IMPROVE QUALITY BASE LINK ROUTING FOR WSN USING GREEDY FORWARD ALGORITHM

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ABSTRACT: *In this paper, proposed Qos link based greedy forwarding model is a simple yet efficient technique employed by many routing protocols. It is ideal to realize point-to-point routing in wireless sensor networks because packets can be delivered by only maintaining a small set of neighbor's information regardless of network size. It has been successfully employed by geographic routing, which assumes that a packet can be moved closer to the destination in the network topology if it is forwarded geographically closer to the destination in the physical space. This assumption, however, may lead packets to the local minimum where no neighbors of the sender are closer to the destination or low-quality routes that comprise long distance hops of low packet reception ratio. To address the local minimum problem, a topology aware routing (TAR) protocol is proposed that efficiently encodes a network topology into a low-dimensional virtual coordinate space where hop distances between pair wise nodes are preserved. Based on precise hop distance comparison, TAR can assist greedy forwarding to find the right neighbor that is one hop closer to the destination and achieve high success ratio of packet delivery without location information. Further, it improves the routing quality by embedding a network topology based on the metric of expected transmission count (ETX). ETX embedding accurately encodes both a network's topological structure and channel quality to node's small size virtual coordinates, which helps greedy forwarding to guide a packet along the optimal path that has the fewest number of transmissions. Thereby routing performance is improved in terms of routing success ratio and routing cost.*

Keyword: QoS Link Base Protocol, TAR, ETX, Virtual Coordinate, Point to Point Routing Protocol

I. INTRODUCTION

Distributed systems are groups of networked computers, which have the same goal for their work. The terms "concurrent computing", "parallel computing", and "distributed computing" have a lot of overlap, and no clear distinction exists between them. The same system may be characterized both as "parallel" and "distributed" the processors in a typical distributed system run concurrently in parallel. Parallel computing may be seen as a particular tightly coupled form of distributed computing, and distributed computing may be seen as a loosely coupled form of parallel computing.

Nevertheless, it is possible to roughly classify concurrent systems as "parallel" or "distributed" using the following criteria:

- In parallel computing, all processors may have access to a shared memory to exchange information between processors.
- In distributed computing, each processor has its own private memory (distributed memory). Information is exchanged by passing messages between the processors.

The situation is further complicated by the traditional uses of the terms parallel and distributed algorithm that do not quite match the above definitions of parallel and distributed systems see the section Theoretical foundations below for more detailed discussion. Nevertheless, as a rule of thumb, high-performance parallel computation in a shared-memory multiprocessor uses parallel algorithms while the coordination of a large-scale distributed system uses distributed algorithms.

II. RELATED WORK

Yunfeng Chen et al [1] describe a Wireless Sensor Network (WSN) is a collection of wireless sensor nodes forming a temporary network without the aid of any established infrastructure or centralized administration. In such an environment, due to the limited range of each node's wireless transmissions, it may be necessary for one sensor node to ask for the aid of other sensor nodes in forwarding a packet to its destination, usually the base station. One big issue when designing wireless sensor network is the routing protocol to make the best use of the severe resource constraints presented by WSN, especially the energy limitation. In this paper, they propose a new scheme called EBMR: Energy-Balancing Multipath Routing Protocol that uses multipath alternately to prolong the lifetime of the network.

Nadeem Ahmed Salil et al [2] describe a several anomalies can occur in wireless sensor networks that impair their desired functionalities i.e., sensing and communication. Different kinds of holes can form in such networks creating geographically correlated problem areas such as coverage holes, routing holes, jamming holes, sink/black holes and worm holes, etc. They detail in this paper different types of holes, discuss their characteristics and study their effects on successful working of a sensor network. Wherever Times is specified, Times Roman or Times New Roman may be used. If neither is available on your word processor, please use the font closest in appearance to Times. Avoid using bit-mapped fonts. True Type 1 or Open Type fonts are required. Please embed all fonts, in particular symbol fonts, as well, for math, etc.

