IJARCCE

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

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 6, June 2016

Enhanced Sleep Scheduling Algorithm for Geographic Routing by Data Encoding

Amal Mohan[1], Dr. Rini Jones S B[2]

M.Tech Scholar (Wireless Technology), ECE Department, College of Engineering, Kidangoor, India[1]

Associate Professor, ECE Department, College of Engineering, Kidangoor, India[2]

Abstract: Recent researches in wireless sensor networks (WSNs) are focused on geographic routing technique. Nearly all existing work in sleep scheduled geographic routing are silent in the case of security and data loss. Also the technique is struggled with limited lifetime, throughput and high energy consumption. In this paper, we focus on improving the security and data loss problems along with increased lifetime, throughput and less energy consumption. Existing sleep scheduling algorithms geographic-distance-based connected-k neighborhood for first path (GCKNF) and geographic-distance-based connected-k neighborhood for all paths (GCKNA) are used as the base to develop the new algorithm. By theoretical analysis and simulations, we show that the new algorithm can achieve better output compared to the existing one.

Keywords: Geographic routing, wireless sensor networks (WSNs), Sleep Scheduling, Data Encoding.

I. INTRODUCTION

Geographic routing[1] is a promising and efficient routing technique in wireless sensor networks (WSNs). It uses the position information for packet forwarding decisions. Unlike the traditional topological routing algorithms, it uses the geographic location of destination, instead of using network address. Hence the algorithm can make forwarding decisions regardless of the network size, irregular radio ranges and location errors. This makes geographic routing attractive among other routing protocols[4]. Sleep scheduling algorithms[6]-[8] have an advantage of saving energy by dynamically putting nodes to sleep and waking them according to some sleep scheduling algorithms.

However, almost all the sleep scheduling algorithms are silent about the data security in the network. Since the sensors are operated on battery power, and energy is not always renewable due to cost, environmental and form-size concerns, lengthy or high power consumed algorithms or techniques are not suited for geographic forwarding. Also, in an ad hoc network, the sensors can actually be mobile; hence, there is a possibility of data loss in the network. The risk is even more in the case of sleep scheduled networks. Considering the connected-k neighborhood (CKN) sleep scheduling algorithm[2] and the geographic routing oriented sleep scheduling (GSS) algorithm, geographic distance based connected-k neighborhood for all paths (GCKNA) may give better result. But finding the shortest path by geographic distance based connected-k neighborhood for all paths (GCKNA)[10] may not be the best method to overcome this problem. Proper encoding of the data can solve this problem to a large extent.

This paper addresses the security and data loss problem in sleep scheduled WSNs with mobile nodes employing geographic routing.

The main contributions of this paper are summarized as follows.

1. Data has been encrypted using the XOR algorithm, and which can increase the network security[11].
2. XOR encoding converts the data packets into blocks and compresses the data, which can solve the data loss problem.

Data compression decreases the data loss and increases the throughput in the network, which may also increases the network life time by increased energy saving.

II. RELATED WORK

A. Geographic Routing

Geographic routing uses the greedy forwarding technique. Here each data packet is tagged with the coordinates of the destination node and the packets are forwarded to the neighboring node closest to the destination node. Assumed, all nodes are known about its own coordinates. Geographic routing has a number of challenges. Since the source and destination nodes can be mobile in nature, there is a chance of data loss in the network. The methods which can be used to overcome this problem are either the use of proper routing algorithm or the compression of data. Nearly all present works do not attempt to attend this problem. Use of a lengthy complex algorithm may not be the right choice to this problem, as it may drain the battery faster. Hence the use of a compression technique may work at this time.

B. Sleep Scheduling

Sleep scheduling is a technique which enables the node to cycle between the sleep and active states dynamically or according to the instructions of some algorithms. Point

IJARCCE

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

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 6, June 2016

coverage and nodal coverage methods are usually employed in the networks. Among a number of sleep scheduling techniques used in geographic routing, connected-k neighborhood (CKN) sleep scheduling algorithm, the geographic routing oriented sleep scheduling (GSS) algorithm and geographic-distance-based connected-k neighborhood (GCKN) sleep scheduling algorithm, are the algorithms which gives focus on node mobility in the network.

C. Network Coding

Network coding [9] is a technique which enables coding of the data packets in every node which received from the neighbouring node.Network coding can affect the security, throughput and reliability in both favourable and adverse ways depending upon the application and network scenario. Network coding has a number of applications. Some of them are link-loss monitoring, topology inference, operation of switches, on-chip communication and distributed storage.

III.ALGORITHM DEFINITION

In network coding technique, the intermediate nodes are allowed to encode the data packets received from its neighbouring nodes.

A. Encoding Operation

A node, that wants to transmit encoded packets, chooses two different set of data packets from two different sources. A set of n packets Pi(i = 1, 2,3,....,n) and Qi(i = 1, 2, 3,.....,n) are encoded linearly into blocks. The output encoded block is given by

$$X = \sum_{i=1}^{n} PiQi$$

The coded blocks are transmitted to the next neighbor and finally to the destination. One of the original data packet from Pi and Qi is used to decode theXORed data packet.

