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# A The Path Transmission Mechanism of Wireless Sensor Network Research

Yang Xingjiang and Zhang Xu

*Aba Teachers College, SiChuan623002, China, Jiangsu Institute of Economic&Trade Technology, Nanjing 211168, China*
*E-mail 630610162@qq.com, 494848647@qq.com*

***Abstract***

*Large time delay is one of the key problems of mobile wireless sensor networks, has been working in reducing mobile wireless sensor network data delay has made certain achievements, but for large scale wireless sensor network (WSN) these methods still can not meet the requirements; In addition, there are studies focusing mobile path planning and the ordinary node to node routing separate consideration, without considering gathering node selection, the common node to node routing as well as the relationship between the moving path. Aiming at this problem, and combining the agricultural large scale wireless sensor network, data allow a certain time delay characteristics, on the basis of this scheme, we design a node to node routing heuristic algorithm.*

***Keywords:*** *MIMO; Wireless SensorNetworks; Routing*

## 1. Introduction

Listing research the path planning of mobile Sink to converge and ordinary node routing separate consideration, without considering gathering node selection, ordinary node to node routing and movement of the relationship between the path of the Sink. Aiming at this problem, this paper puts forward a kind of based on the convergence of mobile Sink nodes data collection mechanism, namely the selected node as the data gathering node, other nodes by jumping more will gather in the node data transmitted to the nearest store, after the mobile Sink mobile to gathering node, gather to previously stored data transfer to mobile Sink nodes. Based on the data collection mechanism, designs a routing and mobile Sink nodes are considered heuristic algorithm of path planning, under the condition of moving path length limit to reduce sensor node to node of data transmission. Simulation results show that the algorithm can effectively reduce the data transmission, thereby saving the energy consumption of wireless sensor network, and prolong the network life span.

With the development of the Internet and mobile terminal technology and popularization, as the Internet of things the underlying technology of wireless sensor network applications will be more and more widely. But due to the limited battery energy of sensor nodes, and in practice usually impossible to replace the battery, lead to the life of the wireless sensor network (WSN) is generally short, thus saving energy consumption has been the chief problem of wireless sensor network (WSN) research. From the physical layer to application layer, the researchers put forward all kinds of energy saving technology. However, in the traditional wireless sensor network architecture, sensor nodes and Sink nodes are stationary, the sensor node will be perceived by means of multiple hops data reach the Sink node, and around the Sink

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node will forward because of the heavy burden and soon run out of energy, finally become the bottleneck of the whole network nodes. This is mainly because the Sink node fixed and uneven of energy consumption caused by multiple hops transmission, in order to balance the network energy consumption, recent literature using mobile wireless sensor network solutions [1-3].

Use in the network mobility to saving energy and enhancing network performance has become a new research field of Wireless Sensor network (WSN), the mobile Wireless Sensor Networks [1-3] (mobile Wireless Sensor Networks, mWSN). Mobile wireless sensor networks is to add mobility in wireless sensor network (WSN), using the movement of the sensor nodes or the movement of the Sink node to increase network coverage, the expansion of network capacity and save the network energy consumption, balance the distribution of the network energy consumption and prolong the network life, convenient and quick access to the Internet, *etc*. As mobile nodes of wireless sensor network, mobile devices and sensor network node in its energy, computing power, storage capacity and transmission distance is not restricted, so you can put in the wireless sensor network data collection, storage, processing, remote transmission, access to the Internet and other task to it. Through the use of mobile node for data collection, can reduce the energy of sensor network in multiple hops communication overhead, and save the network energy costs, extend the service life of wireless sensor network (WSN).