Brad Karp et al [3] describe a Greedy Perimeter Stateless Routing (GPSR), a novel routing protocol for wireless datagram networks that uses the positions of routers and a packet's destination to make packet forwarding decisions. GPSR makes greedy forwarding decisions using only information about a router's immediate neighbors in the network topology. When a packet reaches a region where greedy forwarding is impossible, the algorithm recovers by routing around the perimeter of the region. By keeping state only about the local topology, GPSR scales better in per-router state than shortest-path and ad-hoc routing protocols as the number of network destinations increases. Under mobility's frequent topology changes, GPSR can use local topology information to find correct new routes quickly. They describe the GPSR protocol, and use extensive simulation of mobile wireless networks to compare its performance with that of Dynamic Source Routing. Our simulations demonstrate GPSR's scalability on densely deployed wireless networks.

Pei Huang et al [4] describe a simple yet efficient greedy technique employed by many routing protocols. It is ideal to realize point-to-point routing in wireless sensor networks because packets can be delivered by only maintaining a small set of neighbors' information regardless of network size. It has been successfully employed by geographic routing, which assumes that a packet can be moved closer to the destination in the network topology if it is forwarded geographically closer to the destination in the physical space. His assumption, however, may lead packets to the local minimum where no neighbors of the sender are closer to the destination or low-quality routes that comprise long distance hops of low packet reception ratio. To address the local minimum problem, they propose a topology aware routing (TAR) protocol that efficiently encodes a network topology into a low dimensional virtual coordinate space where hop distances between pairwise nodes are preserved. Based on precise hop distance comparison, TAR can assist greedy forwarding to find the right neighbor that is one hop closer to the destination and achieve high success ratio of packet delivery without location information.

Shigang Chen et al [5] describe a Wireless sensor networks have attracted great attention in research and industrial development due to its fast-growing application potentials. New techniques must be developed for sensor networks due to their lack of infrastructure support and the constraints on computation capability, memory space, communication bandwidth, and above all, energy supply. To prolong the life time of a battery-powered sensor network, an energy efficient routing algorithm for data collection is essential. They propose a new geographic routing algorithm that forwards packets from sensors to base stations along efficient routes. The algorithm eliminates the voids that cause non-optimal routing paths in geographic routing. It replaces the right-hand rule by distance upgrading. It is fully distributed and responds to topology changes instantly with localized operations. They formally prove the correctness of the algorithm and evaluate its performance by simulations.

III. ROUTING METHODOLOGY

A. Routing

The sensor node exploits a path depending only on the location information of neighbor nodes in geographic routing, routing protocol based on geographic information is more efficient. Due to its high expansibility and low influence by network size, geographic routing has wide application prospects in large scale WSNs. Routing protocols based on virtual coordinate have various forms, which make them flexible to implement according to practical network conditions without constraint from the physical locations. Though greedy algorithm is simple in principle and low in complexity, it cannot be applied to all sensor nodes when some routings based on virtual coordinate are adopted in the network. The template is used to format your paper and style the text. All margins, column widths, line spaces, and text fonts are prescribed; please do not alter them. You may note peculiarities. For example, the head margin in this template measures proportionately more than is customary. This measurement and others are deliberate, using specifications that anticipate your paper as one part of the entire proceedings, and not as an independent document. Please do not revise any of the current designations.

B. Routing Void in Geographic Routing

In geographic routing, when greedy forwarding is adopted, it can be easily interrupted due to the terrain or radio coverage, for example, pools, hills or buildings which locate in the sensor area. The finite distance of communication range can also cause greedy forwarding failing. When a sensor node tries to forward the packet to one neighbor node that is geographically closer to the destination node than itself, but such node doesn't exist, then a routing void is encountered. Greedy forwarding fails in this situation.

A node n1 tries to forward a packet to the destination node d1 by greedy forwarding in multi hops. First, node n1 sends the packet to n2 by greedy forwarding. Since the neighbor nodes set of n2 is {n1, n3, n4}, none of which is closer to the node destination d1, and then a routing void is encountered and greedy forwarding fails to deliver the packet. Similarly, a routing void is encountered at node n5 when it tries to forward a packet to the destination node d2.

