ISSN:1991-8178

Australian Journal of Basic and Applied Sciences

Journal home page: www.ajbasweb.com

Multipath Routing Mechanism for Energy Preservation in Wireless Sensor Networks

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ARTICLE INFO

Article history:
Received 12 October 2014
Received in revised form 26 December 2014
Accepted 1 January 2015
Available online 27 February 2015

Keywords:
Wireless Sensor Networks, Nodes, Less Expensive Devices, Communication, Multipath Routing.

ABSTRACT

The wireless sensor networks are today focused for research because it holds a number of less expensive devices for preserving energy among the nodes. The tolerance to faults is provided by routing algorithms as a temporary means. The common techniques is achieved by setting the power required for communication at a minimum level needed for connectivity and mainly for multipath routing which provides strength. The analysis is performed and results were got for multipath routing with large power for communication can provide a solution for energy preservation against node failures.

To Cite This Article: Prof.T.P.Jayakumar and Dr.N. Gunasekaran., Multipath Routing Mechanism for Energy Preservation in Wireless Sensor Networks. ***Aust. J. Basic & Appl. Sci.,*** *9(5): 368-371, 2015*

INTRODUCTION

Sensor networks consists of a huge collection of less expensive energy conserved devices which serves for a wide variety of applications which can vary from tracking a vehicle to environment observation (Warrior, J., 1997; Estrin, D. *et al*., 2001; Cerpa, A. *et al*., 2001). These networks are fixed which uses less expensive devices producing high rates of failures for independent nodes. This feature paves way to the routing algorithms to provide resistance against these failures by preserving the energy. The solutions are proven to be provided using multipath routing with lot of variations. The multipath routing displaces the paths for delivering the information from source to the sink. For illustration the multipath routing over telephone system is considered where multipath routing is used for reducing the overcrowding of calls. All the networks using multipath routing focuses in setting up a low cost displaced paths from source to the destination (Ogier, R. and N. Shacham; Sidhu, D., R. Nair and S. Abdallah).

The multipath routing is not been widely used in mobile ad hoc networks is due to the path failure due to the dynamic nodes. As an alternate a varying path routing was studied (Lin, X. and I. Stojmenovic) in order to adopt load balancing and to overcome the route failures in MANETs. The on demand multipath routing was proposed (Nasipuri, A., R. Castaneda and S.R. Das, 2001) for reducing the flooding that can occur due to uncertainty. A scheme using heuristic was presented for choosing multiple paths in MANETs for which various algorithms based on multipath for wireless networks were studied (Intanagonwiwat, C., R. Govindan and D. Estrin, 2000). For wireless sensor networks the distribution algorithms (Intanagonwiwat, C., R. Govindan and D. Estrin, 2000) were the algorithm which supports routing in varied multiple paths by utilizing proper slope levels. The strength of energy (Ganesan, D., *et al*., 2002) was studied with a focus of separating displaced multipath routing from tress multipath techniques.

Demonstration:

The figure 2 depicts a path to transmit information between source and sink. This can be well demonstrated by considering that the nodes can only communicate with other nodes within their radius Nr. Rφ is amount of energy needed to transmit over the route where the φ is the path loss that can happen during transmission.

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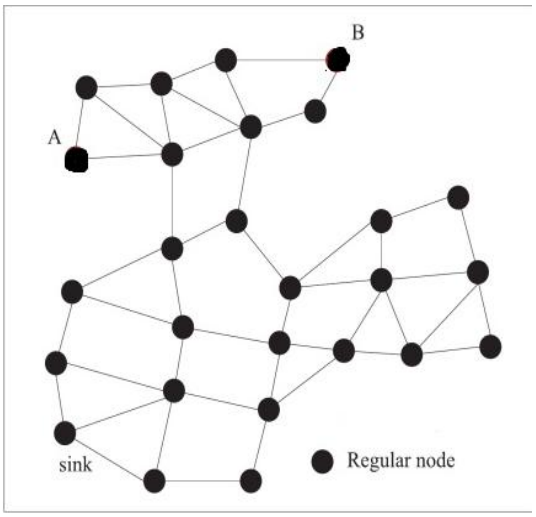


