International Journal of Advance Research in Science and Engineering
Vol. No.4, Issue 11, November 2015
www.ijarse.com
IJARSE
ISSN 2319 - 8354

CLUSTER BASED ENERGY EFFICIENT ROUTING WIRELESS SENSOR NETWORKS

Mohit Kumar[1], Dr. Vinay Kumar Singh[2]

[1]Lecturer, [2]Assistant Professor, HOD (CS & IT Deptt., Anand Engineering College (India)

ABSTRACT

The popularity of Wireless Sensor Networks (WSN) have increased tremendously in recent time as WSN has the potentiality to connect the physical world with the virtual world by forming a sensor network. Sensor networks are composed of thousands of resource constrained sensor nodes and resourced base stations which communicate with each other via wireless communication.

Here, sensor nodes are usually battery-operated devices, and hence energy saving of sensor nodes is a major design issue. Moreover, the energy required to transmit a message is about twice as great as the energy needed to receive the same message. Therefore, the route of each message destined to the base station is really crucial in terms of network lifetime.

In cluster-based routing, special nodes called cluster heads form a wireless backbone to the sink. Each cluster heads collects data from the sensors belonging to its cluster and forwards it to the sink. Energy saving in these approaches can be obtained by cluster formation, cluster-head election, data aggregation at the cluster-head nodes to reduce data redundancy and thus save energy.

I. INTRODUCTION

A sensor network consists of multiple detection stations called sensor nodes, each of which is small, lightweight and portable. Every sensor node is equipped with a transducer, microcomputer, transceiver and power source. The transducer generates electrical signals based on sensed physical effects and phenomena. The microcomputer processes and stores the sensor output. The transceiver receives commands from a central computer and transmits data to that computer. The power for each sensor node is derived from a battery.

Wireless sensor networks satisfy these requirements. Desirable functions for sensor nodes include: ease of installation, self-identification, self-diagnosis, reliability, time awareness for coordination with other nodes, some software functions and DSP, and standard control protocols and network interface. The development of low-cost, low-power, a multifunctional sensor has received increasing attention from various industries. Sensor nodes or motes in WSNs are small sized and are capable of sensing, gathering and processing data while communicating with other connected nodes in the network, via radio frequency (RF) channel.

WSN term can be broadly sensed as devices range from laptops, PDAs or mobile phones to very tiny and simple sensing devices. At present, most available wireless sensor devices are considerably constrained in terms of computational power, memory, efficiency and communication capabilities due to economic and technology reasons. WSNs nodes are battery powered which are deployed to perform a specific task for a long period of time, even years. If WSNs nodes are more powerful or mains-powered devices in the vicinity, it is beneficial to utilize their computation and communication resources for complex algorithms and as gateways to other networks.

Much more important to sensor network operation is energy-efficiency, which dictates network lifetime, and the high level QoS, or fidelity, that is met over the course of the network lifetime. This QoS is application-specific and can be measured a number of different ways. For example, in a typical surveillance application, it may be required that one sensor remains active within every sub region of the network, so that any intruder may be detected with high probability. In this case, QoS may be defined by the percentage of the environment that is actually covered by active sensors. In a typical tracking application, this QoS may be the expected accuracy of the target location estimation provided by the network

II. PROBLEM FORMULATION

2.1 Problem of Security

In the wireless sensor network, all nodes placed randomly, the neighbor node set of any node is not predefined or fixed. At a time of placed A node can be sense its neighbor nodes and evaluates their behaviors of communication. When the node detects there is a ma-licious node that wants to communicate from the neighbor, the node try to eliminate the malicious node from the neighbor nodes and no longer communicates with the malicious node. But the malicious node is always try to move to a new location to continue to implement the attacks. So, when the node detects if there is malicious node, the node try to notify the entire network of the ID of the malicious node. Considering a more complicated situation, the malicious node is detected, and after that the malicious node changes its ID, and after change the id then moves to a new location to attacks. Because the malicious node has a new ID now,and behave like a new node, and other nodes think that the malicious node is a normal node of their group. As shown in Figure 1, this arise a serious problems to the monitoring of malicious nodes.

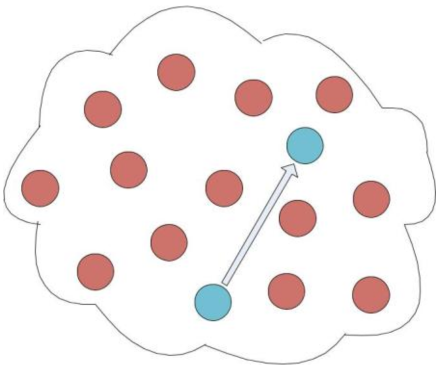

Figure 1. The Malicious Node Moves and Changes its ID.

2.2 Problem of Limited Energy

The Path decision in EBRP is decided According to the energy density of the node.