Literature [7], the author USES integer linear programming method is an optimization model is established to obtain the best stay in each grid sites, to maximize the network lifetime. [8] used the same method, but the use of multiple mobile Sink made than a stationary Sink five to ten times longer network lifetime. Expanded the [7] [9] model of sensor nodes can be deployed in any position rather than on the grid, and considering the routing and residual energy of nodes, thus achieved double in [7] the network lifetime. [10], this paper proposes a distributed protocol GMRE (Greedy Maximum Residual Energy) 'the agreement achieved and the analysis of the theory of optimum approximation network life. [11] proposes a low power consumption of Two layers of Data distribution agreement TTDD (Two - Tier Data Dissemination) used in target tracking, TTDD can send Data efficiently to multiple mobile Sink. Other studies have considered moving and maximize routing network life, [12] the author established a theoretical model of sensor nodes are evenly distributed in the circular area, the research results show that when the mobile Sink along the radius is less than the monitoring area radius of circle moves can get optimal results. The above research work mainly based on the theoretical analysis and in view of the delay sensitive applications. Delay sensitive mobile wireless sensor network is mainly for events and the application of target tracking, the research of this paper is aimed at monitoring model application, the following will focus on delay tolerant mobile wireless sensor networks.

Delay tolerant type wireless sensor network applications such as agriculture, mainly for the collection of simple information, such as temperature, humidity, this kind of information the delay is allowed. Famous ZebraNet project in [13], Princeton university researchers began to send for the first time the energy efficient mobile wireless sensor networks to study the life of a zebra. [14-15] for the first time put forward a three layers of mobile wireless sensor network architecture Data MULEs, the middle layer (namely the MULEs, by carrying communications equipment of people, animals, or cars) mobile access to the underlying static node and collect Data, then transmit to the top of base station or Sink node. To overcome the blindness of random moving, [16] let the mobile Sink at a constant speed along a fixed orbit and collecting data from sensor nodes to

 

meet, so still can predict the arrival time of mobile Sink nodes and efficient conversion between wake and sleep, and save energy consumption. Shorten some researchers from the perspective of mobile path to reduce the data delay [17-18], the traditional TSP Problem is transformed into TSPN ('ll Salesman Problem with Neighborhood) Problem, shorten the length of the path, thus reducing the data delay. [19-20] [is put forward based on the partition tuning while moving the combination of single hop data collection method can maximally save transmission energy consumption, but the new problem appeared again, mobile combined with single jump way of data collection is a major disadvantage is that large time delay, for example, for a 500 x500 square meters of monitoring area, a typical mobile sensor system (*e.g.*, NIMs [41, disposal [5], Robomote [6]), the actual rate of around 0.1 2 meters per second. If the mobile Sink moving at a speed of 0.5 m/s, you need to about 20 minutes to access to the distance between center within 100 metres of all sensor nodes, if moving at a speed of 2 m/s, you need more than four hours to get access to the random distribution in the region of 200 sensor nodes. Therefore, for a bigger sensor monitoring area, move the Sink may take several hours to complete the entire monitoring area of polling, such delay is unbearable for many sensor applications. In addition, in addition to the data of ductility, mobile Sink travel path length is shared by several other factors, such as the speed of the mobile Sink, sensor node buffer size, mobile Sink battery life. These factors make the mobile Sink can't access each sensor node for data collection. Researchers through controlling the movement of the Sink to reduce the time delay has obtained certain achievements, but for larger network time delay is still moving in combination with single jump way of data collection a key question, therefore, the researchers put forward movement combining multiple hops way of data collection, namely ordinary nodes through multiple hops to gather data transmission nodes stored temporarily, mobile Sink data collection by visiting gathering node. To converge to the ordinary node of multiple hops transmission and multiple hops routing are similar, there are many related research, so the research of this kind of wireless sensor network (WSN) is mainly concentrated on the choice of gathering node. [23-24] to study the linear orbit gathering node selection problem, to Sink periodically along a straight line track mobile data collection, a fixed orbit distance was elected together jump inside the node (that is, the cluster head nodes), other node by the shortest path to the nearest cluster based on jump, and through this path, temporary storage, sends the data to the cluster head Sink meet in the process of moving from the cluster head to collect the temporary data. [25] proposed a mobile Sink data collection scheme based on report tree, unlike other studies pursuit of shortest path, the scheme under the premise that guarantee the data delay, by reporting on the tree to choose the appropriate node report to minimize the total length of the tree, thus reducing the energy consumption of data transmission. [26] cluster structure design based on k jump a routing combination of Navigation data collection scheme, this scheme the k jump dominating sets selected as the cluster head nodes (also known as Navigation agent, Navigation Agents), the cluster heads to jump around inside the nodes selected as nodes.

