International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Node Failure Detection & Energy Efficient Routing In Geographic Wireless Sensor Network

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Abstract: ***Geographic routing is one of the most promising routing schemes in wireless sensor networks (WSNs) due to its simplicity, scalability, and efficiency. almost all current works about geographic routing in duty-cycled WSNs try to change the geographic forwarding mechanism to deal with the dynamic topology caused by some nodes being cycled off or going to sleep mode. I propose three type of algorithm for improving the QoS and life time of the network .Two geographic-distance-based connected-k neighborhood (GCKN) sleep scheduling algorithms, a node failure detection algorithm (NFDA) and energy efficient routing algorithm (EERA) are proposed in this paper***

Keywords: WSNS, GCKN, NFDA, EERA

1. Introduction

Geographic routing is one of the most promising routing schemes in wireless sensor networks (WSNs), due to its simplicity, scalability, and efficiency. In such a scheme, regardless of the network size, the forwarding decision is determined purely based on the location of each node and it can be done even when there are irregular radio ranges and localization errors. Recently, the research focus of geographic routing is centering on WSNs with duty-cycles, since duty- cycled WSNs have a natural advantage of saving energy by dynamically putting nodes to sleep and waking them according to some sleep scheduling algorithms. However, nearly all these works overlook one important fact that sensors can actually be mobile to gain better energy efficiency, channel capacity, etc., and enable a lot of new application scenarios .

For example, because sensors can move, they can transmit their data from different locations and avoid the problem that sensors near the gateway or sink always exhaust their energy first; thus, energy usage can be more efficient. Also, mobile sensors such as mobile phones or cars can become the interface between the information centre and the mobile customers; thus, real-time information (e.g., traffic information) transmitted from the information center to these mobile objects can be provided to nearby customers. Moreover, almost all current works about geographic routing in duty-cycled WSNs try to change the geographic forwarding mechanism to deal with the dynamic topology caused by some nodes being cycled off or going to sleep mode. For instance, it is suggested in to wait for the appearance of the expected forwarding successor first and select a backup node if the first mechanism fails. For my project I use WSNs that uses two geographic-distance-based connected-k neighborhoods (GCKN) sleep scheduling algorithms. The first one is the geographic-distance-based connected-k neighborhood for first path (GCKNF) sleep scheduling algorithm, aiming at geographic routing utilizing only the first transmission path in duty-cycled mobile WSNs. The second one is the geographic-distance-based connected-k neighborhood for all paths (GCKNA) sleep scheduling algorithm, for geographic routing concerning all paths explored in duty-cycled mobile WSNs. geographic routing can achieve much shorter average lengths for the first transmission paths searched in mobile WSNs employing GCKNF sleep scheduling and all transmission paths explored in mobile WSNs employing GCKNA sleep scheduling compared with those in mobile WSNs employing CKN or GSS sleep scheduling.

Due to the limited energy and communication ability of sensor nodes, it seems especially important to design a routing protocol for WSNs so that sensing data can be transmitted to the receiver effectively in terms of energy. And the use of large numbers of sensor nodes in WSNs, the sensor node failure gets increased. It has affected the reliability and efficiency of WSNs. To maintain the high quality of WSN, detection of failed or malfunctioning sensor node is essential. The failure of sensor node is either because of communication device failure or battery, environment and sensor device related problems. To check the failed sensor node manually in such environment is troublesome. This project presents a new method to detect the sensor node failure or malfunctioning in such environment.

The proposed method uses the round trip delay (RTD) time to estimate the confidence factor of RTD path. Based on the confidence factor the failed or malfunctioning sensor node is detected. Hardware based simulation result indicates the easy and optimized way of detecting failed or malfunctioning sensor node in symmetrical WSN. An energy-balanced routing method, based on forward-aware factor is used for reduce the energy consumption. These two methods are used for obtain reliable and efficient WSNs which uses geographic-distance-based connected-k neighborhood (GCKN) sleep scheduling algorithm.