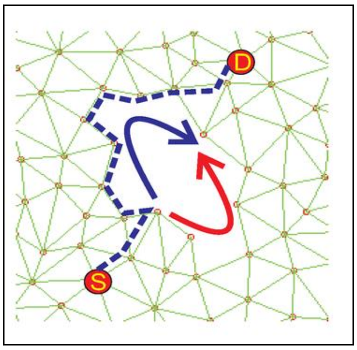

Fig 3.1 GeographicRouting

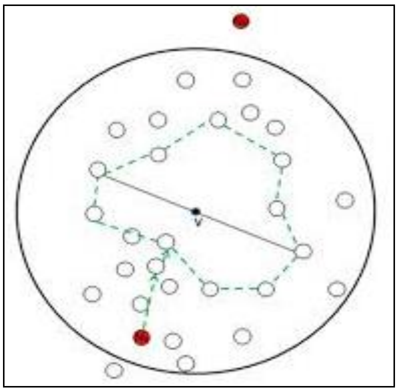

Fig. 3.2. Routing void in greedy forwarding

Around the obstacle area, greedy forwarding fails at node n5 as described above. But for different destinations, greedy forwarding may not fail at the same node. For example, if n5 tries to forward a packet to the destination node d1, packet can arrive at d1 along with the path n5→n6→n7→d1 without routing problem.

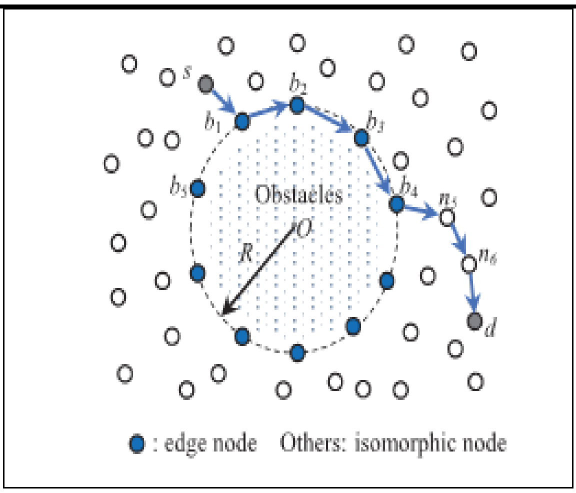

Fig. 3.3. Edge structure without routing void

Assuming the number of edge nodes around an obstacle in WSNs is Nb, the set of edge nodes is {bk | k = 1, · · · Nb}, both of the following conditions should be satisfied

$$\begin{cases} d(b_k, b_{k+1}) < T_c, & k = 1, \cdots N_b - 1 \\ d(b_1, b_{N_b}) < T_c \end{cases}$$

$$\begin{cases} \{b_{k+i} \mid d(b_k, b_{k+1}) < T_c, & k = 2, \ldots N_b - 2, \\ & 2 \le i \le N_b - k\} = \varnothing \\ \{b_k \mid d(b_1, b_k) < T_c, & k = 3, \ldots N_b - 1 = \varnothing \end{cases}$$

where d(x, y) represents the Euclidean distance between node x and y, Tc represents the communication distance of nodes, i is an integer. According to formula, every edge node can only communicate with its two neighbors belonging to the set {bk|k = 1, · · · Nb}. If all the edge nodes around the obstacle have the same distance to a point O as following: d(bk, O) = R, k = 1,. . . Nb, where R is a constant. In this situation, all the edge nodes locate on a circle with center point O and radius R.

IV. LQRT ROUTING METHODOLOGY

Void processing mode is composed of three phases, according to processing in the order, respectively void detecting, virtual coordinate mapping and void region dividing. After the implement of void processing mode, the virtual coordinates of edge nodes are established. Then greedy mode is reactivated, these edge nodes that have the virtual coordinates can be selected as the relay node by greedy algorithm.

