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Developing BREERA Using Transmission Counter

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Abstract- *Wireless sensor networks (WSNs) played an important role in recent years in the process of developing smart environments. WSNs can plays an important role and helps with tiny micro-sensors, cheap cost, low power consumption, deployment of sensor nodes in large scale and wireless feature that make them capable in the field of detection, monitoring and control. WSNs are limited resources such as memory, bandwidth, and power. Many researchers designed different routing algorithms to save energy for the whole network and make each sensor node work as long time as possible .*

This paper aims to modify the Based Random Energy-Efficient Routing Algorithm (BREERA) to make it more efficient in the using of the network energy by using a counter transmission with each cluster head sensor node. The proposed system was simulated depending on the suggested method. It was gave better results under the terms (average received messages, average lost messages, average dead nodes, average total energy and average PDF). The used simulator in simulating the original and modified BREERA was Net Logo.

***Keywords*— WSNs, LBF, throughput, BREERA, PDF .**

I. INTRODUCTION

Wireless Sensor Networks (WSNs) are collection of sensors distributed in certain area and connected in wirelessly manner. The typical definition of sensor networks are "a computer network of many spatially distributed devices using sensors to monitor conditions at different locations such as: temperature, sound, vibration, pressure, motion or pollutants "[1].

Net Logo is a multi agent programming language which have many features such as : easily add and delete a number of nodes of the system, the ability to control the speed of implementation, speeds of implementation, ease of understanding and application of simulation program by any user, ability to make control on specific agent (sensor node) and other features [2].

II. SENSOR NODE

Sensor is a device that have capable to gather sensory information and connected it .The basic components of sensor node are: controller, transceiver, external memory, power source and sensor [3].

III. CLUSTERING

Clustering is a collection of some objects in groups called cluster. Clustering is to make any system very easy to identify and approach. Clusters consist of two components: cluster head and members [4]. The Load Balancing Factor (LBF**)** is measures how well balanced in the cluster head nodes of the network [5].

IV. Throughput

Throughput defined as the total number of massages which received by the destination per time unit delivered from one sensor node [6] .

V. RELATED WORKS

M.Chatterjee at 2001 designed clustering algorithm make node with minimum weight selected to become cluster head [7]. This algorithm called Weighted clustering Algorithm(WCA) depending on four weights of each node like the difference degree ,distance summation to all its neighbours, mobility and the accumulative time .The coefficient used in weights calculation are w1=0.7, w2= 0.2, w3= 0.05, w4 = 0.05 ,The sum of these co-efficient is equal to 1.

Sucec.J at 2002 designed clustering algorithm make the node with maximum degree become cluster-head and other neighbours nodes become members[8]. This algorithm called Highest- degree Algorithm (HD).

Toh.c.k at 2002 designed clustering algorithm make the node with lowest ID to become a cluster head and broadcast to neighbours nodes to become its members [9]. This algorithm called Lowest Identifier Algorithm (LID).

Tzung-Pei Hong at 2010 noted the wireless sensor networks have more restrictions than traditional ad hoc networks .WSNs consume power more than MANETs, so he suggested to add fifth weight to the WCA to make it more suitable to implement with WSNs. This algorithm called Improved Weighted Clustering Algorithm (IWCA). [10]

Mohamed at 2011 proposed clustering by making the active node as a cluster head and it's broadcast for all neighbours to become members to its cluster. Each node send their messages to their cluster head and it will send their messages to the next cluster head. The cluster head make the farest node member from it as a next cluster head. All clusters heads connected with each other. Each node in the network just need to know who is its cluster head without knowing any information about their neighbours nodes like the

previous algorithms that mentioned above previously .The next cluster head send their messages to other head cluster with maximum energy toward the sink (base destination). Nodes exist near the sink send their messages directly to the sink without made them clusters heads. The concept that represent transition message from one node to other neighbour node called hop. Hops number means the Number of Cluster-heads between the sink and the node from where new message is generated. Each massage in this routing algorithm have upper limit number of hops called threshold, if any message have number of hops larger than threshold value is died [2].

VI. PROPOSED WORK

The major drawbacks of the protocol BREERA is in losing the more effective nodes from the network rapidly. We suggested a process of using a counter with the cluster-heads to avoid focuses on some nodes to play the role of the cluster-head for a long time. Using counter with the cluster-heads saving the energy for more effective nodes, make them work for long possible time and then saving the energy for all the network

A. Using Contour with Cluster-Heads

This method will make the cluster-head node doing a limited number of communication process and then ends its role as a cluster-head. This method provides the chance for other effective node to play role cluster-head node and avoiding consume more energy from specific effective nodes**.** The following steps illustrates the suggested algorithm of using a counter transmission for each cluster head**.**

Action 1

Input : hops' number, broadcast range of nodes, value of the variable sc which determines the number of communication process.