The scheme is mainly realized based on cluster head Sink navigation, without the need for traditional navigation based on GPS location information to the movement of the Sink. Mobile combining multiple hops way of data collection to compromise the energy consumption and delay, at the expense of the part of the energy consumption to reduce the time delay, but most studies considered separately gathering node selection, without considering gathering node selection, mobile Sink path planning, the common node to the relationship between the node routing and data delay. Therefore, the need to

 

seek effective energy saving solutions for specific application scenario, at the same time in the meet the requirements of data delay as much as possible to reduce the energy consumption of the network. To solve above problems, and connecting with the agricultural large scale wireless sensor network, data allow a certain time delay characteristics, this chapter puts forward a data collection scheme based on convergence and mobile Sink nodes. By selecting some nodes as the data gathering node, and use the traveling Salesman algorithm (Travelling Salesman Problem, TSP) to get access to all we have the shortest path of node, other nodes through multiple hops routing to deliver data to the nearest gathering nodes stored temporarily, after the mobile Sink mobile to gathering node, converge to previously stored data transfer to mobile Sink nodes, mobile Sink after visiting all gathered node to elevate the collected data to the data processing center. Based on the data collection scheme, we design a selection of nodes are considered together, common node to node routing and mobile Sink path heuristic algorithm. Algorithm to select the minimum connected dominating set of nodes, and according to the definition of the weight to calculate weight of the each dominating sets node, and each time to remove a set of minimum weight control node, and recalculate the weight of the rest of the dominating sets node, until the movement of the mobile Sink path length less than or equal to the ductility demand under the condition of the maximum path length, the resulting node set as aggregation node set. Other nodes is obtained by the shortest path algorithm to reach their closest gathering node routing; At the same time by the TSP algorithm for mobile Sink around each node, the minimum path. The algorithm in the data when the ductility demand conditions, reduce the data transmission of the sensor nodes to the gathering node, so as to achieve the purpose of save energy and prolong the network life.

## 2. System Models

As shown in figure 1, $N$ sensor nodes random arranged in $M \times M$ square meters square area, in the case that the layout of the node can't move, Sink can move freely in monitoring area. Each sensor node periodically generates monitoring data, the monitoring data allow a certain delay, the new data must be uploaded in time. System according to certain algorithm selected some node periodically as aggregation node, ordinary nodes through the shortest routing based on the hop to the monitoring data transfer to the nearest gathering node, together to create a node for data fusion and temporary storage. So you can put together as a traditional hierarchical wireless sensor network node of cluster head nodes, ordinary node as family members. Sink according to the design of the route in order to access each gathering node, when arrive Sink mobile convergence node, gathering node sends the data stored Sink, Sink to collect all the data gathering node, one-time send the data to the data processing center.

 

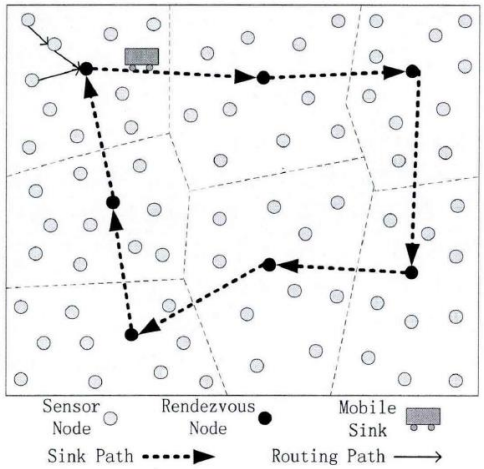


**Figure 1. System Model**

In addition, the assumption of system models such as:

(1) after the sensor node layout can't move, Sink with controllable mobility, namely can Sink depending on the situation in control of their movement speed, direction .

