IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 1, January 2018

A Hybrid Method Based on Clustering to Improve the Reliability of the Wireless Sensor Networks

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Abstract: The wireless sensor networks, because of its low cost and easy communications are used in many supervisory activities of various environments. As such networks have a short lifetime, in order to more usage and increasing the lifetime, researchers are looking for methods by which they can reduce the energy consumption. Clustering methods and optimization algorithms such as genetic and bee colony algorithm are techniques that can increase the network lifetime. In this paper, the genetic algorithm is used to improve the clustering process of nodes in wireless sensor networks and to find an optimum route as well as improving the route of transition through nodes; the bee colony algorithm is applied. To propose the suggested algorithm, the wireless sensor network is divided into cells with variable size. Cells area is investigated in normal mode and compression and energy consumption is being evaluated in various sizes of the cell. After simulation, it is observed that the results of suggested method have a significant improvement in terms of energy consumption compared to other methods.

Keywords*:* Increase of network lifetime, Clustering, Wireless sensor networks, Bees colony algorithm, Genetic algorithm.

I. INTRODUCTION

The wireless sensor networks have attracted much attention because of numerous applicants in various fields. In the wireless sensor networks, the sensor nodes are distributed randomly in supervision and control region. In these networks, the sensors use a limited feeding source that after its finishing, network lifetime ends as these sources are nonrenewable. In order to use more and increase the lifetime of such network, researchers are always looking for the methods by which they can decrease the energy consumption. Of course, data transition and communications consume the most energy consumption of these networks. To increase the network lifetime, we should manage the energy consumed at nodes by some schemes. Clustering is an appropriate method to reach this goal as well as topology control management in the wireless sensor networks. Moreover, this method supplies the possibility of data aggregation and decrease the overhead associated with communications in this network. The manner of cluster construction, cluster head selection methods and the way to transfer data and communications are of issues which involved in energy consumption. Despite the various clustering methods in the wireless sensor networks, yet lots of challenges exist for optimal selection of the numbers of clusters and energy consumption used for selecting cluster head and intra-cluster and extra cluster connection in the wireless sensor networks [1]. Energy consumption decrease in the wireless sensor networks is a complex problem and usually, for this purpose, metaheuristic algorithms are used such as ant, genetic, bee colony, and etc. In this research, the bee colony algorithm and the genetic algorithm is used to decrease the energy consumption. While Karaboga et al used the bee colony algorithm in clustering of wireless sensor network. In their algorithm, the information of network nodes is gathered and the best nodes for clustering are utilized. In the suggestive method, the numbers of nodes of network very increase and available methods are not accountable and we cannot gather information of the entire network and select the bests among the nodes. Therefore, regarding mentioned flaws, a method is proposed for networks with a larger scale to decrease the energy consumption [2]. The rest of this paper is divided like in this way: In section 2, previous works are examined, in section 3; the suggested model with the description of considered architecture is represented. In sections 4 and 5, the results, and finally in section 6, the conclusion and future suggestions are mentioned.

II. RELATED WORKS

In 2011, Norouzi et al used a new method for clustering in the wireless sensor networks. The main idea of this method is using the genetic algorithm for clustering the sensor nodes. In this method the nodes send their information like energy and position to the sink and then the sink determines cluster heads by the implementation of genetic algorithms defined in this paper, and finally the sink notifies the nodes that determined as a cluster head. They start to cluster. In this method, energy consumption has improved but its main issue is that the energy consumption is not equal in all over the network [3].

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In 2012, Kumar et al in his paper used the bee colony algorithm and the ant colony to improve routing and decrease the energy consumption in the wireless sensor networks. In the existing method by Kumar et al, the network is divided into various regions, and then the clustering process is performed by ABC algorithm and in the last step, data transition is done by ACO algorithm [4]. In 2013, Pal et al in his paper used an algorithm to select the cluster head that increases the network lifetime and as a result, leads to increase the rate of data collecting in the network. This algorithm can be used with other clustering distributed algorithms and increases their total efficiency by optimum selection of cluster head [5]. In 2014, Zhao et al suggested an algorithm named GSTEB that the central station in each round appoints a node as the base node. Base node's ID and coordinates are sent to all sensor nodes. After that, the network routes are specified through sending tree information to each node by the central station or nodes themselves [6]. In 2015, Yanjun et al suggested a method named EDAL (Energy-Efficient, Delay-Aware, and Lifetime-Balancing Data Collection) that in addition to a decrease in energy consumption in the wireless sensor network, they considered the balancing of nodes lifetime and data collection [7]. In 2016, Abdul Razaque et al recommended an algorithm named H-LEACH. The main purpose of this algorithm is improving the energy consumption of cluster head nodes. After carrying out the relevant tests, they proved that H-LEACH protocol is more efficient than LEACH and HEED protocol [8]. In 2016, Tina et al proposed a new algorithm to cluster the wireless sensor network and decrease energy consumption by using SMO (Spider Monkey Optimization) algorithm [9]. In 2017, Wenbo Zhang et al advised a method named E2HRC (Energy-Efficient Heterogeneous Ring Clustering). This method is run on Heterogeneous nodes and proceeds to decrease energy consumption of nodes. After the simulation, it was observed that this method has more efficient capability than others on Ring architecture [10].

