Clustering Model Based on Improved LEACH Algorithm in Sensor Network

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Abstract—For the deficiencies of LEACH algorithm includes the lack of consideration to the consumption of energy and the problem of sensor’s topological structure, an improved clustering algorithm with energy efficient is proposed in LEACH sensor networks. Based on the classic clustering algorithm LEACH, it increases the chances for those nodes close to the clustering geographical center and the ones in the area with dense distribution to become cluster heads through introducing average energy consumption regulation parameter and density regulation parameter. When this algorithm is adopted, the selection of cluster heads is more reasonable which further optimizes the structure of cluster and balances the energy consumption of networks. Comparing with the LEACH algorithm, sensor networks’ lifetime can be relatively prolonged.

Index Terms—Wireless Sensor Networks; LEACH Algorithm; Clustering Model; Node Localization

I. INTRODUCTION

With the increasingly maturity of communication technology, computer technology and sense technology, micro sensor starts to appear in the world. Its development include several stages, and it appears earliest in the 1970s. During this period, sensor network has the point to point transportation capacity and simple information acquisition ability. After that, the sensor is connected by serial/parallel interface which can obtain multiple information from sensor network. When it came to the later stage of 1970s, smart sensor can adopt fieldbus connection to form local area network. Along with the introduction of wireless communication technology to sensor, the development and application of sensor network technology have changed dramatically. In the new sensor network research field marked by wireless sensor network, the two aspects of fundamental theories and engineering technologies provide scientific and technical workers with huge amount of challenging topics. Because of sensor network’s unique features different from MANET, traditional MANET protocol cannot be applied to sensor network anymore. A new effective routing algorithm for sensor network is needed. At present in sensor network’s routing algorithm research, in order to improve the performance of routing algorithm, a method based on clustering is adopted normally to design the routing algorithm according to the limited node distribution, node’s energy and storage and data process abilities. As the basis of routing protocol’s research, clustering algorithm has an enormous influence to the advantages and disadvantages performance of routing algorithm.

In addition, in order to guarantee the integrity of information in sensor network, the interested area needs to be judged by data sink node that whether it is covered by a set of given sensor nodes. The coverage problem therefore is considered as a standard to balance the quality of service of sensor network. And the covering algorithm is also researched based on clustering algorithm. Because there are lots of covering algorithm suggested enhancing the quality of the service of sensor network which are based on clustering algorithm, its development can tremendously promote the performance of covering algorithm.

Sensor clustering algorithms usually include two stages. According to some specific mechanism algorithm, the first one is to select a node as the cluster head in order to manage or control the members of cluster, coordinate the work between members, and be responsible for information collecting, data fusion and forwarding in cluster. The second stage is to select some associated network nodes to form sets, namely, the cluster, based on the process of choosing cluster heads. In clustering algorithm, network is usually divided into clusters. Every cluster is composed by a cluster head and other cluster members, and the cluster head is responsible for communicating with BS (base station).

For the problem that traditional LEACH algorithm has no consideration as the consumption of energy and sensor’s topological structure, we proposed an improved clustering algorithm for LEACH sensor network energy effective. Based on the classic clustering algorithm LEACH, it increases the chances for those nodes close to the clustering geographical center and the ones in the area with dense distribution to become cluster heads through introducing average energy consumption regulation parameter and density regulation parameter. Comparing with LEACH algorithm, sensor networks’ lifetime is relatively prolonged.

II. LEACH ALGORITHM ANALYSIS

Battery is a traditional way to supply electricity. However, the engineering technology development of reducing the volume of it and increasing the electricity capacity is so slow that it directly influences the
development of wireless sensor network. Since there is no way to have breakthrough on energy storage hardware, scientific research personnel starts to search other ways to prolong the lifetime of sensor network, which adopts different types of optimal application, the perfection of operating system and communication protocol are needed to reduce the energy consumption in order to increase the utility time of sensor network under the same total energy. Various routing algorithm and communication protocols about sensor network are proposed, and Heinzelman et al proposed LEACH algorithm which is the milestone. It is a typical hierarchical routing algorithm which chooses cluster leader randomly, and averagely shares relay communication to save energy in comparison with flat routing algorithm. Meanwhile the concept of Round is defined by LEACH, which define a threshold \( T(n) \) for each node.