(2) the initial energy of sensor nodes is the same, and the limited node energy, computing power, but the energy of the Sink, unlimited computing power; Sink in addition to communication and sensor node, but also can through the 3 g, Win, such as wireless communication access network, which sends the collected data to the data processing center;

(3) each node can get their location information, can be obtained by GPS or other positioning algorithm.

(4) sensor nodes densely deployed? In the area, and the sensor nodes have the same communication radius R.

Based on the above model and hypothesis, this paper application of graph theory in wireless sensor networks was described. Under the condition of without considering the space differences, the nodes of wireless sensor network can be abstract into graph vertices, the communication relationship between network nodes abstract even between vertex and edge into the picture. For the convenience of the description of the subsequent problems, first used in the basic concept of the problem of definition, and then according to the basic concept for a formal definition of a problem. The following is the definition of some basic concepts:

**Definition 1:** wireless sensor network topology $G=(V,E)$, among them, $V$ is the Euclidean plane sensor node set, representing the position of the sensor nodes in a network, $E$ is the set of edge, on behalf of the wireless sensor network topology, if and only if the sensor nodes $V_i$ and $V_j$ within the scope of the communication of each other, $(v_i,v_j)\in E$.

**Definition 2:** the movement of the mobile Sink path diagram $G'=(V',E')$, which $E'=V\times V$ represents mobile Sink can move between any two sensor nodes.

**Definition 3:** mobile Sink the biggest traversal path length $L = m \times T$, among them: $T$ for the application of the maximum delay tolerance time, $m$ for the mobile Sink movement speed.

**Definition 4:** seed gathering node set $U = \left(u_1, u_2, \cdots, u_{|U|}\right)$, one of them $U \subset V$. Seed gathering node $V$ set from some node, sensor node set chosen as the input of the algorithm, the algorithm of iterative calculation, and finally get a node set.

**Definition 5:** gathering node set $S = \left(v_0^{'}, v_1^{'}, \cdots, v_{|S|}^{'}\right)$, one of them $S \subset U$.

When common nodes and the nearest gathering node is beyond the scope of each other's transmission, needs through multiple hops routing to send data to the temporary storage, gathering node so right by vector definition is as follows:

Definition 6: vector routing $h(v, v')$ for ordinary node to the nearest we have the shortest routing hop count of nodes, which $v \in V$, $v' \in S$.

According to the definition3, the system's maximum delay tolerance time $T$ limit conditions can be converted to traverse the path length, namely as long as meet the biggest traversal path length $L$, it will also meet the maximum delay tolerance time $T$ of the system. Mobile Sink at time T periodically traversal gathering node set of nodes, and upload to collect monitoring data. That is to say, the requirements of mobile Sink traversal path length is not greater than $L$, and can access to all the nodes. Look from the intuitive, the traversal path length L, under the conditions of access node gathers as much as possible, can reduce the data transmission to gather other node. Together, on the other hand, the node selection and access path planning, not only relates to cruise the length of the path, also related to the common node to the gathering node routing. In other words, how under the condition of cruise path length limit $L$, to reduce the number of data transmission, as much as possible to reduce the energy consumption of sensor nodes.