III. THE PROPOSED METHOD'S FLOWCHART

Before describing the suggested approach, an overview of the architecture and the implementation of the proposed method to decrease energy consumption in the wireless sensor networks by the combination of the bee and genetic algorithm should be recommended. In this part, the implementation of the proposed method is shown.

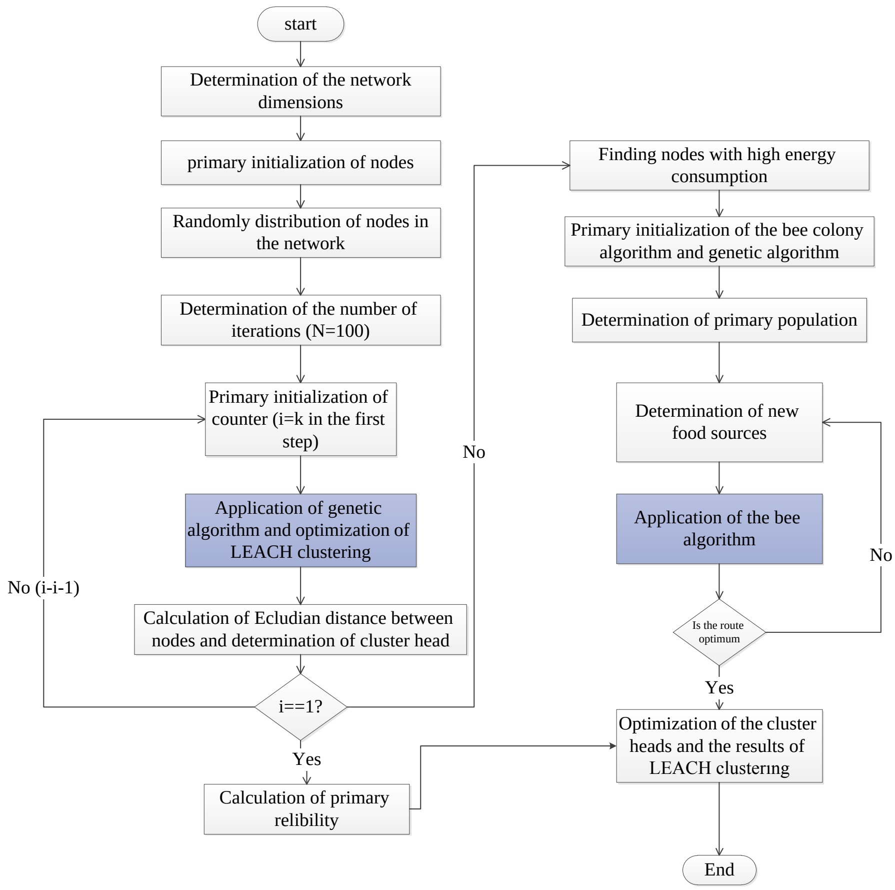

Fig.1. The proposed method's flowchart

As it is observed from the figure (1), at first network dimension and required initializations for each node is done. Then the number of iterations of LEACH clustering algorithm is determined and this algorithm runs in order to cluster initial nodes and to calculate the distance between them and finally evaluates the reliability of the network. Later to optimize the reliability of the network and to advance the results of LEACH clustering algorithm, the genetic algorithm is used. After optimum clustering of nodes and determination of cluster heads, the bee colony optimization algorithm in each step explores an optimum routing to transfer the node signals according to predetermined number of iterations by calculating of fitness. Finally, implementing of these steps leads to increase the lifetime of the network while decreasing energy consumption.

IV. LEACH CLUSTERING ALGORITHM

In this paper, at first, LEACH clustering algorithm is applied on the nodes and then improved that is described in the next section. Each sensor node can reach more than one goal. In each round, collecting data operation is done by cluster head from cluster nodes that among all these rounds, all sensor nodes available including determined goal points and other sensor nodes sense the goal and along two rounds in a region in terms of distance, Radio data transmission turns off to decrease energy consumption [11]. The main station announces the goal and the goals calculate and then maintain remained energy in each round by equation (1).

$$V_i(t) = \left[Initial\ - E_i(t)\right]/r \qquad (1)$$

In equation (1), Initial signifies primary energy, $\boldsymbol{E_i(t)}$ remains energy, and **r** is the current cycle. An area as direction sensing should be supposed. Sensing period that is the period of a sensor can identify particular regions of a region. When a region of the network is covered by **s** sensor, then that particular region's coverage degree will be 1, since coverage operation is done just in sensing region of one sensor. Two sensors **s1** and **s2** are available. Both of these sensors together subscribe when the sum of radius area is less and equal to the distance from each center of the region that its equation will be as equation (2-3).

$$r_1 + r_2 = \sqrt{((x_2 - x_1)^2 + y_2 - y_1)^2)} \qquad (2)$$

As it can be seen in equation (2), Euclidean distance is used. Based on the conditions for intersection operations between two sensors **s1** and **s2**, equation (3) will exist.

$$r_1 + r_2 \leq \sqrt{((x_2 - x_1)^2 + y_2 - y_1)^2)} \qquad (3)$$

There are also several special states that should be examined. When sensing period of two sensors is separated from each other, equation (4) will exist.