A. Void Detecting Phase

The main function of the void detecting phase is to collect edge node information around the routing void after the void is encountered. When routing void emerges in the transmission process, the node at which the greedy mode fails is defined as the discovery node. After the discovery node discovers a void, it stores data packets temporarily at first, then generates a void detecting packet for starting a void detecting process. During the process, the void detecting packet records the time when the void is encountered, edge node's label and geographical coordinate. In the process of void detecting, there may be multiple discovery nodes in the same void region, so there may be multiple detecting packets around current void at the same time. In this condition, in order to avoid the repetition that different detecting packets detect and forward around the same void, the edge nodes record the time when void is encountered after receiving a detecting packet. Based on the sequence of discovery time, a node discards the detecting packet if the time recorded in the current packets is later than their records, otherwise the node forwards the detecting packet.

B. Virtual Coordinate Mapping Phase

The virtual coordinate mapping phase is responsible for mapping the edge node coordinates stored in the detecting packed to a virtual circle, i.e., converting a structure composed of edge nodes to the structure without routing void. The detecting packet that returns to the discovery node stores all the information of the current void, including node's label and geographic coordinates. (x j, y j), (x j+1, y j+1),…(x_{imax}, y_{imax}) represent the nodes coordinates, thus the center coordinate of the void is

$$(x_o, y_o) = \left(\frac{1}{(i_{max} - j + 1)} \sum_{k=j}^{i_{max}} x_k, \ \frac{1}{(i_{max} - j + 1)} \sum_{k=j}^{i_{max}} y_k\right)$$

The maximum distance between edge nodes and the void center is

$$d_o = max\{d_k | d_k = \sqrt{(x_k - x_o)^2 + (y_k - y_o)^2}, \\ k = j, j + 1, \cdots i_{max}\}$$

After virtual coordinate mapping, the discovery node generates a distributing packet which contains the virtual coordinates and center of virtual mapping circle. The distributing packet is forwarded along the way (the routing void edge) that the detecting packet establishes. Every edge node broadcasts a message containing both virtual coordinate and center of virtual mapping circle to its neighbor nodes after receiving the distributing packet. In this way, both the edge nodes and the neighbor nodes learn the void information.

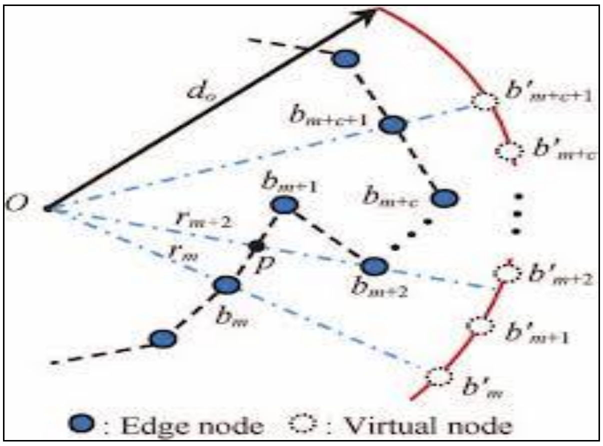

Fig. 4.1. Virtual Coordinate Mapping

O is the center of void, and the arc is a part of the virtual mapping circle. The virtual coordinates of edge node b1, b5 are b'1 and b'5 respectively, and the virtual coordinates of edge node b2, b3, b4 are b'2, b'3, b'4 respectively, locating between the virtual node b'1 and b'5.

C. Void region dividing phase

The main function of the void region dividing phase is to divide the surrounding area of the void into three different regions, in which different routing strategies are applied. According to the void position and the location of destination node of the packets, the surrounding area of a void is divided into approaching region, departing region and free region. O is the center of mapping virtual circle, d is the destination node, the circle shown in dotted line is the virtual mapping circle. Two tangents to the mapping virtual circle through the destination node have the intersections at points m and n respectively.