B. Encoding Algorithm

1. Received data packets are inserted into RecvQueue()
2. Identify the packets to forward and move to PacketQueue()
3. If PacketQueue() is not empty
4. Identify the sources and destinations of data packets
5. If two different sources has the same destination
6. XOR the data packets and put into FrwdQueue()
7. Transmit the encoded blocks to next neighbour
8. elseif
9. Same source has different destinations
10. XOR the packet with another which is to the same destination from another source
11. Transmit the encoded blocks to next neighbour
12. endif
13. endif
14. else
15. Put the data packets into FrwdQueue()
16. Transmit the packets to next neighbour
17. elseif
18. PacketQueue() = empty
19. exit
20. goto step 1

The received data packets are moved to Received Packets Queue(). Thenpackets to be forward are sorted and moved to Packet Queue(). In Packet Queue(),if two different packets from two different sources has the same destination address,then the two packets will be XOR together and moved to Forward Queue(). Alsothe packet from the same source to different destination are XOR with the packetsto the same destination from a different source and moved to Forward Queue().Other packets are directly moved to the forward Queue(). All data packets in theForward Queue are forwarded to the neighbouring node.

C. Decoding Operation

A set of linear equations are solved in a node to solve the retrieved information from the neighbouring nodes. A set of encoding data packet are received bythe receiver sensor nodes with the encoded data.

Let, a set of blocks or packets (Q1, X1), (Q2, X2) ..., (Qm, Xm) has been received by a node. The symbols Yj and Qj denote the informationdata and the coding coefficient or coding data for the jth received packet respectively.The decoding operation of a node involves the solution of m equations and n unknowns.

$$Xj = \sum_{i=1}^{n} Pi\, Qj^{i},\ j = 1, 2, ...m$$

For proper decoding of the received packets, at least n independent packets must be received. The unknowns, Pi and Qi, contains theoriginal packets that are transmitted in the network. XOR coding is used in here which is a special case of linear coding.

D. Decoding Algorithm

1. Received data packets are inserted into RecvQueue()
2. Identify the packets to recover and move to RecvrQueue()
3. If RecvrQueue() is not empty
4. Identify the encoded packets and move to DecdQueue()
5. If DecdQueue() is not empty
6. Pick the encoded blocks and XOR with packets in the RecvrQueue() withsame source address
7. endif
8. exit
9. goto step 1

All received data packets are moved to Received Packets Queue(). Data to bedecoded or not to transmit are moved to RecvrQueue(). From the RecvrQueue()encoded blocks are identified and moved to DecdQueue().

Every data block inthe DecdQueue() will be the data XORed from different sources. Those blocks areagain XOR with packets in the RecvrQueue() which have same source address anddifferent last sending node address.

IJARCCE

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

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 6, June 2016

IV. EVALUATION RESULTS

Snapshot of the experiment results are shown below. Snapshot shows a clear comparison between GCKN algorithm and the new algorithm for delay, lifetime and energy in the network.

