Using ant colony algorithm to construction wireless sensor zigbee and RFID routing

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ABSTRACT

ZigBee is a new low complexity, low cost and low power wireless communication technology. ZigBee technology is used to build a wireless sensor network and we must consider the energy saving and simple of algorithm in designing routing algorithm for wireless sensor networks. As heuristic search algorithm of ant colony optimization has the advantages of good distribution, strong global search capability, and the algorithm is simple to implement. RFID (radio frequency identification) is a kind of automatic recognition technology of non-contact. The paper proposes using ant colony algorithm to construction wireless sensor Zigbee and RFID routing. Simulation results show that the algorithm can effectively achieve balanced energy consumption of nodes.

Keywords: Wireless sensor network, Zigbee, RFID, Ant colony algorithm.
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INTRODUCTION

Mobile Ad Hoc network is a mobile wireless network system is new; it does not need any fixed base facilities, communication between nodes with other mobile nodes forming multi hop communication. Because the network fast, flexible, strong survivability, convenient use and wide range of application, so it is a hotspot of network and communication technical field. From the research content, the network layer protocol Ad Hoc is the emphasis and difficulty in study and the Zigbee routing algorithm is the core technology of network layer protocols.

Energy is exhausted, or a change in the environment lead to node can not work normally, the wireless network quality of service will be reduced, which can lead to network is not reliable, this requires the network routing protocols need to have certain network redundancy, to ensure the reliability of data transmission. Because the topology is constantly changing, which directly affects the energy consumption of nodes, the network quality of service and routing structure, therefore need to routing protocol can converge to the optimal path, in order to adapt to the new topology is better, reduce the energy consumption of the nodes, to improve data transmission capability of nodes.

The application field of RFID is more widely, such as public security, production management, logistics management, traffic management and other fields [1]. Although the RFID technology has been a certain degree of development, but in the large-scale application still exist many problems. One is between the reading card device and the server using a wired connection; the reader's position is fixed, not in urgent cases temporary and rapid networking, and transmits the data to the server automatically to satisfy the requirements of rapid short-term.

ZigBee routing algorithm based on ant colony optimization, the algorithm to improve the quality of service network, improve the average life span of the network routing node, the optimal path for any two nodes in the network, improve the success rate of packet transmission, at the same time, balance network bandwidth, delay cost savings, and to restrict them, ensure the overload congestion in the network, the important data without delay or discarded. Ant colony algorithm shows it in the routing of wireless sensor network advantage.

When the network QoS intensive applications, or in the transmission of data coherence have special requirements. For example, in the need to obtain the monitor screen in real time, the network is required to more coherent view information. However, the dynamic changes in the network topology, signal will lead to network when HERSHEY'S bad, it is difficult to guarantee the reliability of wireless communication transmission process. So when the users of the QoS network when the demand is higher, to a routing protocol for wireless sensor technology for high QoS design. The paper proposes using ant colony algorithm to construction wireless sensor Zigbee and RFID routing.

2. Design Routing of Zigbee in WSN by Ant Colony Algorithm

Ant colony algorithm is a kind of bionics based distributed parallel nonlinear optimization algorithm, is a bionic algorithm of ant colony search path simulation results. Biologists found that ants looking for food in the process, by the group to find a path from the nest to food path; and ant colony and strong ability to adapt to the environment, such as when the ant colony through appearing on the barrier, the ant system can always find again a new optimal path, through the unremitting efforts, bionic scientist, finally found: ant colony is looking for food in the process, will be in the path left a unique secretary substance -- pheromones, other ants within a certain range, can detect the substance and thus their effects on the path finding, when the number of ants through a path on a long time, the path of the pheromone concentration is bigger also, attraction to ants is higher, therefore, form a positive feedback phenomenon, namely the path through the number of ants, the ants will more likely he pass through the path.

In the algorithm, each ant like ant colony optimization algorithm, based on its experience and performance in the network, dynamic update routing table [2]. If an ant is in the network caused a delay of more because after routing congestion, and it is on the table to make larger enhancement. At the same time according to the pheromone volatilization mechanism to realize the system information update, thereby abandoning the routing information out of date. So, the current optimal routing congestion, ACR algorithm can quickly searches another alternative optimal path, so as to improve the rate of load balance, and the use of network. At present, the study in this aspect is still on the rise, because the nature and characteristics of the asynchronous evolution algorithm for distributed information structure, non stable stochastic dynamic characteristics of communication network and the network state and ACO are very similar.

