



Enhanced Greedy Anti –Void Routing Protocol with Hop Count Reduction for Wireless Sensor Networks

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Abstract -- In this paper the solution to the void problem is taken up as the issue. This situation which exists in the currently existing greedy routing algorithms has been studied for the wireless sensor networks. The GAR protocol is a new protocol proposed here to guarantee the delivery of packets and excessive consumption of control overheads is resolved. This protocol is a combination of the GF algorithm and the RUT scheme. In RUT scheme the usage of Boundary Map concept increases the speed and efficiency in finding the nodes which will aid for a faster and a guaranteed delivery. To enhance this protocol's functionality we go in for three mechanisms that can also be implemented in this project. The hop count reduction (HCR) scheme is utilized as a short-cutting technique to reduce the routing hops by listening to the neighbor's traffic, the intersection navigation (IN) mechanism is proposed to obtain the best rolling direction for boundary traversal with the adoption of shortest path criterion. These three schemes are incorporated within the GAR protocol to further enhance the routing performance with reduced communication overhead. The proofs of correctness for the GAR scheme are also given in this Project.

Keywords- Greedy routing, void problem, unit disk graph, localized algorithm, wireless sensor network.

I. INTRODUCTION

Smart environments represent the next evolutionary development step in building, utilities, industrial, home, shipboard, and transportation systems automation. Like any sentient organism, the smart environment relies first and foremost on sensory data from the real world. Sensory data comes from multiple sensors of different modalities in distributed locations. The smart environment needs information about its surroundings as well as about its internal workings; this is captured in biological systems by the distinction between exteroceptors and proprioceptors. The figure1 shows the complexity of wireless sensor networks, which generally consist of a data acquisition network and a data distribution network, monitored and controlled by a management center. The plethora of available technologies makes even the selection of components difficult, let alone the design of a consistent, reliable, robust overall system.