Fig. 1: Network Topology

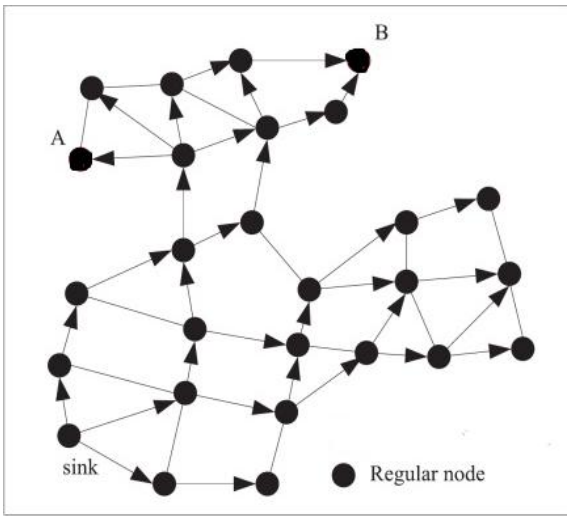


Fig. 2: Routing Process

The energy for each and every routing are defined using a metric M as the lowest common transmission radius needed is Mr for which Mc is the communication needed. The cost required for energy for this scheme is Mc Rφm. The information that is been communicated between the node and its neighboring nodes will utilize same energy cost in accordance to all the above metrics.

For assumption it is considered that all the in between nodes is subjected to fail without depending upon one another with a probability Pf. But here in this case the source and destination are assured to be working in order to measure the strength of failure nodes. The measurement inferred for strength is αM which corresponds to the path M which is the probability for a information transmitted between the source and sink by considering the individual probabilities towards failure (Garey, M.R. and D.S. Johnson). It is been clear that the in between nodes are the creators of failures and by focusing it in the view of strength measurement it is better to avoid these nodes completely. This deals with the energy conservation.

Analysis:

The analysis is conducted between 50 nodes by transmitting information from source to the sink. The experiment is repeated more than 100 times by randomly placing the nodes where the radius of communicating nodes is increased by 0.01 to 1.0.

A variety of multipath strategies were considered for the experiment. The source sends a message to all other nodes within the network where the reply is got from the source node in reverse direction within the path after the transmission of initial message. The nearest neighbor algorithm is used where the source tries to forward some information to the neighboring nodes which transmits the initial message. These messages are then communicated in between nodes to its neighboring nodes. By which this algorithm proves itself as a shortest path algorithm. These paths are chosen for experiments and simple flooding is only carried out by the source and obtains a better result.

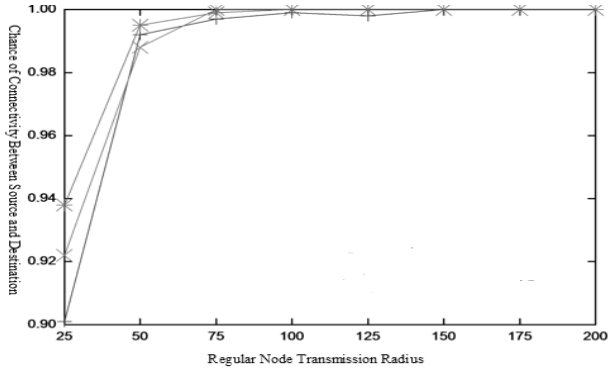
RESULTS AND DISCUSSIONS

The experiments were carried out for multipath routing over wireless networks in order to provide displaced routes between multiple nodes for transmission between source and destination. The nearest neighbor algorithm provides a number of displaced paths between nodes in an increased rate. From figure 3 it is clear that the amount of displacements between nodes is purely based on the techniques employed. The flooding is fruitful only when the metric are been considered. The strength metric αM is the chance that the source are likely to transmit the information to the destination during node failures also.

RESULTS AND DISCUSSIONS

Figure 5 and 6 depicts the variation between the metrics in accordance to the radius for communication. For the considered radius for communication it is to be noted that multipath routing techniques tailors better strength. As added the multipath routing mechanism provides minimized failure rates thus providing same level of strength. It is seen that the multipath scheme provides better strength for the communication radius but at the price of increased transmissions. From figure 4 depicts that the flooding requires increased transmissions thus clearly explaining that it does not provide an energy preservation scheme for providing

strength towards failure between nodes. The possibilities are studied for increasing the strength and energy metrics by changing the path structure without disturbing the topology.