$$distance(s1, s2) > r_1 + r_2 \qquad (4)$$

When one sensor places in sensing period of another sensor, equation (5) will exist.

$$distance(s1, s2) < (r_1 + r_2)\ ,\ \ and\ r_1 > r_2 \qquad (5)$$

Once two sensors just are sensed, it means they subscribe with each other without regional coverage, equation (6) will occur.

$$distance(s1, s2) = r_1 + r_2 \qquad (6)$$

It is so important to consider three qualifications of equations (4) to (6) when two sensing periods of sensors have become one common point, one region is created that will be as equation (7).

$$r_1 - r_2 < distance(s1, s2) < r_1 + r_2 \qquad (7)$$

If we consider intersection region as a shaded area, intersection region between two shaded areas will be achieved as equations (8) and (9).

$$x^2 + (y - 1)^2 = 1 \qquad (8)$$

$$(x - 1)^2 + y^2 = 1 \qquad (9)$$

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified

Vol. 7, Issue 1, January 2018

It can be seen that if a line is drawn from the two coordinate areas $\boldsymbol{x}$ and $\boldsymbol{y}$ as $\boldsymbol{y} = \boldsymbol{x}$, there will be a gap in intersection region of two equal pieces. The sliced part area of a shaded section is $\boldsymbol{\pi/4}$ that has a radius of one. So the whole intersection area will create from equation (10).

$$2 \times \pi - \frac{2}{4} = \pi - 2/2 \quad (10)$$

Now that the intersection area is found, we can determine the coverage degree according to reliability. When two sensors are overlapped with each other, then the coverage degree of two sensors $\boldsymbol{s1}$ and $\boldsymbol{s2}$ which is created by coverage definition is equal to one. Its equation is proven equation (11).

(11)

It is supposed that one sensor is covered in one region. Then the coverage degree is equal to one and after that, if two sensors cover one region, the coverage degree of that region will be equal to two that is calculated by proven equation (12).

$$|s1 \cup s2| = |s1| + |s2| - |s1 \cap s2| = 1 + 1 - 2 = 0 \rightarrow |s1 \cup s2| = 0 \quad (12)$$

Then $|s1 \cup s2| = 0$ is placed in equation (3) which is Euclidean distance, and its output will be of the form $|s1 \cap s2| = 2$. Therefore, it will be shown that the coverage degree of intersection region for sensor period of a sensor is equal to two according to the contradiction method in upper equations. Now that positioning is done and LEACH protocol is considered as GPS, the clustering operation is performed at the beginning of the routing based on LEACH while energy consumption decrease and reliability increase of the network take place. The purpose of using LEACH protocol in this paper is to recognize and distinguish the patterns of a cluster head in the network. At first, a known node is determined as the cluster head. The cluster head collects information of other nodes and sends to the central station. The cluster head acts as a sensor of a local central station. So the same node which cluster head exists in will be used to make the distribution of load transfer better among sensor nodes. There are several clusters that each one has a cluster head in the network and each node belongs to a cluster which is distributed in the whole network. The cluster head is used to increase the network lifetime and to decrease energy consumption. The cluster head is selected based on its energy dynamically.

V. PROPOSED METHOD

In this paper the method has 3 main steps including a) Application of LEACH clustering b Improvement of LEACH clustering using genetic algorithm c) Application of the bee optimization algorithm to improve reliability and routing in the network. Three above steps are examined in this section:

A. Application of LEACH clustering

The implementation steps of LEACH clustering algorithm to produce primary cluster heads and clustering of the nodes is shown in figure (2).

LEACH protocol includes two steps, cluster construction, and planning for the nodes which are active to send pocket in the network and each one generate a random number between 0 and 1. The nodes below the threshold are selected as a

$$T(N) = p/(1 - p * (rmod1/p)) \ , if \ n \rightarrow G \quad (13)$$

cluster head. Equation (13) states this proposition [11].

DOI 10.17148/IJARCCE.2018.716

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 1, January 2018

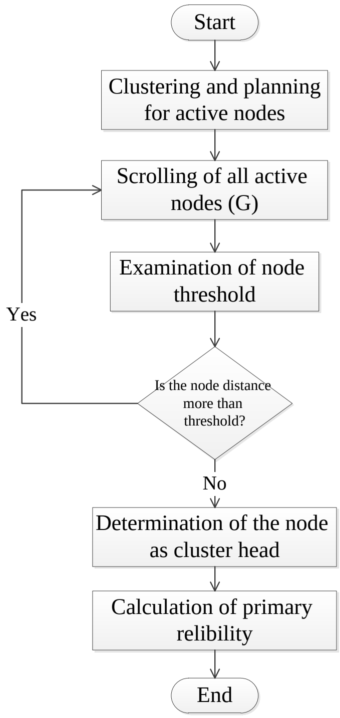

Fig. 2. The implementation of LEACH clustering algorithm to produce primary cluster heads and clustering of the nodes

In equation (13), where p is a value which examines if the node has required conditions to be cluster head or not, r is the numbers of cycles to select cluster head and G is a collection of the nodes which are not selected as the cluster head. At first, the network region which is considered as an area of 400×400 divided into two regions named region 1 and 2 that the nodes in region 1 have a higher probability to be selected as the cluster head. It is noteworthy that the base station is placed as a fixed region in the center of the network region. The base station calculates the distance from the sink node with the threshold value. This is done by equation (14).

$$TR = (2 - (C^2 = a^2 + b^2)) \quad (14)$$

In equation (14), the nodes will be ignored which their distance are more than the threshold value and a node will be selected as the sink node which is near the center and has less energy. Now that the clustering operation is done, improvement of energy conscious routing in LEACH protocol and also increase of the network reliability to send and receive data should be examined simultaneously. This operation will be accomplished by the bee combinatory optimization colony algorithm and genetic algorithm.