The quadrilateral region formed by O, m, d, and n is defined as departing region of the virtual mapping circle, as the region B. The area formed by two tangents of the virtual mapping circle, except the departing region, is defined as approaching region of the virtual mapping circle as the region A. The area outside of the two tangents is defined as free region of the virtual mapping circle as region C. An excellent style manual for science writers is given by Young [7]. Using the Template

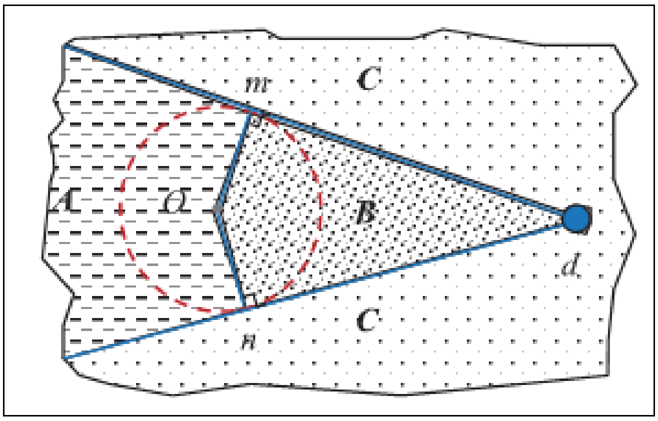

Fig. 4.2. Void Region Dividing

V. RESULT AND DISCUSSION

The simulations are performed in visual studio C#.net to demonstrate and evaluate the performance of Bypass Void Routing – Virtual Coordinate Mapping with quality of links. In the simulations scenario, to evaluate the affection of different void node detection and the quality of the link is considered in random distribution network.

S.NO	Number of WSN Node (n)	BVR-VCM (N_{bvr}) (ND)	QoS-Link-VCM (N_{QoS})
1	50	12	9
2	100	27	17
3	150	36	25
4	200	49	37
5	250	62	46
6	300	76	54
7	350	83	69
8	400	94	73
9	450	102	82
10	500	117	95

Table 5.1. Void Node Detection for BVR-VCM and QoS-Link-VCM Model

The table 5.1 and 5.2 describes the number of WSN nodes in the communication and number of nodes in the void area at the various radious of the obstacle area. And also, it contains the number of quality of the link nodes in the bypass void routing with the virtual coordinate mapping process.

S.NO	Number of WSN Node (n)	BVR-VCM (N_{bvr}) (ms)	QoS-Link-VCM (N_{QoS}) (ms)
1	50	0.07	0.05
2	100	0.15	0.09
3	150	0.22	0.14
4	200	0.26	0.18
5	250	0.34	0.23
6	300	0.39	0.27
7	350	0.42	0.33
8	400	0.47	0.38
9	450	0.51	0.42
10	500	0.58	0.46

Table 5.2. Comparison of Void Node Detection Time for BVR-VCM and QoS-Link-VCM Model