The IEEE802.15.4 specification is an economic, efficient, low data rate (<250kbps), wireless technology in 2.4GHz and 868/928MHz, above the network layer protocol developed by the ZigBee alliance, IEEE802.15.4 is responsible for the standard physical layer and link layer. The complete ZigBee protocol suite by the application of high standards, convergence layer, network layer, and it is data link layer and physical layer and composition.

Ant colony algorithm is a new heuristic optimization algorithm with a kind of ant colony system, based on the principle of self organization ability. The basic principle of ant colony system, ant colony system (usually referred to as the ant colony system) used to pass information pheromone trail and the heuristic information guidance to construct solution [3]. Artificial ant colony is by the foraging behavior of real ant's revelation of this behavior, which can find the shortest path between the food source and the nest of ants. Initially, the ants in a random way to explore the area around the nest, once an ant finds some food source, it will assess the quality and quantity of food, and carry the food back to the nest, as shown in fig. 1.
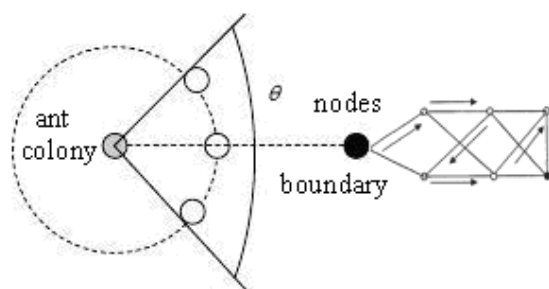

Fig. 1. Path selection of ant colony foraging source point to the node

As shown in Figure 1, through the search angle this restriction conditions, the initial number of ants search is defined as number of boundary nodes within the search range theta angle, this can be avoided by ants flood causes the search speed is slow.

Establish the communication path between the sensor and the observer for storage; cooperative sensing, collecting, processing, publishing information is the basic function of sensor networks. A group of sensor collaboration features limited to complete large perceived task is an important characteristic of the sensor network, sensor network part or all of the nodes can be mobile, sensor network topology will be with the mobile node and the continuous dynamic

changes. Each node can act as a router's role, and every node is capable of dynamic searching, positioning and restoring the connection.

The algorithm mainly the optimal multi hop path searching from the cluster head node to the sink node, the basic idea of the algorithm is: (1) network nodes in the cluster to cluster, the largest diameter of intra cluster into 2 jump -- intra cluster nodes to the cluster head node distances up to 1 hop; cluster head the node to the sink node routing search by ant colony algorithm. (2) The available energy of the node into the ant colony algorithm, to avoid the excessive use of a gateway node for routing process. (3) A group of "ant" agent with distributed execution of parallel test, search from each cluster head node to the sink node routing.

The application layer includes the application object terminal equipment and application interface layer, and can contain at most 31 application objects. Application interface layer will be mainly responsible for the different application is mapped to the ZigBee network layer, including: security and authentication, multiple service data flow convergence, device discovery and service discovery. The network layer is considered using the technology of ad2hoc based network protocol, network layer contains the following functions: universal function, build and maintain the topology structure, naming and related business, including addressing, routing and security, self organization, self maintenance, to the greatest extent reduce consumer spending and maintenance costs.

The entire alternate path basic idea of multipath Zigbee routing algorithm is built close to the main path, further is to replace the node or nodes on the path is on the main path, either adjacent node on the primary path node [4]. Its basic principles can be summarized as follows. The source node flooding route is request packet RREQ Zigbee. Received the RREQ node in the confirmation of this node is not the destination node, without sending the RREQ conditions, the calculation of node and sent to the upstream node link between its RREQ prices, will be written into the RREQ Cost domain forwarding this RREQ. The destination node according to all the RREQ packets received within the specified time to extract the information of network topology construction, simple multipath Zigbee routing.

Multi hop routing can be divided into intra cluster multi hop and multi hop between clusters of 2, cluster multi hop refers to a sensor node in the cluster transfer information with other nodes in the cluster of relay the information to the cluster head nodes (when the entire sensor network field as a cluster, the inter cluster multi hop refers to a cluster head node information through the base station as the cluster head node), he cluster head nodes to relay information that arrive at the receiving device base station, the energy consumed for Formula 1.

$$ETx(l,d)=ETx\text{-}elec(l)+ETx\text{-}amp(l,d) \tag{1}$$

Where: ETX (L, d) is indicating that the sending end energy consumption; ERX (L) indicates that the receiving end energy consumption; Eelec emission circuit energy consumption; ε FS and ε amp amplifier coefficient; d0 is the critical distance.