B. Improvement of LEACH clustering using genetic algorithm

In this paper, the genetic algorithm is used to improve the nodes clustering in the wireless sensor network. The genetic algorithm uses central station or BS to do clustering and therefore the genetic algorithm determines appropriate clusters for the network. The central station broadcasting sends full details of the network to all sensing nodes. The message sent by the central station includes following items:

- The cluster head numbers
- The members associated with each cluster head
- The numbers of transfers for this configuration

In this research, the bits of 0 and 1 are used for the chromosomes of the genetic algorithm. We show cluster heads as the bit 1 and the nodes of a cluster which are known as the members with the bit 0 in the chromosome. The genetic algorithm has operators that should be used in each application to achieve an optimal solution. The most important related operators are:

 DOI 10.17148/IJARCCE.2018.716

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A-Cross over

In this paper, one- point combination is used. If a normal node is altered to a cluster head after combination, all the other normal nodes which are close to this new cluster head should be checked and if this happened, they should be a member of this new cluster head. But if a cluster head becomes a normal node after crossing over, it should find a new cluster head. So, all the nodes in this way are a cluster head or a normal node.

B-Mutation

In mutation process, the mutation rate is according to the bit of 0 to 1 variation and vice versa. As a result, if the bit is 1 converts to 0 and if the bit is 0 converts to 1. Actually, a cluster head converts to a normal node and vice versa.

C-Fitness function

Fitness function which is applied in the genetic algorithm is one of the most important operators that produce the most optimum solutions by using other operators. The Fitness function is used to calculate the fitness of a chromosome including bit strings of existing nodes in the wireless sensor network. So, a formula is proposed as following that calculates the fitness of each chromosome in the population. One of the most significant proposed ideas in this section is a decrease of distances. Since the cluster heads use more energy to send data than other nodes, we can affect the decrease of energy consumption by decreasing the numbers of cluster heads. As it is explained in the last chapter, the process of message transmission in the wireless sensor network is that the existing nodes of each cluster send their message to the cluster heads and the cluster heads also send their message to the sink node. So, the below formula is used to transfer a message of a cluster to the sink node.

$$Energy = \sum_{i=1}^{n} ENCH_i + \big((n-1) * ER\big) + CH_{Sink} + EP \tag{15}$$

In equation (15), where **Energy** represents energy consumption to transfer a message from cluster to the sink nodes, **n** is the number of existing nodes in the cluster, and $\boldsymbol{ENCH_i}$ is the energy consumption for sending a message from existing nodes in the cluster to the cluster head node. **ER** parameter is the energy required to receive the message by CH node. **EP** also is the energy to process and collect data by CH node. $\boldsymbol{CH_{Sink}}$ Parameter is the required energy to send signal and messages of the cluster head node to the sink node. Two important factors involved in calculating the fitness function that are: 1- transmission distance 2- the energy consumption to send data of cluster to the sink. So, the main purpose of the genetic algorithm is minimizing of these factors to optimize of clustering in the wireless sensor network. In addition, we can include decreasing of the cluster head numbers in our function where this can affect energy efficiency like decrease of transmission distance because the cluster heads use more energy than other nodes. Therefore, the fitness of a chromosome that is made of normal nodes and cluster head nodes to bits of 0 and 1 is calculated by the below equation:

$$GA_{Fitness} = \frac{1}{Energy} + (TD - RCSD) + (N - TCH) \tag{16}$$

In equation (16), where **N** is the number of total nodes in the network, **TCH** determines the number of the cluster head's nodes, **TD** determines the sum of distances from all nodes to the sink, and finally **RCSD** specifies the sum of distance from the normal node to the cluster heads plus the sum of distances from all cluster heads to the sink. Lower energy consumption, shorter transmission distance or fewer cluster heads cause the greater of individual fitness. Our proposed genetic algorithm tries to find an appropriate solution by an increase of fitness value. So, all operators listed above will be used to improve the clustering and to calculate the optimum solution. The last section of the equation is related to the importance of the cluster heads numbers. As it is mentioned before, the cluster head's nodes use more energy than the other nodes. So, we need to minimize the number of cluster heads. For this, we minimize the number of cluster heads from the number of all nodes in every race that the increasing of the difference shows the minimizing of cluster head's numbers. We divide this section to constant **N** for normalization; it means that we write the third term of

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 1, January 2018

the equation as **(N-TCH)/N**, that as above, if we want to increase the effect of the third term or in other words the cluster heads' numbers in calculation of the equation, we can multiply that by a constant number.