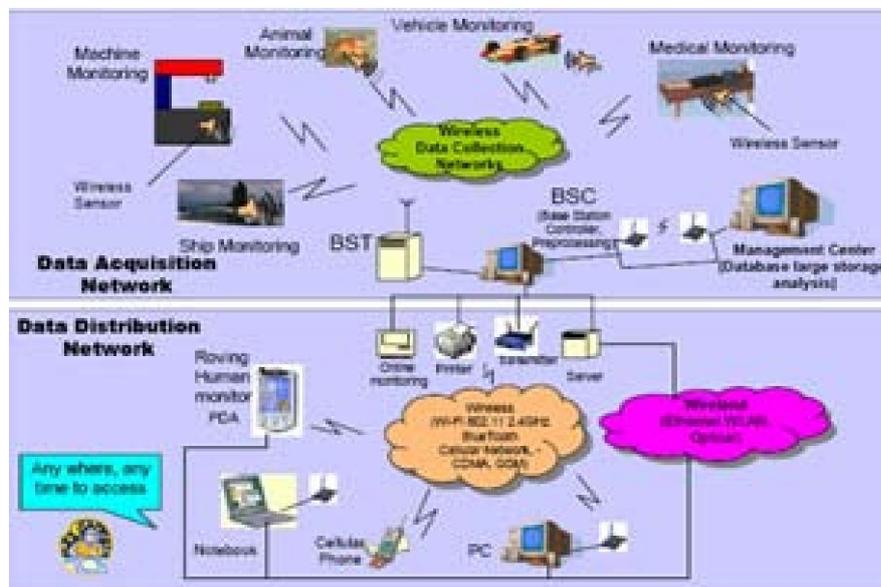


Figure 1 : The Wireless Sensor Network

The study of wireless sensor networks is challenging in that it requires an enormous breadth of knowledge from an enormous variety of disciplines. In this chapter we outline communication networks, wireless sensor networks and smart sensors, physical transduction principles, commercially available wireless sensor systems, self-organization, signal processing and decision-making, and finally some concepts for home automation. Several routing algorithms are proposed. In the nongraph-based algorithms [3], [4], [5], [6], [7], [8], [9], [10], [11], the intuitive schemes as proposed in [3] construct a two-hop neighbor table for implementing the GF algorithm. The network flooding mechanism is adopted within the GRA [4] and PSR schemes while the void problem occurs. There also exist routing protocols that adopt the backtracking method at the occurrence of the network holes (such as GEDIR, [3], DFS [5], and SPEED [6]). The routing schemes as proposed by ARP and LFR memorize the routing path after the void problem takes place. Moreover, other routing protocols (such as PAGER [7], NEAR [8], DUA [9], INF [10], and YAGR [11]) propagate and update the information of the observed void node in order to reduce the probability of encountering the void problem. By exploiting these routing algorithms, however, the void problem can only be either 1) partially alleviated or 2) resolved with considerable routing overheads and significant converging time. On the other hand, there are research works on the design of graph-based routing algorithms [2], [12], [13] to deal with the void problem. Several routing schemes as surveyed in [12] adopt the planar graph derived from the unit disk graph (UDG) as their network topologies, such as GPSR [2], GFG [13], Compass Routing II, AFR, GOAFR, GOAFR+, GOAFR++ [12], and GPVFR. For conducting the above planar graph-based algorithms, the planarization technique is required to transform the underlying network graph into the planar graph. The Gabriel graph (GG) and the relative neighborhood graph (RNG) are the two commonly used localized planarization techniques that abandon some communication links from the UDG for achieving the planar graph. Nevertheless, the usage of the GG and RNG a graph has significant pitfalls due to the removal of critical communication links, leading to longer routing paths to the destination.

The representative planar graph-based GPSR scheme can not forward the packets from NV to NA directly since both the GG and the RNG planarization rules abandon the communication link from NV to NA. Considering the GG planarization rule for example, the communication link from NV.

II. Localized Algorithms

The key idea is to request and process data only at the node which requested a task and some limited number of nodes that are geographically close.

A generic localized algorithm for solving optimization problems in wireless ad-hoc networks. The technique has five components:

- (i) data acquisition mechanism
- (ii) optimization mechanism
- (iii) search expansion rules
- (iv) bounding conditions
- (v) Termination rules

The data acquisition mechanism facilitates which sensed data is obtained from which node. The optimization mechanism provides a partial or complete solution to the targeted task. Search expansion rules indicate which nodes are best to contact next. Bounding conditions indicate which nodes should not be considered further, since information that they have is irrelevant for the final solution.

Finally, termination criteria indicate when search expansion and optimization mechanism can be halted. The idea is to request and process data only locally and only from nodes who are likely to contribute to both final solution as well as to provide good bounds to determine nonpromising search directions. It is important to note that initialization may start from a single point (as in the case of minimal exposure path coverage) or multiple points (as in the case of location)

The approach can be summarized using the following pseudo-code:

.1 Generic Localized Optimization Procedure

Initiate Search;

Request Information from Neighbors; While (termination criteria=No)

{

Form Partial Solution;

Decide which Nodes to Contact; Decide which Nodes to Terminate; Contact Selected Nodes;

}

In order to maintain the network requirement of the proposed RUT scheme under the non-UDG networks, the partial UDG construction (PUC) mechanism is proposed to transform the non-UDG into UDG setting for a portion of nodes that

facilitate boundary traversal.

2.2 Greedy Forwarding (GF) algorithm:

A greedy algorithm is any algorithm that follows the problem solving meta heuristic of making the locally optimal choice at each stage with the hope of finding the global optimum.

2.3 Applications of the GF algorithm

Greedy algorithms mostly (but not always) fail to find the globally optimal solution, because they usually do not operate exhaustively on all the data. They can make commitments to certain choices too early which prevent them from finding the best overall solution later. For example, all known greedy coloring algorithms for the graph coloring problem and all other NP-complete problems do not consistently find optimum solutions. Nevertheless, they are useful because they are quick to think up and often give good approximations to the optimum

III Classes Of Networks For Gpsr Algorithms

GPSR will allow the building of networks that cannot scale using prior routing algorithms for wired and wireless networks. Such classes of networks include:

- Rooftop networks: fixed, dense deployment of vast numbers of nodes
- Ad-hoc networks: mobile, varying density, no fixed infrastructure
- Vehicular networks: mobile, non-power-constrained, widely varying density

3.1 Greedy Other Adaptive Face Routing (GOAFR) algorithm:

GOAFR combines the Greedy Routing and OAFR, such that it is both average-case efficient and worst case optimal. In general GOAFR does Greedy Routing as long as possible and only uses OAFR to tackle the local minima. The details of GOAFR are as follows. GOAFR also has a bounding ellipse.

Initially, the length of the major axis is $c = 2jstj$.

The algorithm starts by Greedy Routing inside the bounding ellipse. There are two cases to interrupt a Greedy Phase.

1. The bounding ellipse is too small, i.e. the current node does not have neighbors closer to t , but all such neighbors lie outside the bounding ellipse.
2. The current node is indeed a local minimum, i.e. it has no neighbor closer to t in the entire graph.