Sensor nodes are deployed randomly hypothesis in the network, the network is a peer-to-peer structure; each node can receive data and send data [5]. However, each node maintains a network node information table, regardless of the bandwidth, energy or storage capacity for nodes limited capacity is huge overhead, so the selection should be routing method, each node knows only adjacent nodes, preservation of routing information limited to improve efficiency in the use of node. Usually s broadcast a should forward ants (reactive forward ant) FA (s, d), each FA (s, d) contains group ID, algebra, time stamp, the source node and the destination node information, and an empty stack, the stack is used to record the timestamp and the forward path. The first generation of ants as their ethnic queen, each ethnic group has ID.

The ad hoc network node mobility, network topology changes, thus to route connectivity must route maintenance. The idea is that each node periodically broadcasts messages to the neighbor node Hello. If in a given time after t, the neighbor node has not received confirmation of Hello message connection, the node is considered to have and disconnect themselves, their road to link repair, failure of nodes will start the routing discovery process, in order to build the new broadcast RREQ routing. If in a given time asked Li to rebuild efficient routing, and then send the data; if a route is not successful, is sent to the RERR upstream node. Routing failure after first local link repair can reduce the data transmission delay, improve packet transmission rate.

The basic ACO model consists of the following three formulas are described below:

$$p_{ij}^k = \frac{\tau_{ij}^{\alpha} \eta_{ij}^{\beta}}{\sum\limits_{j \in \Lambda} \tau_{ij}^{\alpha} \eta_{ij}^{\beta}}$$

(2)

$$\tau_{ij}(n+1) = \rho \times \tau_{ij}(n) + \sum_{k=1}^{m} \Delta \tau_{ij}^k$$

(3)

$$\tau_{ij} = (1-\rho) * \tau_{ij}(t-1) + \rho * \Delta \tau_{ij}$$

(4)

Where, M is the number of ants; n is iteration; i is ant location; J is an ant which can reach the set; ant can reach the position set; as heuristic information, the path here by I to j visibility, namely; as the objective function, here for two Euclidean distance (Euclidean); the path from I to j the intensity of pheromone; ant K from I to leave J pheromone quantity; the path for the right; as heuristic information for the right path; pheromone quantity of evaporation coefficient; Q as information quality coefficient; ant K from the transfer probability position I mobile to position J.

ZigBee is a new low complexity, low cost and low power wireless communication technology. A complete protocol stacks only 32 KB. And can be embedded into a variety of electronic information equipment. Due to the technical characteristics of wireless sensor network requirements, so the ZigBee technology as the wireless communication of wireless sensor nodes is feasible. We through the application of ZigBee technology are to build a wireless sensor network. Due to wireless sensor networks with node calculation ability is weak, node power (battery provides) Limited, in the routing algorithm in wireless sensor networks, must consider the energy saving and simple algorithm. Ant colony optimization as a heuristic search algorithm, has the distribution of good, strong global search capability, algorithm is simple and easy to achieve.

Wireless sensor network congestion can occur in two levels: one is the same with the traditional network congestion, is packet flow nodes need to transmit over the transmission capacity, making the network queuing delay increase, and even result in the loss of buffer overflow and packet; another type is congestion in wireless link level. The wireless channel is a shared channel, adjacent nodes only at the same time a node using the wireless channel. When multiple adjacent nodes compete for the use of the wireless channel at the same time, an access violation occurs, caused the link level congestion, increase packet of business hours, reduce the link utilization and network throughput. For the design of event driven wireless sensor network routing protocol should adopt the cross layer design method, considering the state information from the media access control layer and node caching, load balance and network congestion control.

Ant colony algorithm is a novel simulated evolutionary algorithm; preliminary studies show that the algorithm has many good properties. This paper introduces the basic ant colony algorithm model of AS principle, characteristics, structure and realization method, analyzed the reasonable selection of the parameters of the basic ant colony algorithm, gives the basic principle of algorithm parameters, is helpful for the promotion and application of ant colony algorithm in optimization problems.

On the ant colony algorithm pheromone volatility on the performance of the algorithm and its effect in the practical application of choice, can be analyzed by computer simulation experiment and determine.