According to the implemented simulation and comparison of effects created by different values of parameters in the equation, finally the equation in order to calculate is proposed as follows:

$$Fitness_{Main} = \frac{100}{Energy} + \frac{(TD + RCSD)}{TD} + \frac{(N - TCH)}{N} \quad (17)$$

So, it is emphasized on energy issue by using the above fitness function.

C. Application of the bee optimization algorithm

Before analyzing the equations of the bee colony algorithm, at first, the implementation steps of the bee algorithm are explained generally and each section will be discussed completely.
The bee optimization colony algorithm is an algorithm based on population that is inspired by the bee exploratory behavior. The bee optimization colony algorithm is included three groups of the worker, the supervisor, and the scout. The location of food sources is considered as possible solutions for optimization issues. Besides, the usefulness of a food source shows the fitness of that solution in solving the issue. The number of worker bees is equal to the number of supervisor bees and also is equal to the number of food sources. Every food source which is unable to improve more in a certain cycle will be replaced by a new food source by the scout bees.

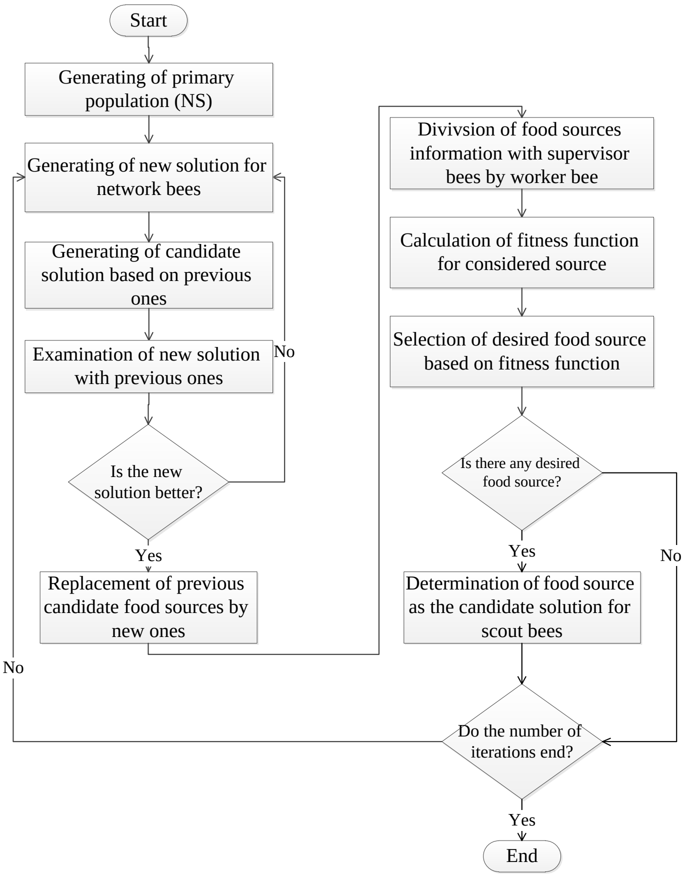

Fig. 1. Application of the bee optimization algorithm's flowchart

At first, the initial population $\boldsymbol{NS}$ is the solution which is produced randomly. As $\boldsymbol{NS} = \boldsymbol{NP}/\mathbf{2}$ is the number of food sources and is equal to the number of worker bees, $\boldsymbol{NS}$ is the size of the population that each $\boldsymbol{x_i}(\boldsymbol{i} = \mathbf{1}, \mathbf{2}, \dots, \boldsymbol{NS})$ solution is a two-dimensional vector. Then the bees perform a circulating research according to the special rules. Each worker bee considers a new candidate as the food source in order to update possible solutions. The selection is based on previous neighbors of food sources. The solution of $\boldsymbol{v_i}$ candidate can be produced by last solutions in equation (18):

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ISSN (Print) 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 1, January 2018

$$v_{ij} = x_{ij} + \emptyset_{ij}(x_{ij} - x_{kj}) \quad (18)$$

Where, $\boldsymbol{k} \in \{\mathbf{1}, \mathbf{2}, \dots, \boldsymbol{NS}\}$ and $\boldsymbol{j} \in \{\mathbf{1}, \mathbf{2}, \dots, \boldsymbol{n}\}$ are the indexes which are selected randomly and these numbers, in order to distinguish from each other, are produced in the interval $[-1,1]$ by random distribution. The candidate solutions are compared with the previous ones and if new food sources have a better than or the same quality as previous sources, the latter will be replaced by the former. Otherwise, the previous sources will remain unchanged. The worker bees return to the hive to share the food sources information with the supervisor bees. In the next phase, every supervisor bee selects a food source according to its fitness. The probability of $\boldsymbol{p_i}$ for each nutritional value can be calculated by equation (19).