Output: Work of a limited number of communication processes.

Process :

1. Start .
2. Set transmitter counter ⟶ 0.
3. Ask clusters heads nodes if one of their members is a sink and transmitter counter != sc then
4. Ask messages if the hop < = threshold then
5. Move to the sink node.
6. Increment transmitter counter.
7. Die
8. Else if
9. Die .
10. Else if
11. Move to the next cluster head.
12. Increment the transmitter counter.
13. End.

Action 2:

Process:

1. Start.
2. Ask next clusters heads nodes if one of their members is a sink and transmission counter != sc then
3. Ask messages if the hop< = threshold then
4. Move to the sink node.
5. Increment transmitter counter
6. Die
7. Else if
8. Die.
9. Else if
10. Move to the neighbouring cluster head which have maximum energy from other neighbours.
11. Increment transmitter counter.
12. End.

Fig. 1 shows sample of the simulation program of the BREERA protocol with a counter transmission method by using the Net Logo simulator.

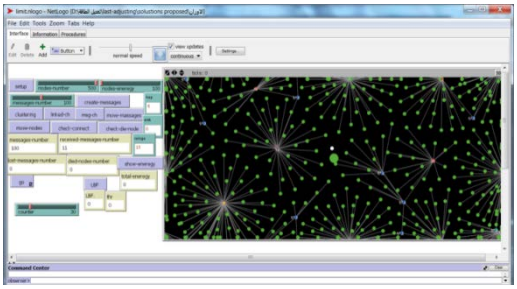

Fig. 1 Net Logo displays clustering of 500 sensors.

The simulation program of BREERA with this suggested method was performed and implemented. Table (1); shows the proposed WSN environment.

Table (1): Proposed WSN Environment

Parameters	Values
The simulator	Net Logo 4.3.1 version (2011)
Protocol	BREERA
Pause time type	Uniform , 1 s
Nodes speeds type	Uniform 5 m/s
Broadcast range	15 m
Hops' number	6
Transmission-counter	Changing (10,20,30,…,100)

Table (2) is summarized the first part of the selected simulated performance metrics extracted from the resulted large data table from the process of implementing the suggested simulation scenario using Net logo Software. The resulted rich table contains about 300 rows with rich detailed Data. Each row in the table (2) represents the average of (the

30 repeated simulation processes) of the original resulted data table.

Table (2): First Part Simulation Results

Counter	Received Messages Averages	Lost Messages Averages	Died Nodes Averages	Total Energy Averages
10	95.7	4.2	0.4	48280.3
20	87.5	12.4	1.1	47892.1
30	87.4	12.5	1	47870.6
40	91	8.9	1	48061.5
50	90.5	9.4	0.7	48369.1
60	84.5	15.5	0.6	48194.8
70	93.3	6.6	0.9	47852.5
80	91.2	8.7	0.8	48157.5
90	91.4	8.5	0.6	48411.1
100	89.1	10.8	0.7	48098.9

Table (3) is summarizing the second part of the selected simulated performance metrics extracted from the resulted large data table from the process of implementing the suggested simulation scenario using Net logo Software.

Table (3) : Second Part Simulation Results

Counter	**PDF Averages**	**LBF Averages**	**Throughput Averages**
10	0.95	0.0032	**17.5**
20	0.88	0.0034	**16.7**
30	0.87	0.0039	**16.8**
40	0.91	0.0033	**19.8**
50	0.90	0.0038	**13.3**
60	0.84	0.0034	**17.6**
70	0.93	0.0034	**18.5**
80	0.91	0.0028	**17.3**
90	0.91	0.0042	**10.2**
100	**0.89**	**0.0034**	**21.9**

The simulation results in the tables (2) and (3) were graphed to explain the comparison in the performance of BREERA protocol before and after using transmitter counter method from the point of view of the ; average received messages, average lost messages, average PDF, average died nodes, average throughput, average LBF and the average total energy. Fig. 2 shows the relasionship between average received messages and different values of the counter transmission.

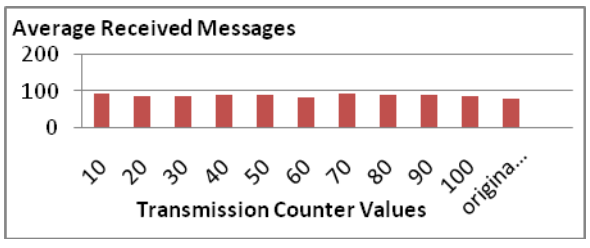

Fig. 2: Average received messages.

Fig. 2 shows when the counter transmission equals 10 gives higher average received messages. Fig. 3 shows the relationship between the average lost messages and different values of the counter transmission.

