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Bayesian Estimation Model for Trust dependent Greedy Antivoid Routing(TGAR) in Wireless Sensor Networks(WSNs)

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Wireless Sensor Networks consist of tiny battery operated sensor nodes and which are connected in a network for communication. Energy, lifetime and reliable data delivery are the major issues in Wireless Sensor Networks(WSNs). The objective of any routing algorithm in WSN is successful data delivery. The existing Greedy Antivoid Routing(GAR) uses the Rolling ball Un-directed Traversal, to guarantee the packet delivery from source to destination. In the case of sparse network, when it experiences either an obstacle or void in the route, then it fails to deliver the data. To address these issues, we propose Trust dependent Greedy Antivoid Routing(TGAR) algorithm to find reliable path from the source to the sink. We use Bayesian estimation model to calculate the trust value for each path. Based on the trust value path is selected for the transmission of data. Simulation results show that TGAR achieves successful data delivery, higher throughput and lifetime with minimum energy consumption than the existing Greedy Antivoid Routing(GAR) Algorithm.

Keywords: Greedy Antivoid Routing, Sparse Network, Unit Distance Graph, Void and Wireless Sensor Networks

1. INTRODUCTION

Sensor nodes are battery operated and have limited energy in WSNs. Replacement or recharging of battery is difficult. Therefore, it is desirable to design an energy efficient routing protocol for WSNs. There are three types of routing techniques *i.e.*, flat, hierarchical and location based routing. In flat routing, nodes are collaborated together to sense an event. There is no unique *id* for all nodes since they are deployed in large numbers and it is not feasible to give identification for each node. In hierarchical approach, high energy node can be used to process and send the information, low energy nodes are used only for sensing. In location based routing, sensor nodes are identified by their locations. The distance between the nodes are calculated based on the incoming signal strength. Coordinates of the neighboring nodes are obtained from the neighbor's list. Node's location is communicated through satellite or Global Positioning System(GPS) are equipped with the nodes. Energy consumption is reduced by keeping nodes in sleep mode when there is no demand for the node.

Geographic Energy Aware Routing(*GEAR*) selects the node from Geographically informed neighbor list to forward a packet to the destination. GEAR conserves more energy than directed diffusion algorithm since it avoids sending query to whole network and transmits a packet to a certain range. The Greedy Antivoid Routing (GAR) forwards the packets to the destination by finding an alternative path when there is a hole in the network. GAR guar-

value. If the probability of priori distributed function value is one *i.e.*, trust value is good then that path is selected for routing. The proposed TGAR algorithm overcomes the void and obstacle problem encountered in GAR that results in lower delay and consumption of energy. Simulation result shows that the proposed TGAR algorithm saves 12% energy and 33% faster than the existing GAR algorithm. Thus, energy conservation is increased with each iteration with higher throughput and increased lifetime of the network. Delay can be reduced further with the mobile sink instead of static sink.

REFERENCES

1. Shigang Chen, Guangbin Fan, Jun Hong Cui. Avoid Void in Geographic Routing for Data Aggregation in Sensor Networks, *International Journal of Ad-hoc and Ubiquitous Computing*, 1(4):169-178, 2006.
2. Sungoh Kwon Ness B. Shroff. Geographic Routing in the Presence of Location Errors, *International Journal in Computer Networks*, 50(15):2902-2917, 2006.
3. Brad Karp and H T Kung. GPSR: Greedy Perimeter Stateless Routing for Wireless Networks, *Proceedings of Mobicom*, pages. 1158-1168, 2006.
4. Hannes Frey and Daniel Gorgen. Planar Graph Routing on Geographical Clusters, *Journal on Adhoc Networks*, 3:560-574, 2005.
5. Swades De, Antonica Caruso, Tamalika Chaira and Stefano Chessa. Bounds on Hop Distance in Greedy Routing Approach in Wireless Ad Hoc Networks, *International Journal of Wireless and Mobile Computing*, 1(2), February 2006.
6. Tassos Dimitriou and Ioannis Krontiris. GRAViTY: Geographic Routing Around Voids in Sensor Networks, *International Journal on Pervasive Computing and Communication*, 2(4), 2007.
7. Wen-Jiunn Liu and Kai- Tew Feng. Greedy Routing with AntiVoid Traversal for Wireless Sensor Networks, *IEEE Transaction on Mobile Computing*, 8(7):910-922, July 2009.
8. Fisher, R A. The use of Multiple Measure in Taxonomic Problems, *Annals of Eugenics*, vol. 7, pages 179-188, 1936.
9. Mohsen Ghaffari, Behnoosh Hariri and Shervin Shrumohammadu, On the Necessity of using Delaunay Triangulation Substrate in Greedy Routing based Networks, *IEEE Communications Letters*, 14(3):266-68, March 2010.
10. Stravos Athanassopoulos, Christos Kaklamanis, Itlias Laftsidis and Evi Papaiannou. An Experimental study of Greedy Routing Algorithm, *In Proceedings IEEE*, 2012.
11. Fragkiskos Papadopoulos, Dmitri Krioukov, Marian Boguna and Amin Vahdat. Greedy Forwarding in Dynamic Scale-free Networks Embedded in Hyperbolic Metric Spaces, *IEEE INFOCOM*, March 2010.
12. Razia Haider, Muhammad Younus Javed and Naveed S. Khattak. Design and Implementation of Energy Aware Algorithm using Greedy Routing for Sensor Networks, *International Journal of Security and its Applications*, 2(2), April 2008.
13. Niklas Carlsson and Derek L. Eager. Non- Euclidian Geographic Routing in Wireless Networks, *Adhoc Networks*, 5(7):1173-1193, 2007.
14. Hadi Noureddine, Qiang Ni, Geyong Min and Hamed AI-Rawesshidy. A New Link Lifetime Prediction Method for Greedy and Contention-based Routing in Mobile Ad Hoc Networks, *In Proceedings of 10th IEEE International Confernce on Computer and Information Technology(CIT 2010)*, 2010.
15. Yujun Li, Yaling Yang and Xianliang Lu. Rules of Designing Metrics for Greedy, Face and combined Greedy-Face Routing, *IEEE Transaction on Mobile Computing*, 9(4):582-595, April 2010.

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