$$p_i = \frac{fit_i}{\sum_{j=1}^{NS} fit_j} \quad (19)$$

In equation (19), where $\boldsymbol{fit_i}$ give us the fitness of a nutritional value of $\boldsymbol{i}$ or the issue solution that is related to the objective function. The probability of selecting a food source can be increased with the growth of the fitness simultaneously by every supervisor bee. After the food source selection, every supervisor bee can find a new candidate for a food source by their neighbors. With calculating of food source fitness, it will be selected by a greedy solution. If the condition of a food source didn't change by a limited cycle, that food source will be considered as a solution. Other bees or the scout bees have a great contribution in replacing food sources and each past food source will be replaced with new food source if needed by the scout bees. The limitation of the cycle is a predetermined number which is defined by the user. If $\boldsymbol{x_i}$ sources want to change by the scout bees, the equation (20) will be used.

$$x_{ij} = x_{jmin} + rand[0,1](x_{jmax} - x_{jmin}) \quad (20)$$

According to the equation (20), $\boldsymbol{x_{jmax}}$ and $\boldsymbol{x_{jmin}}$ are upper and lower bounds of $\boldsymbol{x_{ij}}$ variable which $\boldsymbol{x_{ij}}$ itself is a random number from interval [0,1] that is produced by monotonous distribution. This process will be repeated ring-like as long as the function reaches its threshold. Therefore, we can determine the best route and solution to send the nodes signals in the wireless sensor network by using the bee algorithm.

VI. EVALUATION OF RESULTS

In this paper, a series of assumptions is considered for the wireless sensor network and accomplished simulation that is observed in the following table.

TABLE I
The wireless sensor network parameters

The number of available nodes in the network	100
The network dimensions	400×400 m^2
Initial energy	0.5 J
MAC	IEEE 802.11
Radio Frequency	200 Db
Radio Interval	1m^2
Communicational Range	100m

The bee combinatory optimization colony algorithm and genetic algorithm parameters are mentioned in the table (2).

TABLE III
The bee combinatory optimization colony algorithm and genetic algorithm parameters

Primary population	60
The number of bees and chromosomes	8
Mutation rate	3
Combination rate	1
The number of combinatory algorithm repetition	100

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

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ISO 3297:2007 Certified
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At first, the nodes will be established in the network environment randomly. The difference of the network longitude and the actual position of the sensor node in the network ascertain the received power of nodes in inception which is determined by equation (21).

$$\textit{The}\ \text{network longitude} \times \text{The actual position of sensor node} < \mathbf{0.5} \qquad (21)$$

Meanwhile, the cluster heads will be selected. The cluster heads will be selected by LEACH protocol and it will be improved by combination of the bee optimization colony algorithm and genetic algorithm. Figure (4) displays the output of the node deployment section; of course in the first step with a repetition of 100 training rounds that the cluster heads are identified with black color.

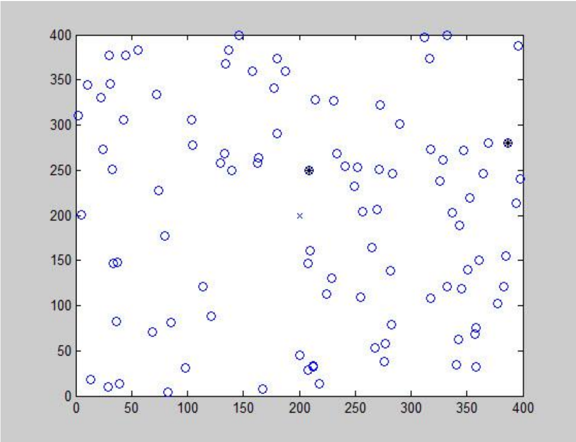

Fig. 4. The node deployment in the first round with two black cluster heads

The Euclidean distance in two-dimensional space is used to obtain the distance between clusters in a network environment and also the nearest node to the other in a cluster that is displayed in equation (22).

$$d_{ij} = \sqrt{\sum_{k=1}^{m} (x_{ik} - x_{jk})^2} \qquad (22)$$

Now, the bee combinatory optimization colony algorithm and genetic algorithm will help and are able to find an optimum policy that can maximize the expectation value for all states in clusters. After optimization clustering operations, initial reliability situation will be determined. At first, the initial situation before reliability optimizing will be displayed in figure (5).

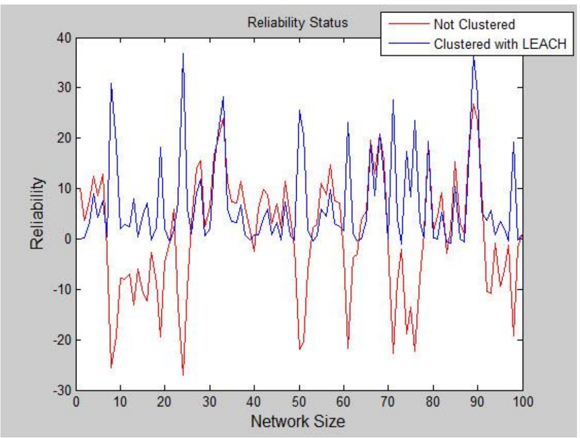

Fig. 5. The initial situation before reliability optimizing

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

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ISO 3297:2007 Certified
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As it can be seen in figure (5), the regions that are not clustered in smaller dimensions of the network with considering reliability are displayed in red color and the regions which are clustered in smaller dimensions of the network with considering reliability are illustrated in blue. Meanwhile, routing and clustering operation based on LEACH also is running and energy is used, the network continues his work to end energy consumption. A node optimum selection probability to be the cluster head is equal to 0,5. Finally, the output of deployment and the cluster heads like figure (4) will be as the figure (6) at the end of work that of course, the slight changes in each round of training will exist because of the initial node deployment as well as space changing.