## 3. SCHCT Scheme Analysis of Energy Consumption

**Definition 7:** based on the mobile Sink node (MSRDC) data collection problem. For a given source node set $V$ and largest mobile Sink traversal path length $L$, fulfilled: 1) a is less than $L$ and access to the gathering node set each node traverse the shortest path $F$ $F \subset G'$, and 2) to make each ordinary node reaches the minimum path routing vector $F$. Can use mathematical MSRDC problem is expressed as:

$$\begin{aligned} &Minimize \ \sum_{v \in V} \min_{v' \in S} h(v, v') \\ &s.t. \qquad S = < v_0{}' = v_e, v_1{}', \cdots, v_{|S|-1}{}', v_{|S|}{}' = v_e >; \\ &\qquad \sum_{i=0}^{|S|-1} l\left(v_i', v_{i+1}{}'\right) \le L, l\left(v_i', v_{i+1}{}'\right) \in E' \end{aligned} \tag{1}$$

Among them, $v_e$ on behalf of the traversal path $F$ start and end node.

**Definition 8:** the shortest traversal of a given node set path length can be expressed as, including traveling salesman algorithm which said.

According to the definitions are 7 and 8, MSRDC problem is similar to the classical traveling salesman problem [27] (TSP), namely how to in the shortest travel path access to predefined every city once and returned to the city. But MSRDC problem and TSP problem, TSP problem in need of the cities visited already know in advance, can only for a visit to the

 

shortest path in each city. In MSRDC problem, also need to solve the convergence node set, and gathering node set of solution to minimize routing vector and at the same time. The following lemma to prove the MSRDC problem is a NP - hard problem.

Algorithm is the main idea revolves around MSRDC problem definition, MSRDC problem definition requirements under the condition of meet the cruise path length limit, on the one hand, to find as many gather nodes as well as its shortest traversal path; On the other hand, find the common sensor nodes to the mobile Sink traverses the shortest routing path. This paper argues that these two aspects of problem solving is not isolated, but influence each other, one will effect on the other hand, the results of the results. And, therefore, the previous algorithm considered separately path planning of mobile Sink is different, the proposed algorithm considers the convergence node selection, cruise of the path planning and ordinary node to the gathering node routing. Algorithm iteration, calculate each round seeds in a node set, mobile Sink optimal traversal path and ordinary node to the mobile Sink the optimal routing, and each round of the results of calculation are calculated on the basis of the previous optimization.

Algorithm firstly from the ordinary sensor nodes as seed gathering selected node. Due to traverse the longest path length limit, mobile Sink can't be in the traverse length within the limited access to each node gathers seeds, algorithm to evaluate each seed gathering node and assign weights, weight for each seed gathering node after removing the influence of the result of the algorithm, first remove the seeds of a weight minimum convergence node, and then again for the rest of the seed gathering node set is evaluated and assigned to the new weights, and then remove the new seed gathering node set weight minimum node, so repeated, until the rest of the seeds in a node set access path length less than or equal to it.

### 3.1 Node Selection

Candidate seed gathering node as aggregation node, should be selected to minimize the average node to node routing transmission. Section on the model, the dense deployment of wireless sensor network can be represented as a connected undirected graph, therefore, can consider to use minimum connected dominating set in graph theory as a seed node set.

Connected dominating set of related concepts are defined as follows:

**Definition 9:** Dominating sets (Dominating Set, DS) S, defined as a subset of V, and has a V - S and S at least one node in the adjacent.

**Definition10:** Connected Dominating Set (Connected Dominating Set, CDS), defined as S is Connected.

**Definition11:** Minimum Connected Dominating Set (Minimum Connected Dominating Set, MCDS), element is defined as the number of Minimum Connected Dominating Set S.

Can be seen from the definition of minimum connected dominating set, dominating sets nodes in a graph G (r,L) plays the role of the backbone nodes, the dominating sets node can arrive by jump dominating sets, so this paper adopt minimum connected dominating set node as a seed gathering node set. Specific use the MCDS algorithm to calculate the minimum connected dominating set.

ter. On the one hand, access convergence node more is beneficial to reduce the data transmission, but for the same convergence node set, different traverse of the different path length. Therefore in the traversal path length L of the limited conditions, seeking the shortest traversal path can access to more nodes. To adopt traveling salesman algorithm can get the

shortest traversal path in the specific node set, this paper adopts Christofide algorithm for solving TSP algorithm of shortest path.