2. Scope and Objectives of Proposed Work

In this project, I focus on sleep scheduling for geographic routing in duty-cycled WSNs with mobile sensors. The research focus on geographic routing, a promising routing scheme in wireless sensor networks (WSNs), is shifting toward duty-cycled WSNs in which sensors are sleep scheduled to reduce energy consumption. Geographic routing is one of the most promising routing schemes in wireless sensor networks (WSNs), due to its simplicity, scalability, and efficiency. In such a scheme, regardless of the network size, the forwarding decision is determined purely based on the location of each node and it can be done even when there are irregular radio ranges and localization errors. Recently, the research focus of geographic routing is centering on WSNs with duty-cycles, since duty- cycled WSNs have a natural advantage of saving energy by dynamically putting nodes to sleep and waking them according to some sleep scheduling algorithms. However, nearly all these works overlook one important fact that sensors can actually be mobile to gain better energy efficiency, channel capacity, etc., and enable a lot of new application scenarios.

Moreover, almost all current works about geographic routing in duty-cycled WSNs try to change the geographic forwarding mechanism to deal with the dynamic topology caused by some nodes being cycled off or going to sleep mode. For instance, it is suggested in to wait for the appearance of the expected forwarding successor first and select a backup node if the first mechanism fails.

The sensor field is sliced into some k-coverage fields, and then some always-on cluster heads are selected to collect the data from their nearby sensors and finally transmit all data to the sink. Apart from the connected-k neighborhood (CKN) sleep scheduling algorithm proposed in and the geographic routing oriented sleep scheduling (GSS) algorithm presented in, few research works have tackled the node availability uncertainty issue in duty-cycled WSNs from the view of sleep scheduling. This project addresses the sleep scheduling problem in duty- cycled WSNs with mobile nodes (referred as mobile WSNs in the following) employing geographic routing. I pro- pose two geographic-distance-based connected-k neighborhoods (GCKN) sleep scheduling algorithms. The first one is the geographic-distance-based connected-k neighborhood for first path (GCKNF) sleep scheduling algorithm, aiming at geographic routing utilizing only the first transmission path in duty-cycled mobile WSNs. The second one is the geographic-distance-based connected-k neighborhood for all paths (GCKNA) sleep scheduling algorithm, for geographic routing concerning all paths explored in duty-cycled mobile WSNs. Due to the limited energy and communication ability of sensor nodes, it seems especially important to design a routing protocol for WSNs so that sensing data can be transmitted to the receiver effectively in terms of energy. And the use of large numbers of sensor nodes in WSNs, the sensor node failure gets increased. It has affected the reliability and efficiency of WSNs. To maintain the high quality of WSN, detection of failed or malfunctioning sensor node is essential. In this project, i focus on sleep scheduling for geographic routing in duty-cycled WSNs with mobile sensors and propose two method for reduce energy consumption and detection of failed or malfunctioning sensor nodes in the network .An energy-balanced routing method, based on forward-aware factor is used for reduce the energy consumption and uses the round trip delay (RTD) time to detect the failed or malfunctioning sensor node.

The objective of proposed method is to detect the sensor node failure or malfunctioning with the help of confidence factors. Confidence factor of round trip path in network is estimated by using the round trip delay (RTD) time. The proposed method will detect the failure in sensor node for symmetrical network conditions.

In this way it helps to detect failed or malfunctioning sensor, which can be used to get correct data in WSNs or the exact sensor node can be repaired or working status (health) of the WSNs can be checked. The time required for detection is in the range of sec; hence data loss can be avoided. And also an energy-balanced routing method FAF-EBRM based on forward-aware factor is proposed in my project. In FAF-EBRM, the next-hop node is selected according to the awareness of link weight and forward energy density. Define forward energy density, which constitutes forward-aware factor with link weight, and propose a new energy-balance routing protocol based on forward-aware factor, thus balancing the energy consumption and prolonging the function lifetime.

3. Design of Proposed Work

In this project, I focus on sleep scheduling for geographic routing in duty-cycled WSNs with mobile sensors and propose two method for reduce energy consumption and detection of failed or malfunctioning sensor nodes in the network .An energy-balanced routing method, based on forward-aware factor is used for reduce the energy consumption and uses the round trip delay (RTD) time to detect the failed or malfunctioning sensor node. These two methods are used for obtain reliable and efficient WSNs which uses geographic-distance-based connected-k neighborhood (GCKN) sleep scheduling algorithm.

Detection of failed or malfunctioning sensor nodes

In the proposed system discrete Round Trip Path (RTP) is formed and need to calculate Round Trip Delay (RTD) time for each discrete RTP. In a Linear RTP number of sensors is equal to RTP to reduce analysis time, optimize is required, hence Discrete RTP is selected to reduce analysis time. RTD is compared with a threshold value to identify the failure node or malfunction node. Malfunction node RTD time is greater than the threshold value and for Failure node RTD value will be infinity.

