 contains article results and further researching background.

MATERIALS AND METHODS

Methodology

Packet Structure

All the nodes into the network with sense and new data dispatch have to do advertisement for its neighbor nodes. This is data Meta message and its size is less than data message. The heart of an awareness message is based on figure 1.

PT	DT	PD	PS	TS

Figure 1: ADV Message structure

In this packet, PT is type of dispatch packet. Three types of packet have defined in this way: MDC_ADV for message of advertisement, MDC_REQ for message of request and MDC_DATA for message of data. Case of DT is for specify of dispatch data type. Each node analyzes its buffer data type accordingly. Two next items are to specify source and destination of message. Application message: the time analyzing top cluster and main top cluster and didn't have advertised message will create one REQ message and will be sent to node advertiser. This message is like figure 2. This message is also Meta data.

PT	DT	PD	PS	TS	LT

Figure 2: REQ Message structure

One data message contains different size from control messages; one data message includes the following elements.

PT	DT	PD	PS	TS	LT

Figure 3: DATA Message structure

In this algorithm, we use the pattern of energy consume (Heinzelman *et al.*, 2010) which uses channel of free spaces and multi paths. Consumption energy for sending a package of 1 bit, it solves with distance (d).

If $d \leq d_0$ then

$$E_{Tx}(l,d) = lE_{elec} + l\varepsilon_{fs}d^2$$

Else

$$E_{Tx}(l,d) = lE_{elec} + l\varepsilon_{mp}d^4$$

d0 in this formula is the threshold distance and answer of it computes. Eelec, that's sufficient energy for activation of electrical circuits. Efs and Emp by the sort are amount of energy for improving dispatch signals for sending one bit in model of free space and multi paths by $d_0 = \sqrt{\frac{\varepsilon_{fs}}{\varepsilon_{mp}}}$.

1: Divide network to equal grids

2: select node by *MCH*

3: cluster grid

4: event and send *ADV*

5: IF *node* > *normal* energy then

6: Drop Packet

7: Else

8: send *REQ*

9: *IF REQ* <>*ADV* then

10: go line 6

11: send *DATA*

12: IF *node*= *CH* then

13: save data

14: Else IF *node* = *MCH* then

15: go to line 13

16: Else IF *node*= *BS* then

17: go to line 13

18: Else

19: go to line 6

Figure 4: the proposed algorithm

Consumption energy for receive one package of 1 bit is computed by $E_{Rx}(l) = lE_{elec}$. Wireless networks for choice of sender node in next step by $CV_{NHF} = \alpha(A) + \beta(B) + A2(C)$.In this formula A, B, and C are mechanizations of router which is used for dispatch of normal, unusual and hard data. A0, A1, and $A2$ are multiples. All nodes are amount of multiples according to their data type which they send in next step to sender node, they use from table no.1 to solve. For example when data type is normal (A0=1, A1=0, and $A2$ =0) , (A0=0 A1=1, and $A2$ =0) for unusual and (A0=0 A1=0, and $A2$ =1) for hard packet.

Distance Average

When it receives the node of a package which has been published, at first it controls the intensity of received signal. These signals are related to its power and by power. We can estimate distance by $P_r = (P_t \times G_t \times G_r \times A2^2) / ((4\pi d)^2 \times L) * P_r$

Pr , Pt by the sort are the signals which have been received and sent and also Gr , Gt by the sort are the interest of sender and receiver signal , $A2$ is length of wave and L is multiple of net loss.

Normal Packet

In this formula cvnt is trust level of next sender node. Enhis cost of remained energy of sender node, Dnhdn is distance between sender node and destination node. The node which has the most CVnh will be chosen as a sender of these operations and is repeated for sender nodes till received data to the main station by $CV_{NH} = E_{NH} / (D_{NH\_DN})^2$

High Risk Packet

Our algorithm is suggested for sending unusual package to choose the fastest path. For choosing the paths, we don't care about cost of their consumption energy so the packages must send from the paths which number of its steps is lower by $P_{Pack\ et} = 1 - \Pi(1 - P_i)$.