The relay way through radio waves to move data from one sensor to another, which makes the communication efficiency, is very high. In general, with increasing the communication distance, equipment complexity, power consumption and system cost are increasing. Compared with the various existing wireless communications technology, low power consumption, low rate of ZigBee technology is most suitable for sensor network standard. ZigBee technology is suitable for carrying less data traffic, especially for sensor networks.

The introduction of a new constant, its range, before the ant K each path to generate a random number, and, after a random number, the path will ant K is carried out according to the following rules..

$$pp = \begin{cases} \arg\max\limits_{j \in AL_x}\left\{ [\tau_{ij}]^{\beta}[\eta_{ij}]^{\beta} \right\} & \text{IF } q \leq q_0 \\ p_{ij}^k & \text{IF } q \succ q_0 \end{cases}$$

(5)

In the formula(5), where the node that currently located ant K is I, then the ant K from node i to the point J moves to follow the rules of using the formula PP expressed as equation(5). Ant colony algorithm is a random search algorithm, and other simulated evolutionary algorithm, through a plurality of candidate solution (a subset of feasible solution set) the evolutionary process groups to seek the optimal solution, not only need the adaptive ability of each individual in the process of mutual cooperation, more needs group. In the search process has shown complex and orderly behavior of ant colony, individual information exchange and cooperation plays a vital role in. Effect of ant colony algorithm in the number of m on the performance of the algorithm and its selection in real application, also can be analyzed by computer simulation experiment and determine.

Wireless sensor network routing optimization is essentially a routing optimization problem solving multi criteria QoS. Usually the wireless sensor network is abstracted into a weighted vertex set V and edge set E directed graph G (V, E), where nodes set V={1,2,, n}, end points s, u V respectively represent the source node and the destination node, the other representing a forwarding node. A collection of A elements called edge, with arc (I, J) represents the node i to node j, wherein I, J V, arc (I, J) E, arc edge (I, J) dynamic variable weights between nodes I and Eij said J routing metric or routing cost.

ZigBee device object (ZD0) a series of service application objects and manufacturer defined used for network layer and application layer interface. The APS sub layer the services provided by the data service entity (APSDE) and management service entity (APSME) to realize. APSDE access points through data service entity (APSDE - SAP) to provide data transmission services.

In the model of ant cycle, released in the path of the information content of Q ant cycle when the amount. The general understanding is: the total amount of information Q bigger, path in ant has passed on the information pheromone accumulation speed, can strengthen the positive feedback performance of ant colony search, fast convergence help algorithm. Due to various algorithm parameters in ant colony algorithm effect is tightly coupled, which plays an important role on the performance of the algorithm is a heuristic factor expected heuristic factor information, and information remains constant 3 parameters.

Ant colony algorithm by swarm intelligence can obtain the global optimal solution, has strong scalability, robustness and adapt to the dynamic environment, is very suitable for wireless sensor networks and has received extensive attention in many research fields. At present, used in network routing algorithm based on Ant Colony Optimization for mobile self networking solution for ARH algorithm, ABC algorithm of telecommunication circuit switched network load balancing problem.

3. Application of Ant Colony Algorithm in Building RFID Routing
RFID radio frequency identification is a kind of automatic recognition technology of non-contact, RF signal through its automatic target recognition and access to relevant data, identify the work without human intervention, it can work in various environments.

Due to the adoption of RFID technology, the system can automatically read RFID tags within the user information, without the need for manual input information related to the payment process, the user does not need to directly provide the mobile phone number, therefore, as the mobile phone number of user privacy is better protected.

Ants from point A (nest) starting, speed is the same, the destination point in D (food), may randomly select route ABD or ACD. Assuming the initial time each distribution line an ant, each unit of time walking step, graph above, after 9 time units when the situation: go ABD ants to reach the terminal, and take the ACD ant just go to C, for half the journey [6]. In the after 18 time units when the situation: go ABD ants arrive after the end to get food returned to the starting point of A, and ACD ants came to D. Assuming the ant every leave pheromone as a unit, after 36 time units, all start starting with the ants go through different paths made food from D, the ABD routes to and from the 2 times, each pheromone is 4 units, while the ACD route round trip, each pheromone is 2 units, the ratio is 2:1.

The RFID chip can be read-only, but also read / write mode, according to the application demand. Passive marker equipment adopts E2PROM (electrically erasable programmable read only memory), easy to use specific electronic processing device to write data. General labeling equipment in the factory is set to read-only. The Auto-ID specification also includes deadlock command, to stop the tracking process under appropriate circumstances.