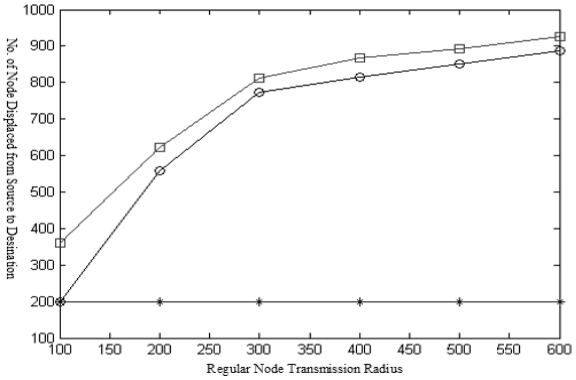
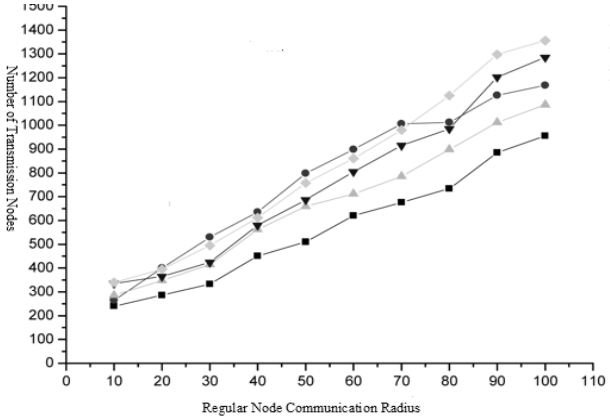


Fig. 3: Node Displacement from Source to Destination **Fig. 4:** Chance of Route between Source and Destination



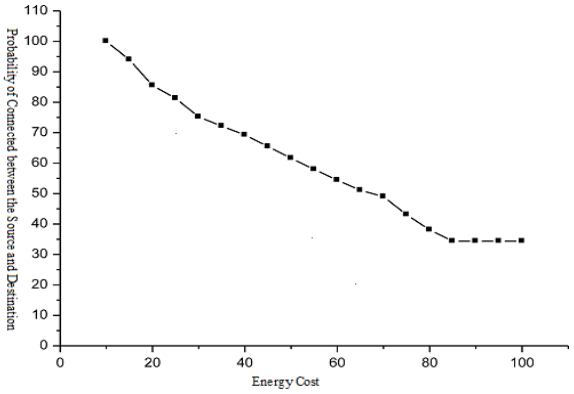
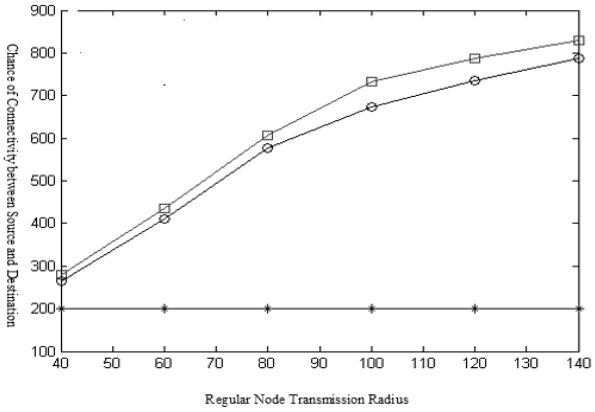


Fig. 5: Regular Node Transmission Radius

Fig. 6: Existence of Energy with respect to Regular Energy Cost



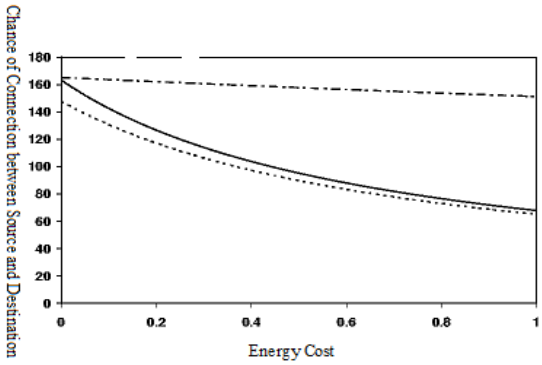


Fig. 7: Existence of Path with respect to Regular Energy Cost

Fig. 8: Chance of Energy with respect to Regular Energy Cost

Figure 7 and 8 provides greater strength by minimizing the energy levels. It is observed that it is advisable to communicate directly between the source and destination without setting higher communication ranges. Figure 7 depicts the importance of energy allocation to higher communication ranges than directing them along multiple paths during energy starvation.

Conslusion:

The composition of wireless sensor networks consists of a number of less expensive devices that are more subjected to failures. Earlier studies conclude that multipath routing techniques were usually adopted in order to provide resistance against failures. The paper described the strength of nodes

during failures especially during energy starvation for which multipath routing can cost high.

The better technique for dealing with energy is to maximize the strength. Larger communication powers are used as alternates using fewer paths more precisely even a single path. An analysis was done using simulations using constraints which can serve as preservation mechanism for energy which provides strength against failed nodes. It is to be noted for wireless sensor networks that higher communication power can increase strength as added to multipath routing.

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