Algorithm for detecting fault node consists of two phases. In First phase consider all nodes working properly calculate RTD value highest RTD time is consider as the threshold value. In second phase the fault node is identified by comparing RTD value with the threshold value identified in first phase if the RTD value is greater than the threshold value then it is consider as the malfunction node .RTD value is equal to infinity then the node is consider as the dead node.

An energy-balanced routing method

As an important part of industrial application (IA), the wireless sensor network (WSN) has been an active research area over the past few years. Due to the limited energy and communication ability of sensor nodes, it seems especially important to design a routing protocol for WSNs so that sensing data can be transmitted to the receiver effectively. An energy balanced routing method based on forward-aware factor (FAF-EBRM) is proposed in this project. In FAF-EBRM, the next-hop node is selected according to the awareness of link weight and forward energy density.

FAF-EBRM is used for the large-scale WSN for static data collection and event detection. In (30), the first term takes the FED of all of the possible next-hop nodes into account, which means the ability to transmit data. The second term considers the weight of transmit link, which can be used to choose the next-hop node directly. Because the definition of the weight of edge considers parameters like nodes' energy, length, and load, the routing algorithm based on FAF is able to consider many factors and get a better energy-balanced solution. The routing algorithm can be divided into seven stages as follows.

The routing algorithm can be divided into seven stages as follows.

1) Determine FTA (i) (Forward transmission area of node i) and all of the possible next-hop nodes of node. First, take as the communication radius, determine the set of all of the nodes that have edges with i, N`(i). (N`(i) is the set of nodes of N(i) that have an edge with node i), Select the nodes that closer to Sink than does, which constitute the set of all of the possible next-hop nodes and the furthest node determine FTA(i) .

2) Determine FTA (j) and S_{FTA}(j) of each possible next-hop node. Determine FTA(j) as we determined FTA(i) . Plug the furthest distance between j and nodes in FTA and the distance between j and *Sink* into

$$S_{\mathrm{FTA}}(i) = \frac{1}{2}\pi d_2^2 - d_2\sqrt{d_1^2 - \frac{1}{4}d_2^2} + \left(d_1^2 - \frac{1}{2}d_2^2\right) \times \arccos\left[1 - \frac{1}{2}\left(\frac{d_2}{d_1}\right)^2\right].$$

and obtain S_{FTA}(i)

3) Calculate FED (j) of each possible next-hop node using.

$$\mathrm{FED}(i,t) = \frac{\sum_{j\in FTA(i)} E_j(t)}{S_{\mathrm{FTA}}(i)}$$

Plug all of the nodes' energy into $\frac{2E_i(t=0)}{\pi d_0^2} < \mathrm{FED}(i,t) < +\infty$ and get FED(j).

4) Calculate the weight of edges between i and each nodes according the equation

$$w_{ij}(t) = \frac{\zeta(E_i(t)E_j(t))^{\psi}}{(d(i,j)^2)^{\eta}(T_{ij}(t))^{\xi}}.$$

5) Plug the parameters of III and IV into

$$\mathrm{FAF}(ij) = \alpha\frac{\mathrm{FED}(j)}{\sum_{j\in\mathrm{FTA}(i)}\mathrm{FED}(j)} + \beta\frac{w_{ij}}{\sum_{j\in\mathrm{FTA}(i)} w_{ij}}$$

$\alpha+\beta=1.$ and calculate FAF of each possible transmit link.

Choose the next-hop node according to $j = \max_j[\mathrm{FAF}(ij)]$

6) If there is no node closer to Sink than i in N`(i) , directly compare FAF of all of the nodes in N`(i), and choose the next-hop node according to $\alpha+\beta=1.$. If there is no node in N`(i), i will increase the transmit power to get a longer radius than d0 until connected with another node, or i will abandon the packet.