When, on the other hand, remove seeds together after a node node set, can make the rest of the gathering node set the shortest traversal path shortened, so hope choose to remove the remaining seeds gathering node set traversal node with the shortest path so that can make the shortest traversal path length to achieve qualification L as soon as possible, at the same time as little as possible to remove the seed node set of nodes. On the other hand, is to satisfy the L at the same time, access convergence node as much as possible.

(2) shall be selected to reduce network more jump transmission nodes as aggregation node, reduce the number of ordinary node to the gathering node routing cost, which meets the definition of the second condition MSRDC problem. Measured based on the definition of 6 routing vector routing cost, specific routing based on hop count of Floyd Warshall algorithm to calculate. When removing seeds in node set a gathering node, must make ordinary node belonging to this gathering node seeking other routing nodes together as a new convergence with the shortest path so that the data stored by the shortest path transmission to the nearest node, and wait for the mobile Sink access. If, on the other hand, to remove a seed gathering node, increase the total number of transmission jump is large, you should try not to move in the seed gathering node, and select remove total transmission hop count as few nodes are added.

Based on the above analysis, and considering the gathering node selection, traversal path planning and ordinary node to the gathering node routing, to make the following definition: seed gathering node weights

$$w(x)=\frac{\sum_{v\in V}\min_{u\in(U-x)}h(v,u)-\sum_{v\in V}\min_{u\in(U)}h(v,u)}{TSP(U)-TSP(U-x)},x\in U,U\subset V \qquad (2)$$

Type of U to use section method to select the seeds of gathering node set $x$, $w(x)$ of the seed influx of node set a node $x$, on behalf of the weight of the node, to traverse the seeds we have length of the shortest path of node set $TSP(U)$, $\sum_{v\in V}\min_{u\in(U)}h(v,u)$ said the entire network from ordinary node to node transmission to the total number of jump.reversal path length. As you can see, when to remove node X, if part of the value of the smaller, and the value of the numerator is larger, the value is small, then suggests that X node to remove not only makes the ordinary node to the gathering node routing cost increase is not big, but also makes the mobile Sink node traversal path compared to remove X shorter before, that is to say, the node X removed to minimize the routing cost as soon as possible to traverse the path length L, at the same time under the condition of limited length L may traverse in the number of nodes. So every time should be selected for minimum node is removed. Designed so that the weight has two advantages: 1) the weights were considered in the design of the traversal path length, the position of the gathering node and ordinary node to node in the routing cost, through the weight calculation of seed gathering node can get various seed gathering node in the three aspects of comprehensive quantitative reference; 2) on the other hand, by the ordinary node to node in the routing cost and traversal path length on the molecular and the denominator respectively, can be avoided in seed gathering node in the same weight value of node, to ensure that the selected node the uniqueness of the minimum cost.

MSRDC algorithm as shown below, to realize the algorithm's input to traverse the path length L, constraints of sensor nodes location information and sensor communication radius R, P final output for gathering node set, and to combine the traversal path of node set F.

Algorithm firstly based on the input of the sensor node location information and communication radius R, on the basis of definition 1 to generate the sensor nodes of network

 

topology graph G (V, E); Using the minimum connected dominating set algorithm, find the graph G (V, E), the minimum connected dominating set, and with the minimum connected dominating set as the initial seed gathering node set S. Then according to the section (2) the calculation of the weight definition in the convergence S the weight of each node in the node set, at the same time using the TSP algorithm calculating seed gathering node set S the shortest traversal path length tl; Then determine whether tl less than or equal to traverse the limitation of length L, if less than or equal to immediately withdraw from circulation; Otherwise, find seeds together for minimum node, node set and removed, the third step, and then return algorithm to calculate the rest of the seed weight and seed gathering together node set the traversal path length. Visible, the algorithm is not a one-time calculated gathering node set, but the loop iteration, each loop from seed gathering node set to select a minimum node to remove, and then update the weight of the rest of the seed gathering node and into the next cycle.