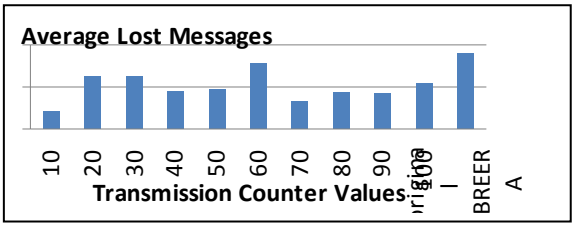

Fig. 3 Average lost messages.

Fig. 3 shows when a counter transmission equals 10 gives lower average lost messages. Fig. 4 shows the relationship between average PDF and the transmission counter values.

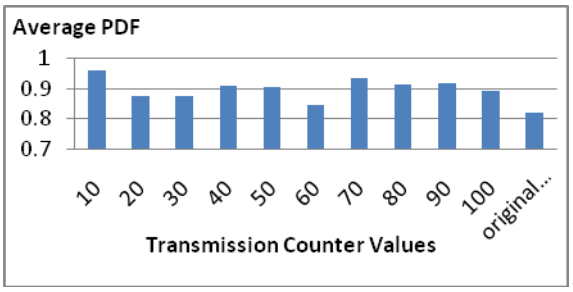

Fig. 4 Average PDF

Fig. 4 shows when a counter transmission equals 10 gives higher average PDF. Fig. 5 shows the relationship between the Average dead nodes and different values of the counter transmission as below.

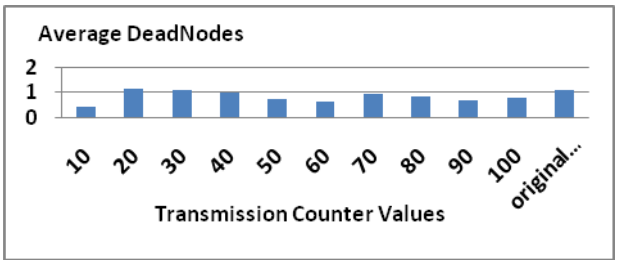

Fig. 5 Average dead nodes

Fig. 5 shows when a counter transmission equals 10 gives lower average of dead nodes. Fig. 6 shows the relationship between average throughput and different values of the counter transmission as below.

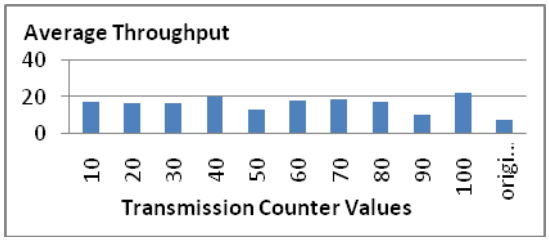

Fig. 6 Average throughput.

Fig 6 shows when a counter transmission equals 100 gives higher average throughput.

Fig. 7 shows the relationship between average LBF and different values of the counter transmission as follow.

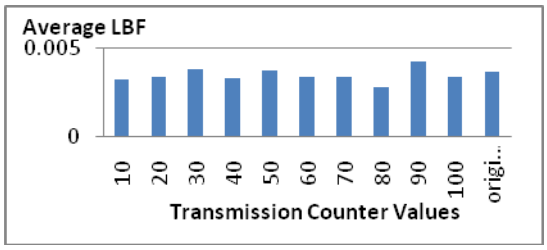

Fig. 7 Averages LBF

Fig. 7 shows when a counter transmission equals 90 gives higher average LBF.

Fig. 8 shows the relationship between average total energy of whole the network and different values of the counter transmission.

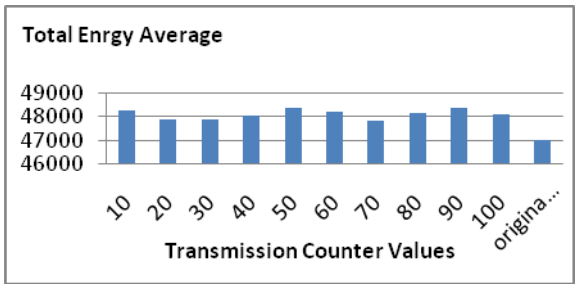

Fig. 8 Average Total energy

Fig. 8 shows when a counter transmission equals 90 gives higher average total energy. The performance of BREERA with using a counter transmission method is better than performance of original BREERA under terms (average received messages, average lost messages, average PDF, average dead nodes, average throughput, average LBF and average total energy of whole the network).

VIII. Conclusion

Based Random Energy-Efficient Routing Algorithm (BREERA) performance with using transmission counter method is improved under terms (received messages, lost messages, PDF, dead nodes, throughput, and total energy of whole the network). Any value of transmitter counter could gives the best results than original BREERA except LBF parameter. It is not possible to control the value of average LBF and make it than average LBF of original BREERA because it depends on the number of cluster-heads that best fits the size the network, and this number of cluster-heads according to the protocol BREERA is randomly. There exists ideal value of transmitter counter gives higher value for specific parameter.

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