\[
T(n) = \begin{cases} 
1 \ (\text{mod} \ p) \ n \in G \\
1 - p(r \mod \frac{1}{p}) \\
0 
\end{cases} 
\]

where, \( p \) denote the percentage of the clustering head in all the nodes of the network, \( r \) denote the upgraded Round of the clustering head, and \( G \) is a collection of the node that is not selected as a clustering head in the latest \( 1/p \) Round. The clustering head is chosen from the candidate node according to the threshold. The detailed steps are given as following.

1. **Step1:** If the sensor node \( Ni \in G \), so obtain the threshold \( T(n) \) by calculating separately Equation(1) for each \( Ni \).
2. **Step2:** If \( Ni \) does not belong to \( G \), according to Equation(2.1), \( T(n) \) is equal to zero.
3. **Step3:** \( Ni \) generate a random number \( \text{RandomNum} \) distributed at the interval \((0,1)\).
4. **Step4:** If \( T(n) > \text{RandomNum} \), some nodes are randomly selected as the clustering heads in the initialization stage, which each cluster-head announces its information to all its neighbors. Others choose a corresponding cluster based on the intensity of the received information, and inform the corresponding cluster-head. Because the information intensity is proportional to the distance between sensor nodes, so actually each non-cluster head node join in the cluster which has the shortest distance between the ordinary node and its cluster head, and form the cluster topological structure, as shown in Figure 1.

5. **Step5:** Other nodes join in a cluster of certain corresponding cluster head, in order to form stable structure.
6. **Step6:** The stable phase.
7. **Step7:** The nodes are selected as the cluster heads of the next round every other period \( t \). Go to step 1, then Update the cluster head and form the clusters.

According to the above steps, we can see that the round refer to a period of time between two selected cluster-heads in LEACH algorithm, which it is composed of two parts: initialization stage and stable stage. In the initialization stage, the nodes randomly are selected as cluster heads for spreading broadcast information; others choose the cluster they want to join on the basis of intensity of the received information, and notify the corresponding cluster head. Because the distance between the strength of information and nodes is directly proportional, other nodes which are not cluster head join the cluster with shortest geographical distance in order to form cluster topological structure, as shown in Figure 2.

Sensor network firstly produces the central node, and others join the cluster with the closest central node, then the central node communicates with SINK node directly. During the stable working period, nodes collect monitoring data continuously, transmit them to the cluster head, and send them to the terminal node after the necessary fusion processed by the cluster heads. When every working period ends, the cluster heads will be re-selected, and repeat the former works again.

### A. Analysis of LEACH Algorithm

Based on the above description about LEACH algorithm, through our careful consideration, it’s not hard to find the following problems. 1. The algorithm does not consider cluster head’s influence on cluster’s energy consumption in cluster structure. During the process of selecting cluster head, the chances to be cluster head for those nodes at the center or the edge of cluster are the same. But because the communication consumption of cluster head at the cluster edge is much higher than it of the central nodes, the energy consumption of every cluster head is very disproportionate, so some energy will be depleted rapidly. LEACH holds no consideration on the density distribution of node’s influence on the energy consumption of cluster heads, so their energy consumption in the area with dense distribution of nodes is huge, yet in the area with sparse distribution is relatively small, which means the energy consumption of each cluster head in network is uneven. 3. The incessant changing of topological structure and the huge amount of communication caused by dynamic clustering can bring extra energy cost.

In order to point out some of the existing problems in LEACH algorithm which do not consider the cluster-head location in cluster structure, Firstly, it is assumed that the sensor network deployed by the aircraft seeding has already formed several clusters. Among them, certain cluster is composed of five sensor nodes A, B, C, D, E which the initial energy is 40. The concrete distribution of the five sensor nodes in cluster is shown as following Figure 2.