In this formula, Ppacket is probability to send a package to each node in the next step and Pi is approximating rate of dispatch package in node i. When the candidate node hear the package from far away, the first one checks the probability for sending a package and if amount of it will be bigger than default amount, for example 90% , candidate node doesn't send the package. If else it sends the package that causes it to receive the probability of package dispatch. If candidate node sends the package, it will update the probability of dispatch for each of the packages by$P_{Packet} = 1 - (1 - P_{over\ hear}) * (1 - P_{calculated})$

Poverhere has been published for probability of dispatch, Ppacket is probability, Pcalculate is the probability of package dispatch which has been heard and the dispatch is based on the rate which node dispatch which was computed.

Data Analysis

Simulate the desired algorithm with GCC and we compared the grasped scores with LEACH and HEED that it has gathered down curve.

Table 1: Initial Parameters setting

Amounts	Parameters
200 meters * 200 meters	Simulation province
(100,100) meter	Place of base station
100	Number of nodes
3 JUL	Primary energy of nodes
50 NJ/BIT	E ELEC
10 PJ/BIT/M2	E fs
0.0013 PJ/BIT/M2	E MP
87 meters	d 0
5 NJ/BIT/SIGNAL	E da
8192 bits	Size of each data package
40 bits	Size of each BEACON package

Tin table 1, the amounts of each of used parameters show the simulation. Figure 5, the curve which relates to remained energy of whole of network in each of the period will show in LEACH, HEED and our method (OM). The related curve to our method is more interest than related curve to LEACH and HEED. Figure 6 also compares the number of dead nodes in each period in LEACH, HEED and our method to each other. Figure 5 shows length of network life for different modes. The length of network life will decrease by decreasing the number of the normal packages and increasing two types of other packages.

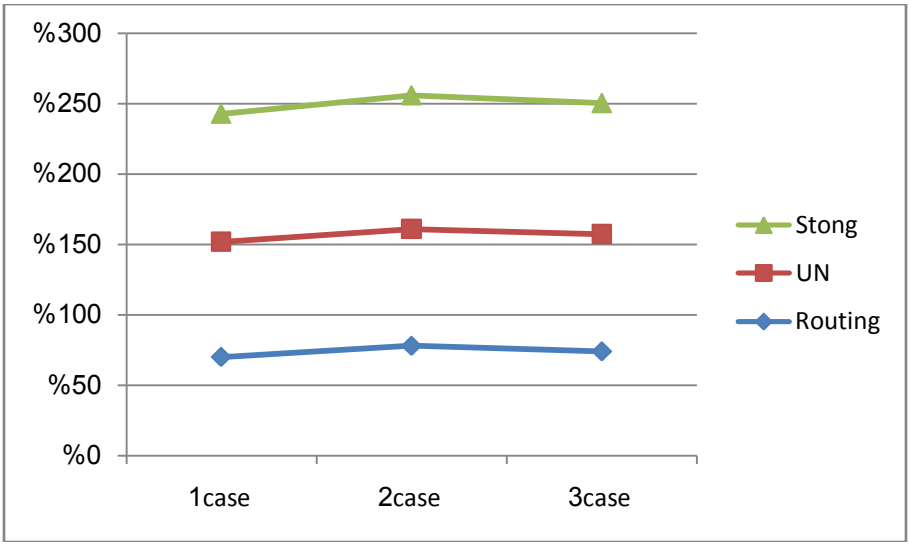

Figure 5: Death time of nodes for different modes
Case 1: U= 300, Un: 40, H: 20
Case 2: U= 250, Un: 70, H: 40
***Case 3:* U= 180, Un: 110, H: 70**

To analyze lag, end to end of radio bound width has assumed megabit per second and we simulate the desired algorithm for different modes. In this section, we assume simulation which number of hard packages is fixed and equal 10. In figure 6 RP is equal normal packages and UP is equal unusual packages.