Sorting ant colony system introduced the concept of sorting genetic algorithm, the basic principle is: the improvement of each ant release pheromone evaporation affected by their respective levels, according to their respective level to determine volatile degree.

$$\Delta\tau_{ij} = \sum_{k=1}^{\omega-1}(\omega-\gamma)\Delta\tau_{ij}^{k} + \omega\Delta\tau_{ij}^{best} \tag{6}$$

$$\Delta\tau_{ij}^{\gamma} = \begin{cases} 1/L_{\gamma} \\ 0 \end{cases} \tag{7}$$

Where w is an ant generation path, and it is from short to long be sorted according to their respective path length, r represents the grade shorter path length is higher, and k is vice versa. Therefore, in the update pheromone, not considering all of the ants, and it is only considering the "excellent" ant (said ant ranking), as is shown by equation (6,7). The algorithm proposed in this paper has the following characteristics:

(1) Routing cost. The distributed routing decisions, to avoid the routing table in the network, route maintenance automatically in the data transmission process, does not need the transmission process using additional data package and data transmission for route maintenance;

(2) Good adaptive ability. Ant colony algorithm for self-organizing features make the algorithm can automatically adapt to the dynamic changes in the network state and the node energy, algorithm robustness.

In RFID system, signal transmitter for different application purposes, will exist in different forms, the typical form of tag (TAG). Label the equivalent of bar code technology in the bar code symbol, used to store the need to identify the transmission of information, in addition, with the bar code is different, the label must be able to automatically or under the action of external force, the stored information initiative launched.

The first cycle started, these ants were arrived at the B point and D point, since all the path on the initial pheromone values are equal, it is assumed that the ants are divided into two parts from two paths in the optional a, so there will be fifteen only to C, the rest of the way to F. The second cycle, because half of the BFD is the length of the path BCD path, thus BcD pheromone will be two times, after BFD, and thirty ants from the B and the D, as shown in figure (c), the route choice probability formula, there will be twenty ants to C and B admiral D, ten ants left to F, and so on, the path to the BCD pheromone will be more and more, so that the ants will choose the optimal path.

Each from the source node to the destination node V_I V_J transmission of data packets, and it is the equivalent of a path to enhance the ant. The path is enhanced by the ant pheromone to achieve cast mechanism, namely through the modified node pheromone to achieve in the data transmission process. Optimal path will automatically appear in the process. Automatic optimization mechanism can ensure automatic selection of optimal path in the data transmission process of ants. As with real ants, it is the pheromone concentration, not permanent. Changes in the concentration of pheromone through two mechanisms, and it are pheromones and pheromone evaporation enhancement.

This algorithm is seeking the optimal multi hop path from the cluster head node to the sink node, artificial ants according to formula (3) choose the next hop node, only need to explore the neighbor nodes, instead of all nodes except the list nodes, the total computation times are reduced. PSACA algorithm is a distributed parallel algorithm, artificial ants from the boundary node set out to find the optimal path, the sink node. So, the time complexity of the algorithm can be used in the worst situation any artificial ants search only met to consider.

4. Using Ant Colony Algorithm to Construction Wireless Sensor Zigbee and RFID Routing

Ant colony algorithm is a bionic optimization algorithm of intelligent behavior of ant colony a simulated insect kingdom of latest developments in. It has strong robustness, excellent distributed computer system; it is easy to combine with other methods, the source of thought in nature in ant colony foraging for food process. In the process of feeding, the ant will release related to path length of the pheromone on the path it through, path is longer, the smaller amount of information release. Then the ants can exist and the concentration of pheromone perception, to guide their direction of motion, and tend towards the pheromone concentration high direction. Then, the collective behavior of ants will show a positive feedback of information tendency.

In wireless sensor network, each node needs to know the information of adjacent nodes, including each connection round-trip time, available bandwidth, and the pheromone values. In order to accurately reflect the network status, need to be connected in sending the HELLO message detection with the neighbors, update the routing information. The HELLO message includes a transmitting node ID, timestamp, and available bandwidth. HELLO message every time (such as one second) broadcast again. The receiving node to the news, with the current time minus the time stamp to calculate RTT, then check the message nodes in the neighbor table, if you update the value in the corresponding table neighbors, if not add the node information in the neighbor table.