## 4. Simulation Results

In this section, the simulation to evaluate MSRDC algorithm performance, the simulation using c + + language. In simulation experiment, the wireless sensor network node random distribution in 400 x400 meters square area, the number of sensor nodes in between 100 and 400. Sensor node communication radius of 50 meters, when and only when the sensor nodes in each other's communication range, between nodes can communicate with each other. Sensor nodes generate every 1 minute 10 bytes of data storage and sent to gathering node. Network maximum allowable delay for 20 minutes, the mobile Sink every 20 minutes to complete the round of data collection, mobile Sink from each node bits of data collection is about 1.5 K. Assuming that mobile Sink in m moving at a constant speed of speed, the scope of m to 0.5 m/s to 0.5 m/s, according to define the scope of 3 available L for 600 meters to 1800 meters. In order to evaluate the MSRDC Algorithm, this paper also implements an Algorithm based on clusters [24] CBA (Clustering -based Algorithm). CBA algorithm implementation is not limited to, in accordance with the literature [24] in a fixed orbit to head for a visit, but first of all, the most magnanimous formed multiple points according to the node. Namely degree of node becomes the first largest cluster heads, a jump in the neighbor node as the cluster members, then find out from the rest of the node degree of node to become the second largest cluster heads, a jump in the neighbor node has been a member of the cluster, so on, until all nodes in the network to form clusters. Then L under the limit of the condition of time delay, by the TSP algorithm priority access to members of the clan head up, forming a traversal path, there is no access to the family of the head and members based on the shortest in [2] jumped into a family of methods through many connected to the nearest traversal path of cluster heads, the mobile Sink to the cluster head access for data collection. Convergence based on the mobile Sink node data collection scheme, CBA algorithm is the most intuitive way to minimize the network transmission hop. Therefore, the use of CBA algorithm for comparative reference, can better reflect MSRDC superiority of the algorithm. Algorithm evaluation index for network transmission to the total number of jump and network age, network lifetime is defined as the first node in the network energy exhausted, the network has been running round number.

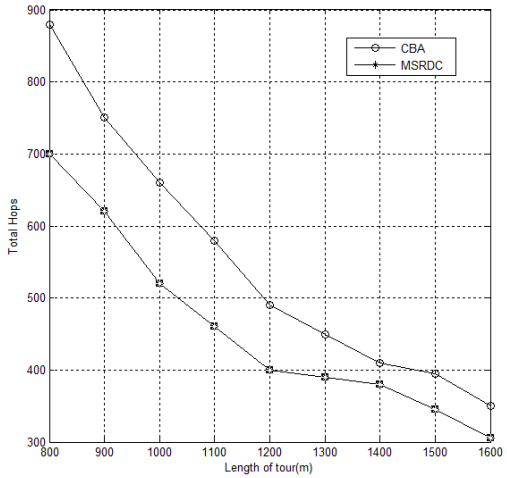


**Figure 2 Network Transmission to the Total Number of Hops**

Figure 2 reflects two algorithm of network transmission to the total number of jumping change with the increase of the path of the mobile Sink. Figure in the mobile Sink path length increased from 800 meters to 800 meters, the path length of mobile Sink each additional 200 meters two kinds of algorithm of the change of transmission to the total number of jump. Conclusion can be seen from the figure 3:

First, both the algorithm of the total transmission hop along with the increase of mobile Sink path length decreases. This is because the force of the mobile Sink path length increases n, enables the access of mobile Sink more nodes for data collection, this will reduce the ordinary node to the gathering node transmission, so the longer the mobile Sink path length, the less the total network transmission hop.