In the former case, we double the length of c , and continue the Greedy Routing inside the larger ellipse. In the latter case, we have to use OAFR. An OAFR Phase of GOAFR only traverses one face boundary to get around the local minimum. After that, GOAFR returns to the Greedy Routing immediately.

The details of an OAFR Phase are the same as the original OAFR algorithm. It tries to find the best possible node inside the bounding ellipse and doubles the major axis when necessary.

3.2 GAR protocol:

Basically there are some mechanisms which can be implemented or incorporated in this GAR protocol to make this GAR work even better in the network. In the Figure2 mechanism is explained. Those 3 mechanisms are

Hop count Reduction Intersection Navigation Partial UDG construction.

3.3 Mechanism 1 – Hop Count Reduction (HCR):

Based on the rolling-ball traversal within the RUT scheme, the selected next -hop nodes may not be optimal by considering the minimal HC criterion. Excessive routing delay associated with power consumption can occur if additional hop nodes are traversed by adopting the RUT scheme. According to the concept as stated above, the HCR mechanism is to acquire the information of the next few hops of neighbors under the RUT scheme by listening to the same forwarded packet. It is also worthwhile to notice that the listening process does not incur additional transmission of control packets.

3.4 Mechanism 2 – Intersection Navigation (IN):

The IN mechanism is utilized to determine the rolling direction in the RUT scheme while the void problem occurs. It is noticed that the selection of rolling direction (i.e., either counterclockwise or clockwise) does not influence the correctness of the proposed RUT scheme to solve Boundary Traversal problem as in Theorem 1. However, the routing efficiency may be severely degraded if a comparably longer routing path is selected at the occurrence of a void node. The primary benefit of the IN scheme is to choose a feasible rolling direction while a void node is encountered. Consequently, smaller rerouting HCs and packet transmission delay can be achieved. Considerable routing efficiency can be preserved as a shorter routing path is selected by adopting the IN mechanism.

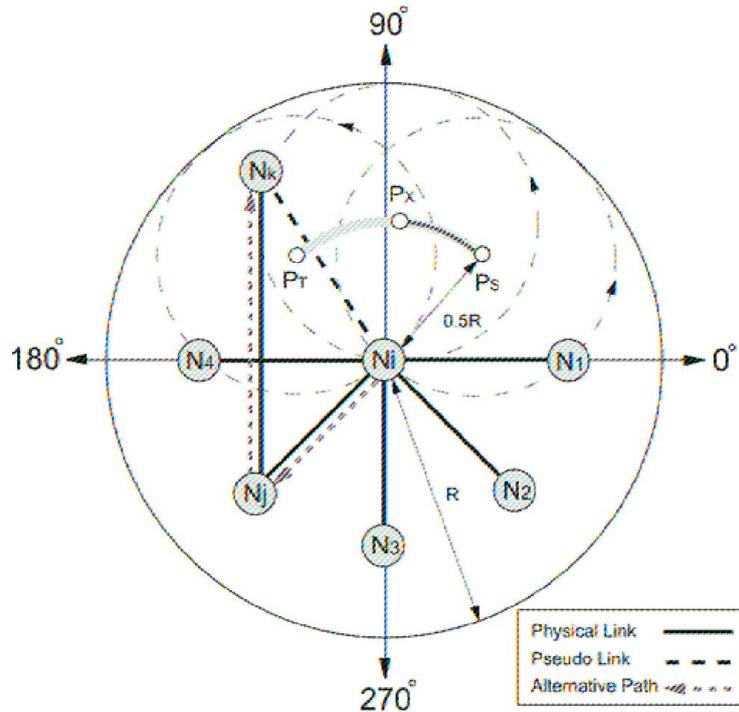


Figure 2: The PUC mechanism

3.5 Mechanism 3 – Partial UDG Construction:

The PUC mechanism is targeted to recover the UDG linkage of the boundary node N_i within a non-UDG network. The boundary nodes within the proposed GAR protocol are defined as the SNs that are utilized to handle the packet delivery after encountering the void problem. As node N_i is considered a boundary node since the converged SP arc segment $S_{N_i}^{SP} (P_s, P_r)$ exists after N_i conducts the proposed IMS algorithm by the input of the current one-hop neighbors $\{N_1; N_2; N_3; N_4; N_j\}$. It is noted that the boundary nodes consist of a portion of the network SNs. Therefore, conducting the PUC mechanism only by the boundary nodes can conserve network resources than most of the existing flooding-based schemes that require information from all the network nodes.