At present, the routing algorithm design features and use the energy of ZigBee network itself effectively has become an important research topic in ZigBee network. As the energy resource, computing power and bandwidth of ZigBee nodes in the network are very limited, and the ZigBee nodes are usually powered by batteries, the effective use of ZigBee network's lifetime depends heavily on energy of the batteries, the effective use of node energy and prolong the network lifetime in ZigBee network is crucial.

RFID access to consider this problem, in this design, the privacy issues are saved in the IBS or server in the leakage of information, such as personal data. RPS confirmed that a user's privacy rights and privacy policy. No matter when, in the IBS server or receive security information server query events will be transmitted to the RPS, the RPS server check user information and gives the user privilege level.

Above the columns of the TSP problem as the research object, 0.5, 0.6, algorithm of the parameter information heuristic factor taken as ant cycle: total quantity Q = a week by the release of 1, pheromone remaining constant 1, the stop condition of the operation is adjacent two loop search optimal solutions in difference of less than 0.003 the number of ants, and make changes to m={12,23,34,45,55, expected heuristic factor 7}. The simulation results on the performance of the algorithm affect the number of ants.

In this paper, through the Matlab programming, the improved ant colony algorithm, the traditional ant colony algorithm is analyzed and compared. This paper selects 600 nodes randomly distributed and each transmission process of data fusion, here, the assumption that each node transmits and receives are of a fixed size 4500bit data. In the range of 403m*210m, the base station is located at (95600), in the range of 340m*350m, the base station is located at (50200). Ant colony algorithm parameters setting are 564343. Experiment 1000 times. According to the network size scaling network scene area is to maintain a constant node density.

Impact on the performance of the algorithm and its selection in practical application, it can be analyzed by computer simulation experiment and determine. Above the columns of the TSP problem as the research object, and a □ heuristic factor in ant colony algorithm ant colony number 0.9, M = 65, the algorithm parameters taken as ant cycle: total quantity Q = a week by the release of 1, pheromone remaining constant simulation on the performance of the algorithm affects the results as described in the following table. Display: stop condition and operation of two adjacent circular searches for optimal solutions in difference of less than 0.001, combined the heuristic factor of different values.

This paper presents an algorithm of Zigbee wireless sensor network based on ant colony optimization. Maintenance of distributed memory mechanism of this algorithm using ant colony adaptive optimization mechanism and ants are selected and the routing path, through optimizing the data transmission path and the remaining energy of nodes, network balanced energy consumption, prolong the network lifetime.

CONCLUSION

The paper proposes using ant colony algorithm to construction wireless sensor Zigbee and RFID routing. In WSN, each sensor node in the routing process and the ant foraging optimization behavior has great similarity, therefore, routing algorithm based on ant colony optimization to design WSN is feasible on theory. Based on this, we put the sensor node simulates the ants, the selection of sensor path simulation into ant foraging path choice heuristic information path simulation into ant release in the pheromone on a path, we propose a routing algorithm based on ant colony optimization.

The ant colony optimization ZigBee routing algorithm shows unique advantage in the routing of wireless sensor network, and it can improve the service quality of the network, prolong the service life, saving the cost of. Therefore, the ant colony algorithm routing protocol for sensor networks based on a great deal of attention. Due to the positive feedback principle, coordination and the implicit parallelism more so that it has great development potential, and can be understood as a reinforcement learning algorithm of special. According to the ZigBee routing strategy and ant colony optimization features, and it is structure of sensor node. This algorithm has better energy

saving and global optimization ability, and improve the performance of network, to achieve network optimization.

REFERENCES

[1] Coello C A C;Gutierrez R L Z;Garcia B M. *Engineering Optimization*,**2002**,34(2),109-127.
[2] Heinzelman W B; Chandrakasan A P; Balakrishnan H. *IEEE Trans. on Wireless Commun*, **2002**, 1(4): 660-667.
[3] Jiping Li; Shouyin Liu; Shixun Wu. *IJACT*, **2012**, 4(12), 233 - 240.
[4] He Jialiang; Ouyang Dantong; Zhu Xi; Ji Jinchao, *AISS*, **2012**, 4(7), 155 - 162.
[5] WANG Jun-Ping; LI Jia-Yan. *JCIT*, **2013**,8(5), 585 -592.
[6] ZHANG Deyu; LI Chunyan.*JDCTA*, **2012**,6(23), 766 - 773.