Second, two algorithms before 1200 meters, the transmission to the total number of jump cut faster, and reduce the trend slowing after 1200. Area is larger, because the sensor for the 400 meters square area, when the mobile Sink path length is less than 1200 meters, the movement of the mobile Sink can be covered area is limited, so at this time with the increase of path length, two algorithms of transmission to the total number of jump quickly reduced; However, when the mobile Sink after the path length of more than 1200 meters, the movement of the mobile Sink almost the entire sensor monitoring area can be covered, so at this time with the increase of path length, transfer to the total number of jump to reduce speed slow.

Third, with the mobile Sink traverses path length increases, MSRDC algorithm CBA algorithm can save the transmission to the total number of jump. As shown in figure in, when L is 1200 meters, than the CBA MSRDC algorithm algorithm can save about 100 jump, when L is 1600 m, MSRDC algorithm than the CBA algorithm can save less than 50. This is mainly because the longer the mobile Sink traversal path length, the transmission to the total number of jump less, is difficult to show the advantages of MSRDC algorithm, so as the Sink traversal path length is more and more big, the two algorithms of transmission to the total number of jump the gap will be more and more small.

 

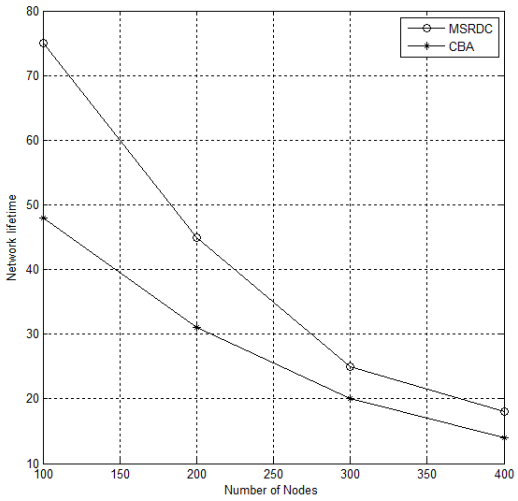


**Figure 3 Network Life Changes with the Increase of Number of Nodes**

Figure 3 reflects the two algorithm's network life changes with the increase of number of nodes. Diagram node number increased from 100 to 400, you can see, as the number of nodes increases, two algorithms of the network life decreases, and MSRDC network life longer than CBA algorithm of the algorithm. In addition, with the power, the node number MSRDC algorithm and CBA algorithm is less gap between the network life. Because MSRDC algorithm is better than the CBA algorithm can save the network transmission hop, so as to save the network energy, so in the number of nodes is small, the energy saving can prolong the network lifetime effectively; And when the node number is large, relatively heavy burden on forward, therefore MSRDC algorithm saves the energy, MSRDC algorithm could only slightly better than the algorithm of CBA, then two algorithms of network life gap is narrowing.

## 5. Conclusion

For larger scale, simple data and allowed to have a certain time delay of wireless sensor network (WSN), a wireless sensor network data collection based on mobile Sink energy saving algorithm. To describe and define the MSRDC problems need to be solved, and proved that the problem is a NP - hard problem. Finally, a heuristic algorithm is proposed to solve MSRDC problem, describes in detail the main idea of the algorithm, algorithm design and implementation of the algorithm. MSRDC simulation results indicate that the algorithm can effectively select the gathering node, in order to reduce network transmission hop count as much as possible, so that they can save the network energy consumption and prolong network lifetime.

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## Authors

**Xingjiang Yang**, majoring in Mathematics, graduated from Aba Teachers College in 1994. In 2005, graduated from Southwest Jiao Tong University with a master's degree in Cryptography. And now, Working in Aba Teachers College, mainly researching on Machine Learning and Image Annotation.

**Zhang Xu**, received the B.Eng degree in Software Engineering from Nanjing Normal University and the M.Eng degree in Software Engineering from Nanjing University of Aeronautics and Astronautics,CHINA in 2003 and 2010 respectively.He is currently research on System Integration(SI),RFID and Data mining.

 