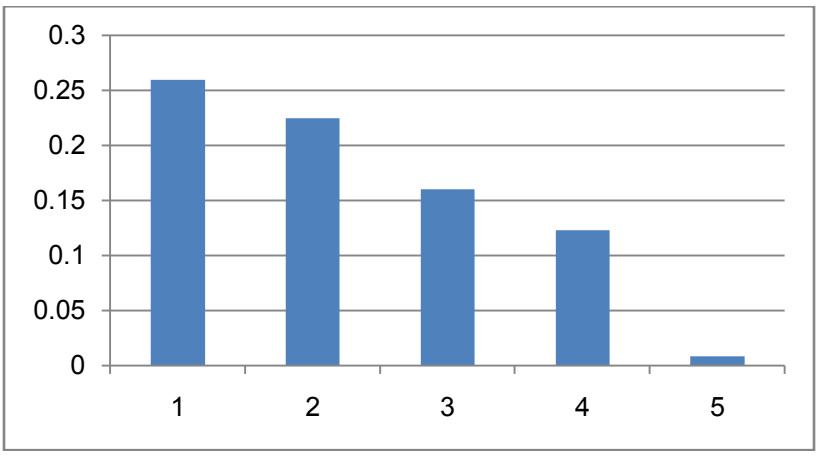

Figure 6: Average lag of end to end for different number of packages
***Case 1: RP= 100, UP: 0**
***Case 2: RP= 80, UP: 20**
***Case 3: RP= 50, UP: 50**
***Case 4: RP= 20, UP: 80**
***Case 5: RP= 0, UP: 100**

As the lag of end to end increases by the number unusual packages, normal packages will decrease.

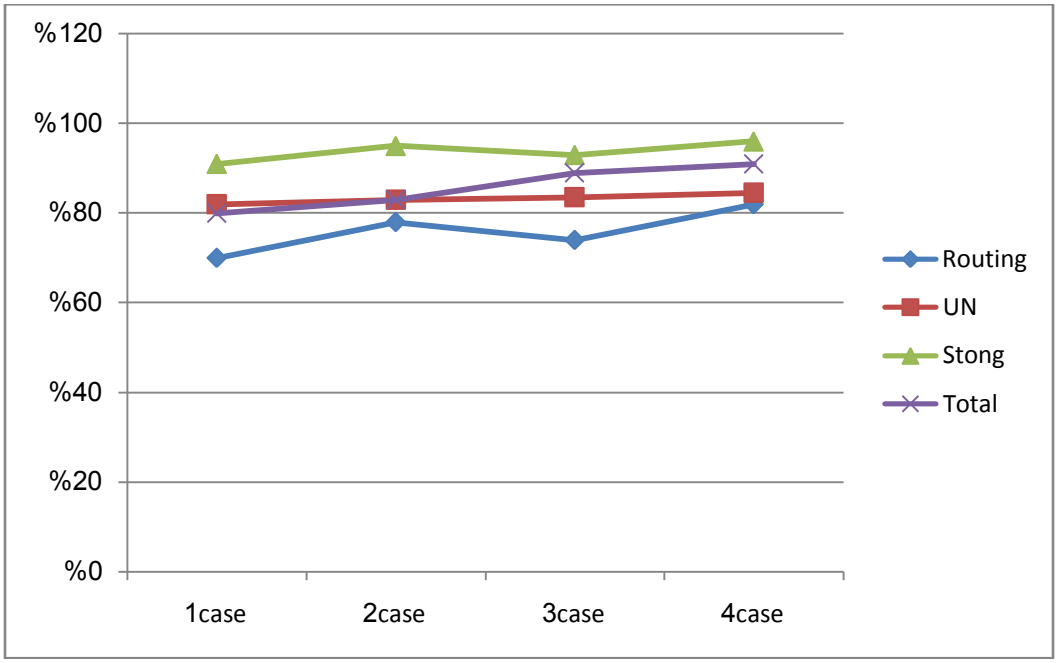

Figure 7: Dispatch rate of package for different modes
***Case 1: U= 150, Un: 50, H: 30**
***Case 2: U= 110, Un: 50, H: 70**
***Case 3: U= 80, Un: 50, H: 110**
***Case 4: U= 50, Un: 50, H: 130**