![Figure 1. Clustering graph](image)
Figure 2. The sensor network with five nodes

For the convenience of calculation, we assume the distance among these nodes A, B, C, D, E in the cluster, which is shown as following Table 1.

<table>
<thead>
<tr>
<th>Distance</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>D</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Let us assume that every member of cluster only transmit one message to cluster-head in each round, and the work energy consumption of every node in each round is also is shown as following Table 2.

<table>
<thead>
<tr>
<th>Cluster-head/energy consumption</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>10</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>14</td>
<td>6</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>D</td>
<td>8</td>
<td>12</td>
<td>6</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>E</td>
<td>6</td>
<td>8</td>
<td>4</td>
<td>6</td>
<td>12</td>
</tr>
</tbody>
</table>

On the basis of Equation (1), the lifetime of the whole network in LEACH algorithm is shown as following Table 3.

<table>
<thead>
<tr>
<th>Cluster-head/residual energy</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st round: A is cluster-head</td>
<td>30</td>
<td>36</td>
<td>36</td>
<td>22</td>
<td>26</td>
</tr>
<tr>
<td>2nd round: B is cluster-head</td>
<td>28</td>
<td>30</td>
<td>30</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td>3rd round: C is cluster-head</td>
<td>24</td>
<td>18</td>
<td>20</td>
<td>14</td>
<td>22</td>
</tr>
<tr>
<td>4th round: D is cluster-head</td>
<td>16</td>
<td>6</td>
<td>14</td>
<td>-2</td>
<td>16</td>
</tr>
</tbody>
</table>

III. DISTRIBUTED CLUSTER HEADS SELECTION BASED ON ENERGY EFFICIENT

Many currently proposed routing algorithms do not consider the real distribution situation of sensor nodes. Actually, the current in nature, terrain and other elements all can influence the distribution of sensor network. Nodes might be extremely dense somewhere, but very sparse in another place. So the cluster heads adopted by LEACH algorithm’s cluster selection system will cause the early end of sensor network’s lifetime, which is undesirable in wireless network.

Firstly we proposed density regulation parameter mathematics model; then we combined it with the average energy consumption regulation parameter suggested in previous chapter in order to give the distributed cluster heads selection algorithm based on energy efficient. It has been proved by experiment that this method will prolong the lifetime of sensor network to some extent in comparison with LEACH algorithm.

A. EECHS Algorithm

In order to solve above problem, the node distribution density in sensor network must be quantized at first. In order to express accurately and conveniently, the following suppositions are made:

1) Communication radius \( R \) of sensor nodes can be adjusted with the demand, where \( R \) is the basic communication radius, and \( R \geq R_0 \);

2) \( N_i \) denotes the \( i \)th node in sensor network.

3) The coordinate of an arbitrary node \( N_i \) is \((x_{N_i}, y_{N_i})\);

4) \( \text{Dist}(N_i, N_j) = \sqrt{(x_{N_i} - x_{N_j})^2 + (y_{N_i} - y_{N_j})^2} \)

On the basis of the above hypothesis, we can find that Dist \((N_i, N_j)\) represents the crow-fly distance between any two nodes in sensor networks. But we can’t obtain the node’s location information in distributed routing algorithm, so we offer the \( f \) (SignalIntensity) function. Among them, SignalIntensity means the intensity of the signal which is received by node \( N_i \) and transmitted by node \( N_j \), whose value can be obtained through the node \( N_i \)’s communication module. While \( f \) (SignalIntensity) expresses the mapping relation between the receiving signal intensity and the two nodes’ distance of the receiving and transmitting signals. For any a node \( N_i \), if Dist\((N_i, N_j) < R_0\), then \( N_j \) is considered as the neighbor node of \( N_i \).

From the above description we can know that when a certain node has quite many neighbor nodes, it means there are many nodes distributed in the circular area whose center of a circle is just this node and the whose radius is the node’s basic communication radius and the node has a high density in unit regional. Therefore, we can quantify the node distributing density as the directly proportional function about the total quantity of its neighbor nodes.