The protocol defined with all these enhancements is called as the GAR – E (i.e. The Enhanced GAR) protocol. This protocol thus stated with all these mechanisms works more appropriate and more effectively than the GAR protocol.

IV CONCLUSION

In this paper, a UDG-based GAR protocol is proposed to resolve the void problem incurred by the conventional GF algorithm. The RUT scheme is adopted within the GAR protocol to solve the boundary finding problem, which results in guaranteed delivery of data packets under the UDG networks. The BM and the IMS are also proposed to conquer the computational problem of the rolling mechanism in the RUT scheme, forming the direct mappings between the input/output nodes. The correctness of the RUT scheme and the GAR algorithm is properly proven.

The HCR and the IN mechanisms are proposed as the delay-reducing schemes for the GAR algorithm, while the PUC mechanism is utilized to generate the required topology for the RUT scheme under the non-UDG Networks. All these enhanced mechanisms associated with the GAR protocol are proposed as the enhanced GAR (GAR-E) algorithm that inherits the merit of guaranteed delivery. The performance of both the GAR and GAR-E Protocols is evaluated and compared with existing localized routing algorithms via simulations. The simulation study shows that the proposed GAR and GAR-E algorithms can guarantee the delivery of data packets

Under the UDG network, while the GAR-E scheme further improves the routing performance with reduced communication overhead under different network scenarios.

REFERENCES

- [1] D. Estrin, R. Govindan, J. Heidemann, and S. Kumar, "Next Century Challenges: Scalable Coordination in Sensor Networks," *Proc. ACM MobiCom*, pp. 263-270, Aug. 1999.
- [2] B. Karp and H.T. Kung, "GPSR: Greedy Perimeter Stateless Routing for Wireless Networks," *Proc. ACM MobiCom*, pp. 243- 254, Aug. 2000.
- [3] I. Stojmenovi_c and X. Lin, "Loop-Free Hybrid Single-Path Flooding Routing Algorithms with Guaranteed Delivery for Wireless Networks," *IEEE Trans. Parallel and Distributed Systems*, vol. 12, no. 10, pp. 1023-1032,

Oct. 2001.

- [4] R. Jain, A. Puri, and R. Sengupta, "Geographical Routing Using Partial Information for Wireless Ad Hoc Networks," *IEEE Personal Comm. Magazine*, vol. 8, no. 1, pp. 48-57, Feb. 2001.
- [5] I. Stojmenovi_c, M. Russell, and B. Vukojevic, "Depth First Search and Location Based Localized Routing and QoS Routing in Wireless Networks," *Proc. IEEE Int'l Conf. Parallel Processing (ICPP '00)*, pp. 173-180, Aug. 2000.
- [6] T. He, J.A. Stankovic, C. Lu, and T. Abdelzaher, "SPEED: A Stateless Protocol for Real-Time Communication in Sensor Networks," *Proc. Int'l Conf. Distributed Computing Systems (ICDCS '03)*, pp. 46-55, May 2003.
- [7] L. Zou, M. Lu, and Z. Xiong, "A Distributed Algorithm for the Dead End Problem of Location Based Routing in Sensor Networks," *IEEE Trans. Vehicular Technology*, vol. 54, no. 4, pp. 1509-1522, July 2005.
- [8] N. Arad and Y. Shavitt, "Minimizing Recovery State in Geographic Ad-Hoc Routing," *Proc. ACM MobiHoc '06*, pp. 13-24, May 2006.
- [9] S. Chen, G. Fan, and J.H. Cui, "Avoid Void" in Geographic Routing for Data Aggregation in Sensor Networks," *Int'l J. Ad Hoc and Ubiquitous Computing*, vol. 1, no. 4, pp. 169-178, 2006.
- [10] D.D. Couto and R. Morris, "Location Proxies and Intermediate Node Forwarding for Practical Geographic Forwarding," *Technical Report MIT-LCS-TR-824, MIT Laboratory for Computer Science*, June 2001.
- [11] J. Na, D. Soroker, and C.K. Kim, "Greedy Geographic Routing Using Dynamic Potential Field for Wireless Ad Hoc Networks," *IEEE Comm. Letters*, vol. 11, no. 3, pp. 243-245, Mar. 2007.
- [12] H. Frey and I. Stojmenovi_c, "On Delivery Guarantees of Face and Combined Greedy Face Routing in Ad Hoc and Sensor Networks," *Proc. ACM MobiCom '06*, pp. 390-401, Sept. 2006