Figure 8: Shows the rate of package dispatch for different data. In 4 forms, as we see, the dispatch rate of all packages will increase by increasing number of hard data

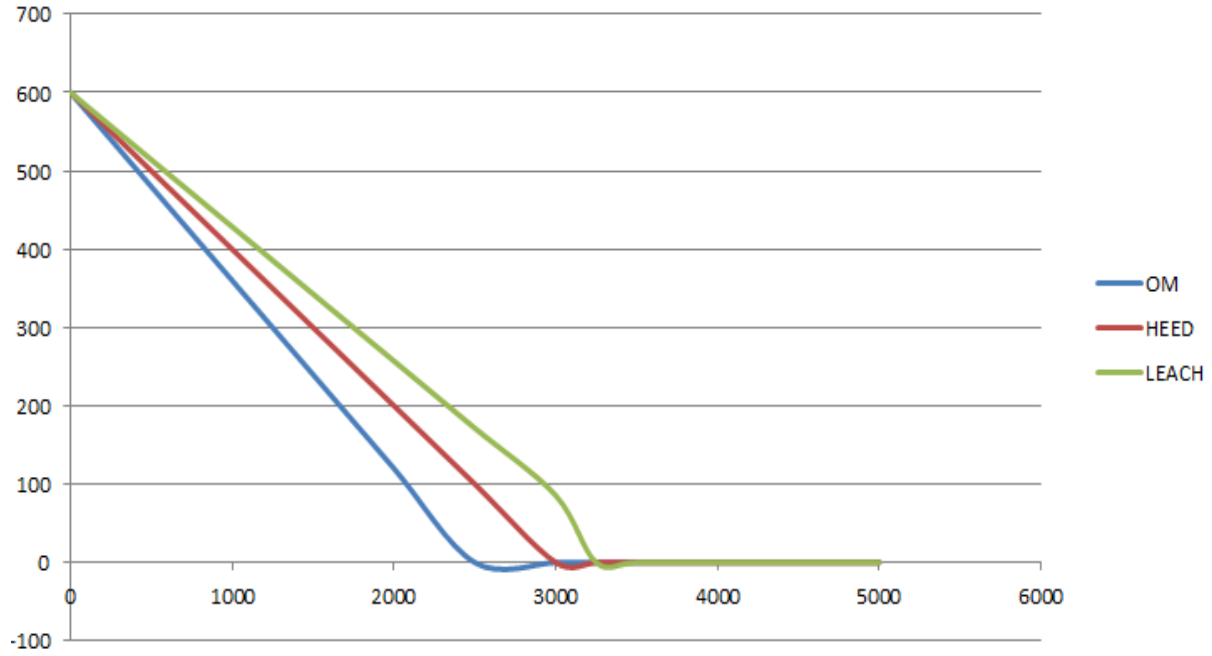

Figure 8: The remained energy of network

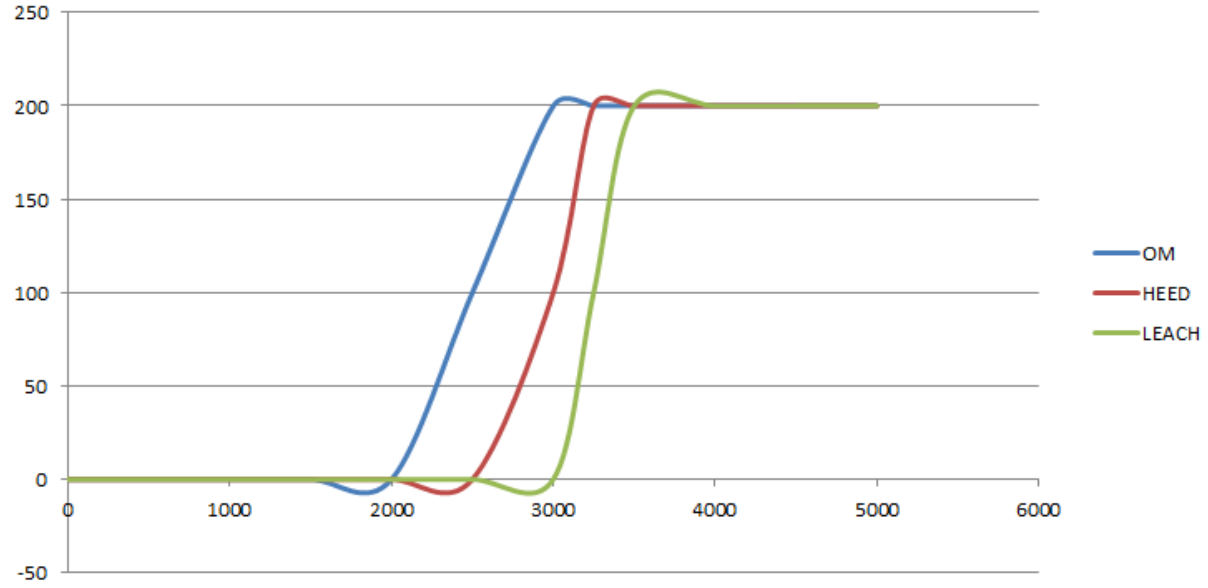

Figure 9: The number of dead nodes

As it seems, the performance of suggestion algorithm in comparing with LEACH and HEED is more interest so our method by the sort in comparing with LEACH and HEED upgrade the death time of the first node 48%, 8%, respectively and will upgrade the death time of half of the nodes about 29%, 11%, respectively. It improves the death time of the last node about 44%, 20%. Also it shows the scores of simulation. The performance of suggestion algorithm is too interest in networks which have the lower density. The rate of advertisement message dispatch in network is a random number. For received packets by BS in both of the ways, we computed amount of lag. Medium of dispatch packets lag per each 50 seconds has been shown in table 2.

Table 2: SPIN, MDC in Lag counting

	MDC	SPIN
The most delay	0.001813	3.3010971
The most delay	0,001213	0,001245
100	0.00111706	0.0725867
200	0.001056143	0,067211
300	0.0013312814	0,082696
400	0,001214837	0.07991
500	0.0010905	0.06373
600	0.0010678	0.013343

In this studying, medium number of step, which the packet has been received by BS, has been computed for both ways. Grasped scores in table.4 have been shown. The most step numbers in MDC way equal with 3.

Table 3: SPIN, MDC in Step counting

	MDC	SPIN
Medium	5.2	0.33
The least	0	0
The most	5	98

This cause the packet in three levels of BS will be delivered. At the first level, the packet will be send to top cluster then top cluster will send it to main top cluster and finally at the last level main top cluster will send the packet for BS but cause the nodes in SPIN don't contain structure of hierarchical .it's possible for a packet to pass more number of step to arrive to BS.

Conclusion

In this article, one new routing algorithm works separately to provide services quality and presents according to request. This algorithm is able to provide services quality for each option according to requirement. The simulations scores shows that the defined algorithm in comparing to other algorithms are too interest and more useful. This algorithm uses three routing mechanisms separately and according to the conditions possible to happen in network. In wireless networks exist different data. For different data dispatch, we must use combination of these three routing techniques. In next article, we will try to present the suitable algorithm with our requirement in wireless networks. Energy and length of network life in wireless networks is so important. These networks contain small nodes which are called wireless and their energy comes by battery. In this article, the new way is presented for routing in these networks.

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