Based on the above analysis, Energy Efficient Cluster Heads Selection (EECHS) algorithm is proposed in this section, which simultaneously introduce the energy regulation parameter and the density regulation parameter. Adjusting the parameter through energy can produce more residual energy and make the node with the less mean working energy consumption in each round is more possible to be cluster head. The latter can make the node in higher density region has more opportunities to become the cluster head.

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The density regulation parameter is the following Equation (2)

$$F(n) = \frac{\text{Nodedensity}(i)-1}{\text{Nodedensity}(i)} \quad (2)$$

where, \( \text{Nodedensity}(i) = \sum_{j=1}^{n} N(j) \)

\( N(j) \in \text{NeighborSet}(i) \), where, \( \text{NeighborSet}(i) \) is a collection of Ni’s neighbour node. The value of Nodedensity(i) refer to the total number of Ni’s neighbour node, which is the number of the node in circular area of a R0 radius around the N(i). The larger the value of Nodedensity(i) is, it means that the higher is the density of the node on corresponding area. Namely, the Eq. (1) can be modified as Eq. (3)

$$T(n) = \begin{cases} \frac{p}{1 - p(r \mod \frac{1}{p})} & F(n): \ n \in G \\ 0 & \text{Others} \end{cases} \quad (3)$$

A adjustment function is introduced to make the node with the more residual energy and the less energy consumption in each round has chance to become the cluster head. The adjustment function \( F(E_{\text{cur}}) \) is defined as following.

$$F\left(\frac{E_{\text{cur}}}{E_{\text{avg}}}\right) = \begin{cases} \frac{1 - E_{\text{avg}}}{E_{\text{cur}}} & E_{\text{avg}} < E_{\text{cur}} \\ 0 & \text{Others} \end{cases} \quad (4)$$

where \( E_{\text{cur}} \) refer to the current residual energy of the node, and \( E_{\text{avg}} \) is the average energy consumption in each round. Namely, the Eq. (1) can be modified as Eq. (5)

$$T(n) = \begin{cases} \frac{p}{1 - p(r \mod \frac{1}{p})} F\left(\frac{E_{\text{avg}}}{E_{\text{cur}}}\right) & F(n): \ n \in G \\ 0 & \text{Others} \end{cases} \quad (5)$$

In formula (5), when the whole network has a lower energy, namely, if \( E_{\text{cur}} \geq E_{\text{avg}} \) and \( E_{\text{cur}} \) is close to \( E_{\text{avg}} \), \( F\left(\frac{E_{\text{avg}}}{E_{\text{cur}}}\right) \) is approaching to zero, so \( T(n) \) is also close to 0. That is to say the probability of the entire node selected as cluster-head tend to zero, which is obviously not the case in reality. In order to ensure the node under the above condition is selected as cluster-head with large probability. The Eq. (5) is further improved, and written as the following Equation (6)

$$T(n) = \begin{cases} \frac{p}{1 - p(r \mod \frac{1}{p})} F\left(\frac{E_{\text{avg}}}{E_{\text{cur}}}\right) & F(n): \ n \in G \\ 0 & \text{Others} \end{cases} \quad (6)$$

where, \( rs \) is the round of a node which is not continuously selected as cluster-head. Once the node is selected as cluster-head, \( rs \) is set as 0. So the density regulation parameter is shown in Equation (7).

$$H(n) = \begin{cases} \frac{1 - E_{\text{avg}}}{E_{\text{cur}}} + \frac{r \div 1}{p} \left(1 - F\left(\frac{E_{\text{avg}}}{E_{\text{cur}}}\right)\right) & E_{\text{avg}} < E_{\text{cur}} \\ 0 & \text{Others} \end{cases} \quad (7)$$

So the Eq. (1) can be modified as Eq. (8)

$$T(n) = \begin{cases} \frac{p}{1 - p(r \mod \frac{1}{p})} & a * F(n) + b * H(n): \ n \in G \\ 0 & \text{Others} \end{cases} \quad (8)$$