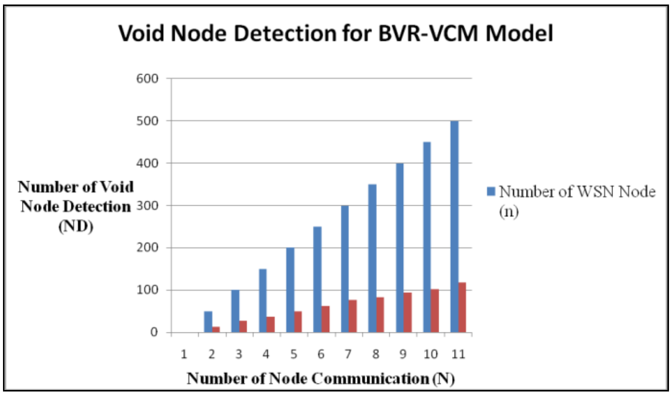

Fig 5.3. Void Node Detection for BVR-VCM Model

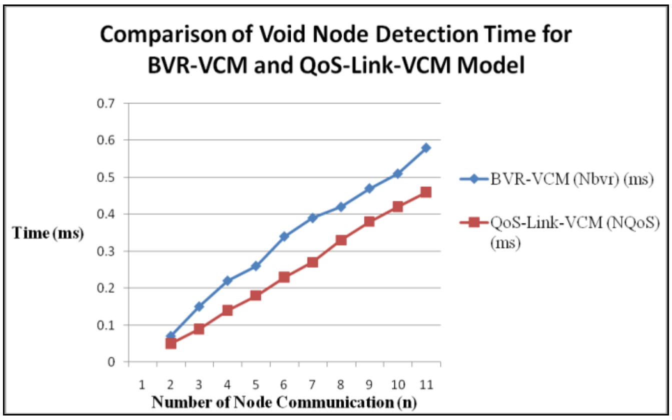

Fig 5.4. Comparison of Void Node Detection Time for BVR-VCM and QoS-Link-VCM Model

VI. CONCLUSION

The paper introduces a method to improve routing performance with small routing states. It solves the local minimum problem by embedding a network topology to a low-dimensional Euclidean space where hop distances between pairwise nodes. Based on accurate hop distance comparison between neighboring nodes, the greedy forwarding can find the shortest path between two nodes. The project shows that the routing quality can be improved by embedding a network topology to a Euclidean space. Nearest node location need not be retrieved from base station, since partial path information (achieved through maintaining trusted value of the path) is maintained. Calculation overhead is reduced since it maintains the quality details of previous communications. Future work will be to make proposed protocol generalized to common applications. To eliminate the possibility that the discovery packet could overload when detecting large voids, the alternative method of void detecting will be taken into consideration. The project provides a best assistance in the network environment. It allows adding up the following facilities in future.

- The routing success ratio can be tracked.
- The routing log can be maintained.

REFERENCES

[1] M. Chen, J. Wan, S. Gonzalez, X. Liao, and V. C. M. Leung, "A survey of recent developments in home M2M networks," IEEE Commun. Surveys Tuts., vol. 16, no. 1, pp. 98–114, Feb. 2014.

[2] M. Li, Z. Li, and A. V. Vasilakos, "A survey on topology control in wireless sensor networks: Taxonomy, comparative study, and open issues," Proc. IEEE, vol. 101, no. 12, pp. 2538–2557, Dec. 2013.

[3] S. Zhang, D. Li, and J. Chen, "A link-state based adaptive feedback routing for underwater acoustic sensor networks," IEEE Sensors J., vol. 13, no. 11, pp. 4402–4412, Nov. 2013.

[4] F. Cadger, K. Curran, J. Santos, and S. Moffett, "A survey of geographi- cal routing in wireless ad-hoc networks," IEEE Commun. Surveys Tuts., vol. 15, no. 2, pp. 621–653, May 2013.

[5] B. Tang and L. Zhang, "Optimization of energy multi-path routing protocol in wireless sensor networks," J. Syst. Eng. Electron., vol. 35, no. 12, pp. 2607–2612, Dec. 2013.

[6] X. Wang, J. Wang, K. Lu, and Y. Xu, "GKAR: A novel geographic K-anycast routing for wireless sensor networks," IEEE Trans. Parallel Distrib. Syst., vol. 24, no. 5, pp. 916–925, May 2013.

[7] S. Lee, E. Kim, C. Kim, and K. Kim, "Localization with a mobile beacon based on geometric constraints in wireless sensor networks," IEEE Trans. Wireless Commun., vol. 8, no. 12, pp. 5801–5805, Dec. 2009.

[8] W. Liu, E. Dong, Y. Song, and D. Zhang, "An improved flip ambiguity detection algorithm in wireless sensor networks node localization," in Proc. 21st Int. Conf. Telecommun., Lisbon, Portugal, May 2014, pp. 206–212.

[9] J. Wang, E. Dong, F. Qiao, and Z. Zou, "Wireless sensor networks node localization via leader intelligent selection optimization algorithm," in Proc. 19th Asia-Pacific Conf. Commun., Bali, Indonesia, Aug. 2013, pp. 666–671.

[10] W. Liu, E. Dong, and Y. Song, "Robustness analysis for node multilatera- tion localization in wireless sensor networks," Wireless Netw., Nov. 2014. [Online]. Available: http://dx.doi.org/10.1007/s11276-014-0865-0