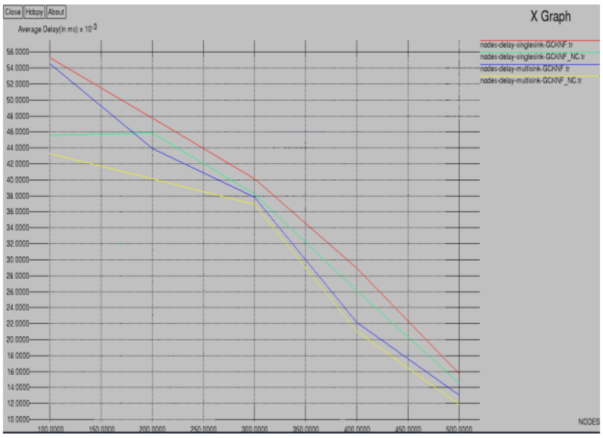

Fig1.Nodes delay in single sink and multi sink experiments

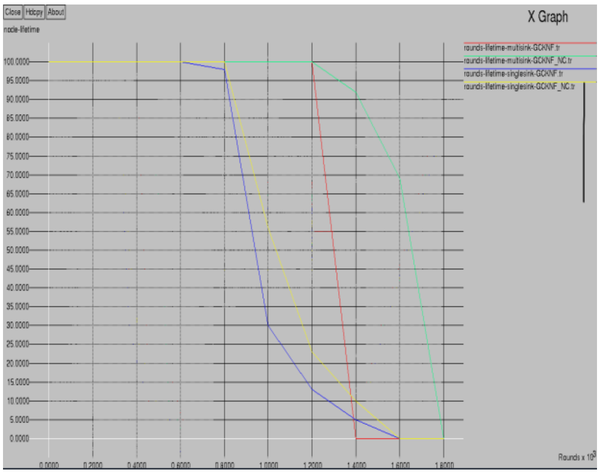

Fig 2.Nodes lifetime in single sink and multi sink experiments

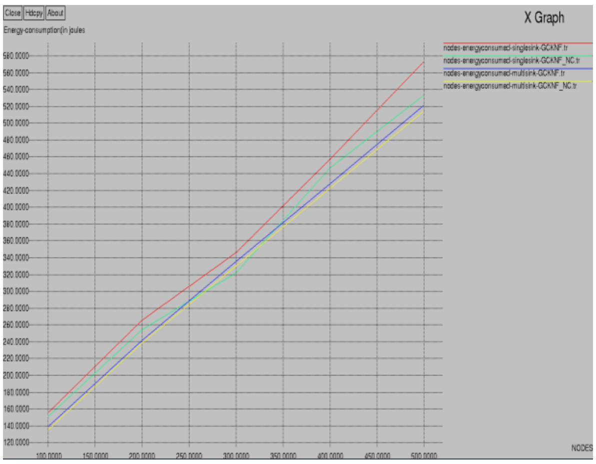

Fig. 3. Nodes energy in single sink and multi sink experiments

Every figure shows results in both single sink and multi sink conditions.

In every figure, red and green lines show the corresponding results in single sink condition and blue and yellow shows them in multi sink condition. Also red and blue are for GCKN algorithm and green and y are for new encoding algorithm.

From the figures, it is clear that, the new algorithm can perform better than that of a GCKN algorithm in a sleep scheduled geographic routing network. Decreased delay, energy consumption and increased lifetime can be obtained by the use of new algorithm. Also the algorithm ensures more security and throughput in the network.

V. CONCLUSION

In this paper, we have explored geographic routing in sleep scheduled mobile WSNs and proposed an enhanced geographic distance based connected-k neighborhood (GCKN) algorithm with XOR encoding and decoding.

The newly developed algorithm for sleep scheduled geographic routing networks can solve the data loss problem of a mobile node to a large extent. It also offers better security, throughput, less energy consumption and delay in the network.

REFERENCES

[1] Theory and Practice of Geographic Routing, Stefan Ruhrup
[2] S. Nath and P. B. Gibbons,"Communicating via fireflies: Geographic routing on duty-cycled sensors," in Proc. IPSN, 2007, pp. 440–449.
[3] C.-F. Hsin and M. Liu, "Network coverage using low duty-cycled sensors: Random & coordinated sleep algorithms," in Proc. IPSN, 2004, pp. 433–442.
[4] B. Karp and H. T. Kung, "GPSR: Greedy perimeter stateless routing for wireless networks," in Proc. MobiCom, 2000, pp. 243–254.
[5] C. Ma et al., A geographic routing algorithm in duty-cycled sensor networks with mobile sinks, in Proc. MSN, 2011, pp. 343344.
[6] A. H. M. Ammari and S. K. Das, Joint k-coverage, duty-cycling, and geographic forwarding in wireless sensor networks, in Proc. IEEE ISCC, 2009.pp. 487492
[7] P. Cheng, F. Zhang, J. Chen, Y. Sun, and X. Shen, A distributed TDMA scheduling algorithm for target tracking in ultrasonic sensor networks, IEEETrans. Ind. Electron., vol. 60, no. 9, pp. 38363845, Sep. 2013.
[8] Q. Cao, T. Abdelzaher, T. He, and J. Stankovic, Towards optimal sleepscheduling in sensor networks for rare-event detection, in Proc. IPSN, 2005,pp. 202.
[9] S.Y. Li, R. W. Yeung, and N. Cai, "Linear network coding," IEEE TransInf. Theory, vol. 49, no. 2, pp. 371-381, 2003.
[10] C. Zhu, L. T. Yang, L. Shu, J. J. P. C. Rodrigues, and T. Hara, "A geographicrouting oriented sleep scheduling algorithm in duty-cycled sensor networks,"in Proc. IEEE ICC, 2012, pp. 5473-5477.
[11] Rashmi Ranjan Rout, Soumya K. Ghosh, Enhancement of Lifetime using Duty Cycle and Network Coding in Wireless Sensor Networks, in IEEE transactions on wireless communications, vol. 12, no. 2, february 2013

IJARCCE

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

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 6, June 2016

BIOGRAPHY

Amal Mohan is pursuing M.Tech in Wireless Technology from College of Engineering Kidangoor. He received his B.Tech in Electronics and Communication Engineering from Veda Vyasa Institute of Technology, Malappuram, Kerala. His primary research interest includes communication and computer networking.

Dr. Rini Jones S B is working as Associate Professor and HOD in Department of Electronics and Communication Engineering, College of Engineering, Kidangoor. She received her Ph.D in Control Systems from Department of Electronics and Instrumentation Engineering, Karunya University, Tamil Nadu, India, Master of Engineering Degree in Applied Electronics from Anna University, Tamil Nadu, India and Bachelor of Engineering Degree in Electronics & Communication Engineering from M.S. University, Tamil Nadu, India.Her areas of interest are Control Systems and Fuzzy Systems.