Because \( F(n) \) and \( H(n) \) are decimal fraction and \( 0 < T(n) < 1 \), so \( [a * F(n) + b * H(n)] \) is variable within the range of 0 to 1. If parameters \( a, b \) satisfies the following Equation (9)

$$a + b = 1 \quad (9)$$

Obviously, when \( a=0, b=1 \), the Eq.(8) is simplified as the following Eq. (10)

$$T(n) = \begin{cases} \frac{p}{1 - p(r \mod \frac{1}{p})} & H(n): \ n \in G \\ 0 & \text{Others} \end{cases} \quad (10)$$

That is to say we only need to further consider the influence of the node’s residual energy and its working energy consumption on network lifetime in LEACH algorithm. Nevertheless, when \( a=1, b=0 \), the Eq.(8) is simplified as the following Eq. (11).

$$T(n) = \begin{cases} \frac{p}{1 - p(r \mod \frac{1}{p})} & F(n): \ n \in G \\ 0 & \text{Others} \end{cases} \quad (11)$$

Similarly, only the influence of the node distribution density on network lifetime in LEACH algorithm needs to be considered.

<table>
<thead>
<tr>
<th>Nodes</th>
<th>The total number of neighborhood nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
</tr>
<tr>
<td>C</td>
<td>6</td>
</tr>
<tr>
<td>D</td>
<td>7</td>
</tr>
<tr>
<td>E</td>
<td>8</td>
</tr>
<tr>
<td>F</td>
<td>9</td>
</tr>
<tr>
<td>G</td>
<td>5</td>
</tr>
<tr>
<td>H</td>
<td>3</td>
</tr>
</tbody>
</table>

B. Algorithm Performance Analysis

In order to illustrate the performance of the proposed algorithm, taking an example of a network, the lifetime of whole network is calculated by the new algorithm.
(1) Suppose the sensor node’s basic communication radius is set as 10, so the size of each node’s neighborhood nodes can be evaluated easily, as shown in table 4.

(2) According to the total number of neighborhood nodes, the density regulation parameter \( F(n) \) is proposed, as shown in table 5.

<table>
<thead>
<tr>
<th>Nodes</th>
<th>( H(n) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5/6</td>
</tr>
<tr>
<td>B</td>
<td>5/6</td>
</tr>
<tr>
<td>C</td>
<td>5/6</td>
</tr>
<tr>
<td>D</td>
<td>6/7</td>
</tr>
<tr>
<td>E</td>
<td>7/8</td>
</tr>
<tr>
<td>F</td>
<td>8/9</td>
</tr>
<tr>
<td>G</td>
<td>4/5</td>
</tr>
<tr>
<td>H</td>
<td>2/3</td>
</tr>
</tbody>
</table>

(3) If D, F, H are not selected as a clustering head in the latest \( \frac{1}{p} \) Round, so we only need to calculate \( T(n) \) of the three candidate cluster-nodes. As far as three nodes are concerned, their \( \frac{p}{1 - p(r \mod \frac{1}{p})} \) are the same. Let us assume \( \frac{p}{1 - p(r \mod \frac{1}{p})} = K \), so \( T(n) \) of D, F, H are respectively \( \frac{6K}{7} \), \( \frac{8K}{9} \), \( \frac{2K}{3} \).

(4) According to probability theory and aiming at D, F, H, we can know F has the maximum probability which is selected as a clustering head, while H has the minimum probability.

Suppose that only two of three nodes can be the cluster head, on the basis of the above computing result, the two nodes F and D are the most possible combination. F and D locate in the region with a high density of nodes, while H is in the region of nodes’ sparse distribution, which exactly makes sure that the cluster heads’ quantity in dense region of nodes is higher than that in sparse region and effectively avoids the phenomenon that the cluster in the dense distributing region of nodes has a too large scale and the energy consumption is not balanced.

IV. SIMULATION EXPERIMENT

In this paper, we must construct the node class in producing the nodes. For all the nodes we suppose are isomorphic, we only need to construct one node class which includes several key attributes, for example, the only ID of the node, the present energy of the node, the relative location and the density, etc. In order to simulate the random distribution of the node, we firstly fix the disposed area size of the sensor node, that is, the length and width of the area and then generate separately two random numbers \( x, y \), among which, \( x \)’s value range is between 0 and the area’s length and \( y \)’s value range is between 0 and the area’s width. At the end, we take \( x \) and \( y \) as the node’s coordinate so as to fix the node’s location. Because \( x \) and \( y \) is generated randomly, we can think the node is of random distribution.