The algorithm try to achieve efficient energy-balanced effect in immobile wireless sensor network, but there may be some problems arise in mobile wireless sensor network. In EBRP, the following formula calculating energy density:

IJARSE
ISSN 2319 - 8354

$$ED(i) = \sum_{j} \frac{E(j)}{S(i)} \qquad (1)$$

The j is the neighbor node of the node i, E(j) is the residual energy of the node j, S(i) is the area of communication coverage of the node i.

The neighbor nodes of the node i change rapidly, Due to node mobility. when every time the neighbor nodes change, the values in Formula (1) are calculated again for a sum operation, this calculation may be some time complex. Because whenever the location of neighbor nodes change, the neighbor node has to set either adds a new node or reduces an old node. So the energy density is also change because, needs to add the value of the new node or subtract the value of the old node.

III. ENERGY FACTOR

The node needs to consider the energy factor when making the routing decision. The energy factor includes the residual energy and energy density.

The detail energy model is shown in Figure 5 .

If A k-bit message Forwarding consumes energy as follows:

$$E_{Tx} = E_{Tx\text{-}elec}(k) + E_{Tx\text{-}amp}(k,d) = \begin{cases} kE_{elec} + k\varepsilon_{fs} d^2, & d < d_0 \\ kE_{elec} + k\varepsilon_{mp} d^4, & d \geq d_0 \end{cases} \qquad (12)$$

To receive a k-bit message, the energy consumption is computed by:

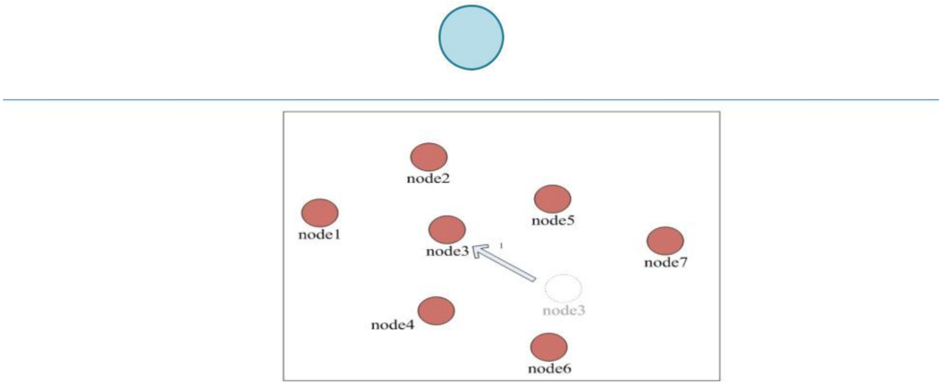

Figure 4. Tracing Technique Through Neighbor Nodes

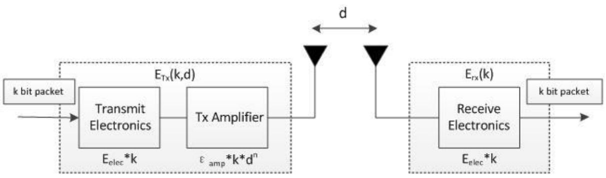

Figure 5. Energy model.

$$E_{Rx} = E_{Rx_{elec}}(k) = kE_{elec} \tag{13}$$

In Wireless Sensor Networks, energy consumption is happened due to the communication and calculation, but communication is the main energy consumption. So, Formula (12) and (13) will be used in simulation experiments to calculate the energy consumption of sensor nodes.

Formula (14) is to calculate the energy density of the node:

$$ED(i) = \sum_j \frac{E(j)}{S(i)} \tag{14}$$

J is the parent nodes and sibling nodes, their depths are less than or equal to the depth of the node i, E(j) is the residual energy of the node j, S(i) is the area of communication coverage of the node i.

IV. SECURE AND ENERGY-BALANCED ROUTING ALGORITHM

This improved genetic algorithm uses three basic genetic operators. Shown in Fig. 4.1 the description of the main operational process is:

Step 1: Data Initialization. This step includes: setting the counter of the evolutionary generation as zero(t<-0), setting the maximal evolutionary generation T, coding, converting the feasible solution space into the search space, producing M Individuals(namely chromosomes) randomly as the initial population P(0).

Step 2: Local Routing Repair. This step removes the routing loop through the repair function.

Step 3: Evaluating Individual Fitness. This step mainly computes the each individual fitness in the population P(t) through the fitness function.

Step 4: Selection Operation. This step selects the better individuals according to the corresponding selection operator.

Step 5: Crossover Operation. This step produces the new individuals to complete the global search according to the corresponding crossover operator.

Step 6: Mutation Operation. This step produces the new individuals to complete the local search according to the corresponding mutation operator.

Step 7: Producing the New Population. This step takes charge of integrating all the individuals into the new population P(t+1).

Step 8: Judging Whether to Terminate the Program. If t <T, the program goes to Step 5 and t<-t+1. If t>T, the program goes to Step 9.

Step 9: Outputting the Result. In this step, the program outputs the best individual, and then the program is terminated.