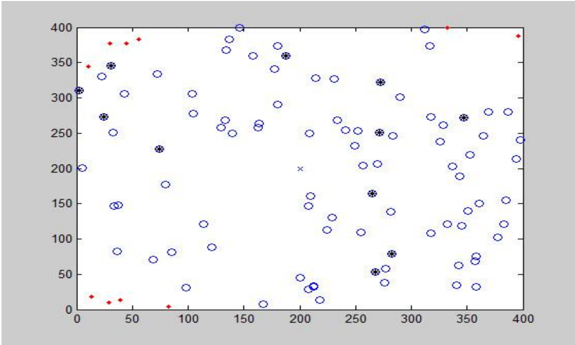

Fig. 2. The node deployment in the last round with two cluster heads in black

As it is clear in figure (6), there are 11 cluster head nodes and the points in red are the nodes which have the most energy consumption but they also are outside the cluster. We determine four amounts for data measurement to send in the network in terms of bits of various sizes so that the energy consumption versus distance obtained in the wireless sensor network. We set the first pocket 10 bits. Then the bee combinatory optimization colony algorithm and the genetic algorithm will start to do in LEACH protocol that the result of starting operation can be observed in figure (7).

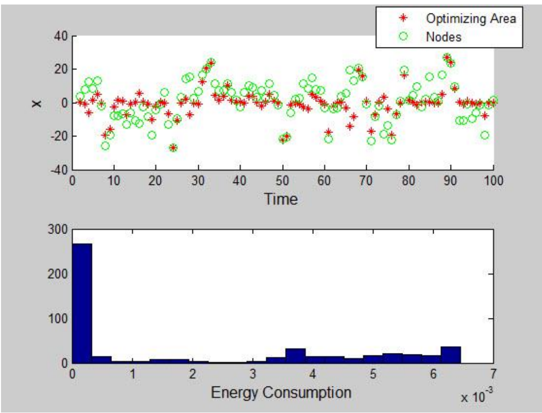

Fig. 3. The last result of the bee combinatory optimization colony algorithm and the genetic algorithm

As it is observed in figure (7), the optimization operation of consumer nodes is done in the upper part of the figure and the nodes with high energy consumption are defined and detected that show the evaluation of reliability and security operations. Now that the energy consumption optimization is done, the bits enter till the results will be seen. The result will be as the figure (8).

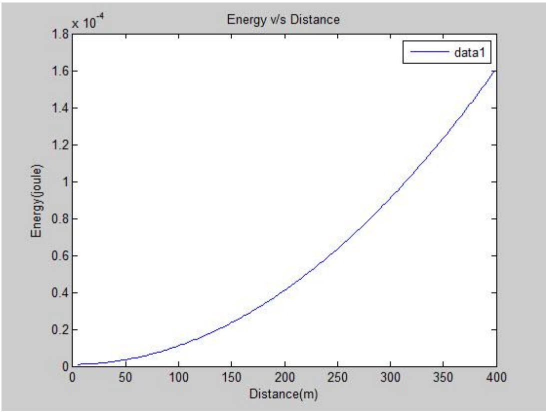

Fig. 4. The result of energy consumption v/s distance with 10 bits

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319-5940
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For the second data, we enter 12 bits that the result will be as the figure (9).

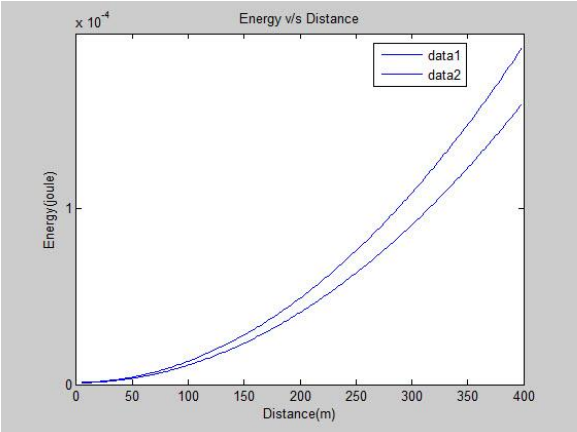

Fig. 5. The result of energy consumption v/s distance with 12 bits

For the third data, we enter 16 bits that the result will be as the figure (10).

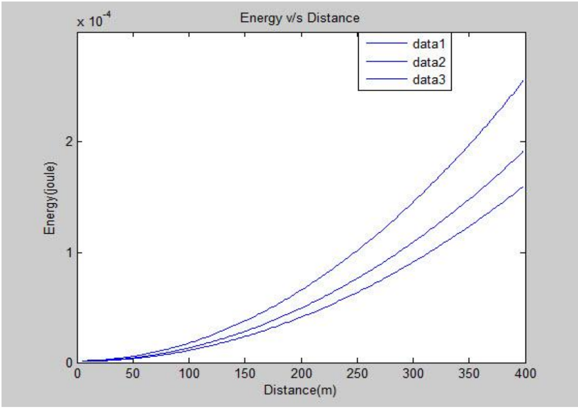

Fig. 6. The result of energy consumption v/s distance with 16 bits

For the fourth data, we enter 22 bits that the result will be as the figure (11).