In the experiment, several nodes are randomly generated, which represents the randomly distributed sensor. Suppose \( p=0.1 \), the initialized energy of nodes are all 2000. When the quantity of the sensor nodes is fixed as 200 and the disposed area size is separately fixed as 800, 900, 1000, 1100, 1200, the result of the simulation experiment is shown in the figure 4, 5:

In figure 4, the abscissa is the side length of the square disposed area and the ordinate is the round in cluster, that is, the network’s life cycle, when adopting the LEACH algorithm or EECHS algorithm. From figure 4, we can know, if the node’s quantity is constant, the acreage of the disposed area is increasing, and we only consider the node’s residual energy and its working energy consumption \( (a=0, b=1) \), or only consider the node’s residual energy and its working energy consumption \( (a=1, b=0) \), or comprehensively consider the nodes’ density distribution, residual energy and its working energy consumption \( (a=0.5, b=0.5) \), in the EECHS algorithm, all the life cycles of the sensor network are longer than that in LEACH algorithm. Specially, when we comprehensively consider the nodes’ density distribution, residual energy and its working energy consumption \( (a=0.5, b=0.5) \), the life cycle of the sensor network is prolonged nearly 150%.

If 100, 150, 200……points are generated randomly, and the disposed area size is fixed as 1000, \( p=0.1 \), then the result of simulation experiment is shown as in figure 4.
In figure 4, the abscissa is the disposed number of nodes, and the ordinate is the round in cluster, namely, the network’s life cycle, when adopting the LEACH algorithm or EECHS algorithm. From figure 4, we can know, if the acreage of the disposed area is constant, the number of the disposed nodes is increasing, and we only consider the node’s density distribution (a=0, b=1), or only consider the node’s residual energy and its working energy consumption (a=1, b=0), or comprehensively consider the nodes’ density distribution, residual energy and its working energy consumption (a=0.5, b=0.5), in the EECHS algorithm, all the life cycles of the sensor network are longer than that in LEACH algorithm. Specially, when we comprehensively consider the nodes’ density distribution, residual energy and its working energy consumption (a=0.5, b=0.5), the life cycle of the sensor network is prolonged nearly 100%.

If 100 points are generated randomly, and the disposed area size is fixed as 1000, p=0.1, and the initialized energy of nodes is separately adopted as 1000, 1500, 2000, 2500, and 3000, then the result of simulation experiment is shown as in figure 5.

In figure 5, the abscissa is the node’s initialized energy, and the ordinate is the round in cluster, namely, the network’s life cycle, when adopting the LEACH algorithm or EECHS algorithm. From figure 7, we can know, if the acreage of disposed area and the node’s quantity is constant, the node’s initialized energy is increasing, and we only consider the node’s density distribution (a=0, b=1), or only consider the node’s residual energy and its working energy consumption (a=1, b=0), or comprehensively consider the nodes’ density distribution, residual energy and its working energy consumption (a=0.5, b=0.5), in the EECHS algorithm, all the life cycles of the sensor network are longer than that in LEACH algorithm. Specially, when we comprehensively consider the nodes’ density distribution, residual energy and its working energy consumption (a=0.5, b=0.5), the life cycle of the sensor network is prolonged nearly 90%.

V. CONCLUSIONS

According to the cluster heads selection algorithm based on energy efficient, this paper selects the cluster head’s location and the concrete coordinates of each cluster head node in the coordinate system in each round of the running algorithm. In the meantime, this experiment platform can conveniently modify the experiment parameters and analyze the performance of the newly-proposed algorithm. According to the result of the experiment platform, when we adopt the new proposed algorithm in this paper, the cluster heads selection of sensor network is more reasonable and compared with that in LEACH algorithm, the life cycle of sensor network is prolonged to a certain extent.

REFERENCES