V. ANALYSIS OF SIMULATION RESULTS

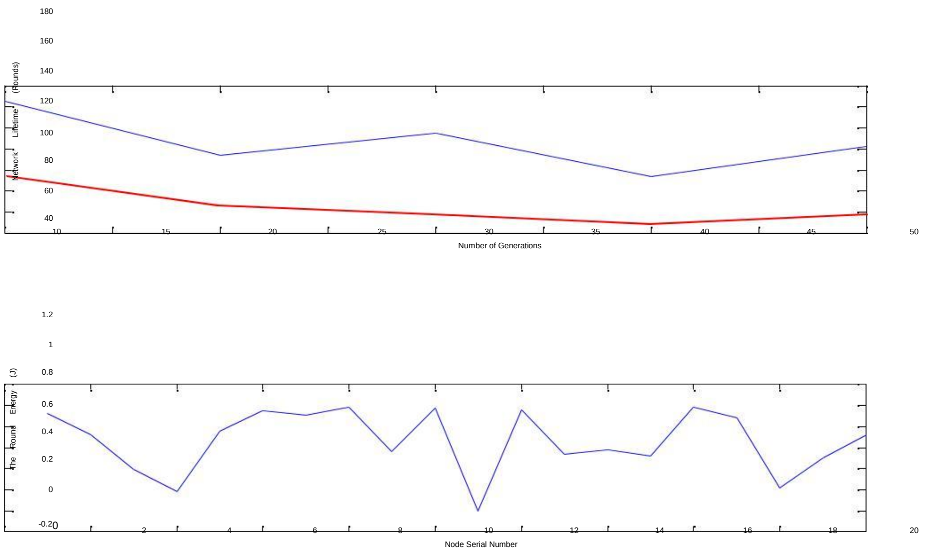

Figure 6 The comparison of network lifetime under the different amounts of the nodes

Figure 6.shows two diagrams. The first one show respectively the results of network lifetime among the above two situations for 100mx 100m area, for the different amounts of the nodes.

The second graph shows the residual energy of twenty nodes for 100m X 100m network area when the first dead node appears.

VI. CONCLUSION & FUTURE SCOPE

In this Dissertation work, the energy efficient clustering algorithms related to WSNs are discussed.

The work reported herein investigates two aspects of WSN.

(a) Energy efficient routing algorithm for WSN.

(b) Deployment of WSN in Environmental monitoring of Food products' Warehouses using energy efficient routing and Genetic Algorithm.

The basic genetic algorithm for the design of energy-efficient routing in the wireless sensor network has been improved and simulated. The improved genetic algorithm can overcome the problem of energy imbalance caused by the connection of multi-node to one node in the wireless sensor network, so as to greatly prolong the network lifetime.

The future work will focus on how to further improve the convergence of genetic algorithms. It will shorten the time used to find the best routing and reduce the delay caused by processing.

In this thesis, genetic algorithm has been used. Other algorithms can also be compared to genetic algorithm to reduce the computational complexity; but the challenge of significantly reducing time and power consumption still remains. Comparable study of computational complexity of different algorithm need to be analyzed.

REFERENCES

[1] Ahn,C.W. and Ramakrishna, R.S. "A Genetic algorithm for Shortest Path Routing Problem and the Sizing of Populations", IEEE Transactions on Evolutionary computation, vol.6(6), (2002).

[2] Glenn Fung, *"A Comprehensive Overview of Basic Clustering Algorithms",*June 22, 2001

[3] Guo Wenliang, Shi Huichang, Yan Jun, Zhou Yifei, "Application of Genetic Algorithm in Energy-Efficient Routing", School of Communication and Information Engineering, Shanghai University, Shanghai 200072, China

[4] Juhana Yrjölä, "Energy-Efficient Communication Protocol forWireless Microsensor Networks", T-79.194 Seminar on theoretical computer science 2005 Algorithmics of sensor networks

[5] S.Mohanty and S.K.Patra, "A novel Bio-inspired Clustering algorithm for Wireless Sensor Networks", *accepted in 3rd International Conference on Intelligent and Advanced Systems,* Kuala Lumpur, Malaysia *(ICIAS 2010).*

[6] S. Misra, S. C. Misra, I. Woungang, *Guide to Wireless Sensor Networks*.: Springer, 2009.

[7] Shah.R.C. Rabaey.J.M. "Energy aware routing for low energy ad hoc sensor networks", Wireless Communications and Networking Conference, (WCNC2002), IEEE, vol.1, pp.350- 355, (2002).

[8] W. Heinzelman, A. Chandrakasan and H. Balakrishnan, "Energy-efficient communication protocol for wireless microsensor networks," in *Proc. of the 33rd Annual V Hawaii International Conference on System Sciences (HICSS),* Maui, HI, Jan. 2000, pp. 3005 – 3014.

[9] Zhen Jiang, Junchao Ma, Wei Lou, Jie Wu, "A Straightforward Path Routing in Wireless Ad Hoc Sensor Networks," 29th IEEE International Conference on Distributed Computing Systems Workshops (ICDCSW), pp.103-108, (2009).