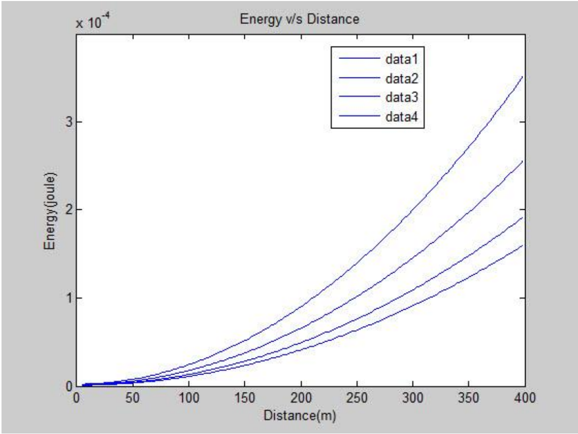

Fig. 7. The result of energy consumption v/s distance with 22 bits

The resulted point of figures (9) to (11) is that the energy consumption will be decreasing in a certain distance by a growth of data measurement from 10 to 22 bits. The reason is using clustering based on proposed method that the result

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 1, January 2018

has been effective in decreasing energy consumption in the wireless sensor network. Now, we examine the main purpose which is increasing reliability in the wireless sensor network. The estimation and improvement operations can be observed in the figure (12).

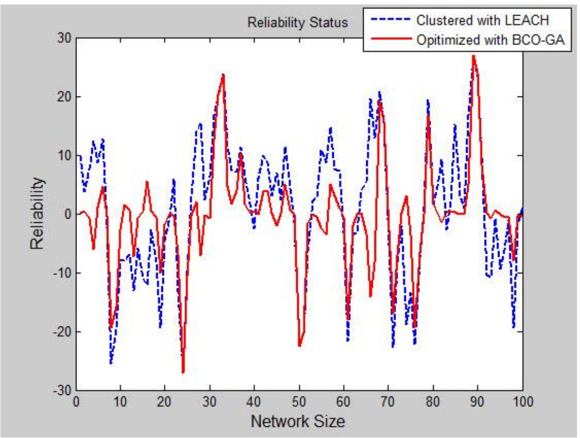

Fig. 8. Improvement of the reliability condition

The figure (12) can be compared with the output of the figure (5) that a dramatically improvement in reliability has resulted. Besides, consumed energy at the time of reliability after improvement of energy consumption as two-dimensional can be seen in the figure (13).

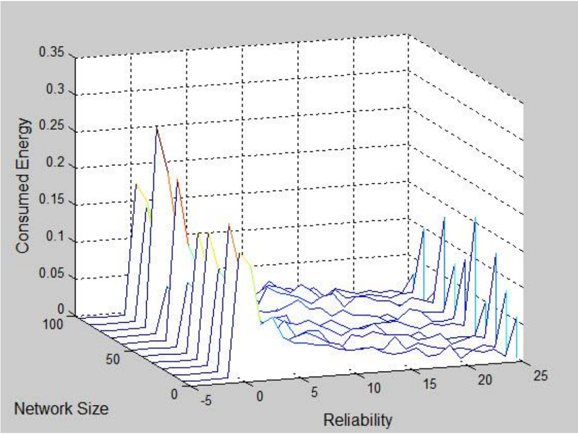

Fig. 9. The energy consumption at the time of increasing reliability after improvement

It's obvious that the proposed method has the ability to improve LEACH protocol clustering, as well as knowledge of energy consumption and more important goal means increasing the reliability at the time of routing in the wireless sensor network. The proposed method uses the bee combinatory optimization colony algorithm and the genetic algorithm that shows its ability as well. It should be noted that the outputs may be different in each round of performance since random property in these two algorithms strategy.

VII. CONCLUSION

The efficiency increase of the wireless sensor networks will be measured and evaluated by a series of parameters. One of them is the network lifetime since the nodes have a low battery in this network. Therefore, the increase of network lifetime with considering of energy consumption in different states is an important issue. Another important parameter is routing that has energy consumption its kind. The method, in which the routing is aware of energy consumption and increases the network efficiency, is an effective method. The reliability and confidence evaluation to check sending and receiving pockets without attacking to them by using a specific mechanism in a safe environment is the other important issue that is proposed as a significant section in the wireless sensor networks. So, proposing a method which possesses the mentioned parameters can be used as an efficient method in the wireless sensor networks. This paper tries to increase the reliability and improve the energy-aware routing. The proposed approach is LEACH routing and clustering protocol. Then two bees' evolutionary optimization colony algorithm and the genetic algorithm will be entered with the aim of improvement in two sections of the energy-aware routing and the reliability. At first, it's required that LEACH protocol and its parameters for clustering be improved and in the next step, reliable routing is performed with minimum energy consumption. The proposed method showed that the network has a high rate of reliability and is able to decrease the energy consumption greatly.

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