4. Simulation Results

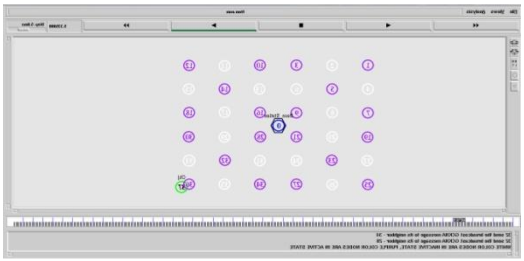

Figure 1: Sleep scheduling in geographic wireless sensor network

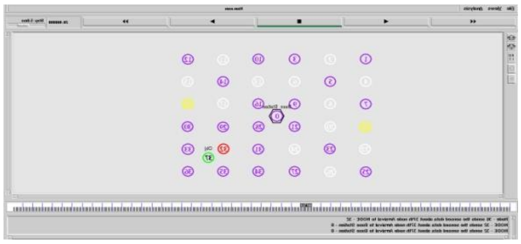

Figure 2: Node failure detection in sleep scheduled geographic wireless sensor network

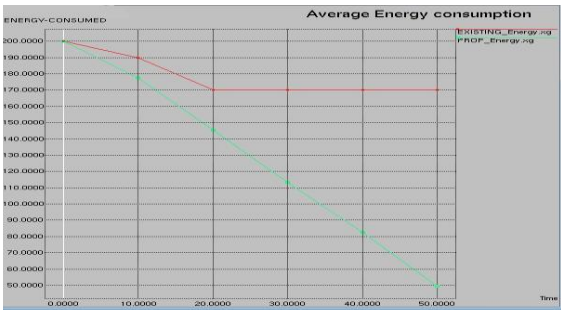

Figure 3: graph showing energy consumed verses time in node failure detection and energy efficient routing in geographic wireless sensor network

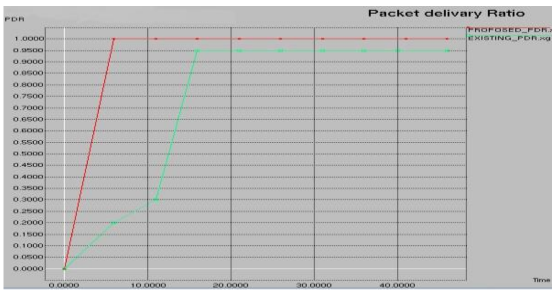

Figure 4: graph showing packet delivery Ratio verses time in node failure detection and energy efficient routing in geographic wireless sensor network

5. Conclusion

An energy-balanced routing method FAF-EBRM based on forward-aware factor is proposed in this project. In FAF-EBRM, the next-hop node is selected according to the awareness of link weight and forward energy density. For the experiment, FAF-EBRM is compared with LEACH and EEUC, and experimental results for showing that FAF-EBRM outperforms LEACH and EEUC, which balances the energy consumption, prolongs the function lifetime, and guarantees high QoS of WSN. Also, need to show that the distributions of node degree, strength, and edge weight follow power law and represent “tail,” so the topology has robustness and fault tolerance, reduces the probability of successive node breakdown, and enhances the synchronization of WSN

The proposed method requires few computations in case of symmetrical network conditions. Because of this it requires less time and has good accuracy. By using this method we can detect one faulty node present in any path in an easy and efficient way. Fault in terms of failure or malfunctioning is detected correctly by the proposed algorithm. The wireless device interfaced with sensor circuit plays a major role in the measurement of round trip delay time. So selection of efficient wireless communication module is essential. For such detection scheme Bluetooth as well as ZigBee are best suited modules.

References

[1] Chunsheng Zhu, Laurence T. Yang, , Lei Shu, Victor C. M. Leung**,** Sleep Scheduling for Geographic Routing in Duty-Cycled Mobile Sensor Networks, Ieee Transactions On Industrial Electronics, Vol. 61, No. 11, November 2014,
[2] Degan Zhang, Guang Li, IEEE Transactions On Industrial Informatics, Vol. 10, No. 1, February 2014 An Energy-Balanced Routing Method Based on Forward-Aware Factor for Wireless Sensor Networks, IEEE Transactions On Industrial Informatics, Vol. 10, No. 1, February 2014
[3] Ravindra Navanath Duche and Nisha P. Sensor Node Failure Detection Based on Round Trip Delay and Paths in WSNs B. Karp and H. T. Kung, “GPSR: Greedy perimeter stateless routing for wireless networks,” Sarwade IEEE Sensors Journal, Vol. 14, No. 2, February 2014
[4] B. Leong, B. Liskov, and R. Morris, “Geographic routing without pla- narization,” in Proc. NSDI, 2006, pp. 339–352.
[5] Y.-J. Kim, R. Govindan, B. Karp, and S. Shenker, “Lazy cross-link re- moval for geographic routing,” in Proc. SenSys, 2006, pp. 112–124.