Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 79 (2016) 866 – 874

Procedia Computer Science

7th International Conference on Communication, Computing and Virtualization 2016

Neighbor Adjacency based Hole Detection Protocol for Wireless Sensor Networks

Pearl Antil[a], Amita Malik[b], Sanjay Kumar[c]

[a,b]DCR University of Science and Technology, Murthal, Sonepat-131039, Haryana, India
[c]SRM University Haryana, Sonepat-131038, India
[a]pearl.comfy@gmail.com, [b]amitamalik.cse@dcrustm.org, [c]skmalik9876@gmail.com

Abstract

Coverage and communication holes may appear in sensor networks due to limited battery life, presence of obstacles and physical destruction of nodes. These holes have a negative impact on the network performance. In order to ensure that optimum area in sensing field is covered by sensors, coverage holes must be detected. This paper proposes an adaptive routing algorithm based on neighbor adjacency for detecting coverage holes in sensor networks. Proposed algorithm can compute location of holes in the network from remote locations based on hop count measure computed from network statistics. Simulation results show that algorithm gives better performance in terms of end to end delay and packet delivery fraction as compared to previous works. Simplicity and efficiency are the key features that distinguish this work from existing routing and hole detection schemes.

© 2016 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).
Peer-review under responsibility of the Organizing Committee of ICCCV 2016

Keywords: Wireless Sensor Network; Hole detection; Routing; Neighbor Adjacency

1. Introduction

In Wireless Sensor Networks (WSNs), surveillance quality is dependent on coverage of a given target area. The sensing range of sensor nodes is limited by several resource constraints such as limited battery and processing power, small amount of memory and limited communication and computation capabilities [1]. Thus, a large number of sensors are deployed in the target region which collaborates to ensure complete coverage [2]. Coverage requirement is application dependent. Battlefield surveillance applications may want a region to be monitored by multiple sensors simultaneously to make system more resilient to failures while there may be some applications such as habitat monitoring that need low degree of coverage. With passage of time some of the nodes may exhaust their

Corresponding author. Tel.+91- 9416315432
E-mail address: skmalik9876@gmail.com

1877-0509 © 2016 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).
Peer-review under responsibility of the Organizing Committee of ICCCV 2016
doi:10.1016/j.procs.2016.03.089

energy or may be destroyed by some exogenous disturbances leading to formation of coverage holes in the network [3]. Random deployment of nodes further aggravates the problem of coverage holes in WSNs. In order to prevent

expansion of such holes in network, they must be detected. Moreover, holes provide significant information about geographic characteristics of target region [4]. They help in identifying damaged and inaccessible nodes in the network. Hole detection in WSN is one of the major challenges faced by researchers. In this paper, a novel and efficient method for adaptive routing and coverage monitoring is proposed. Proposed algorithm can compute location of holes in network from remote locations based on hop count measure computed from network statistics. The most alluring feature of the proposed protocol is that it uses only basic data traffic information to detect coverage holes in the network. The rest of paper is organized as follows: Section II presents related work. Section III details our proposed algorithm. In Section IV, results of extensive simulations are discussed. In Section V, we conclude with a summary of the contributions of this paper and present a preview of future research.

2. Related Works

Geographic routing is a Hop by Hop routing where decisions are made on each hop. Each node upon receiving the packet consults its neighbor table and selects the most promising neighbor as the next hop. This process repeats until packet reaches the destination [5]. Two of the simplest geographic routing schemes are Greedy Forwarding and Face routing [6]. In Greedy forwarding, a node forwards packet to a neighboring node that is closer to destination than itself. Such routing scheme gets stuck in Local Minimum Problem. Face routing is an alternative to greedy forwarding where routing advances along the faces of planar graph and along the line joining source and destination. To improve upon basic greedy scheme, Karp and Kung proposed Greedy Perimeter Stateless Routing (GPSR). In this scheme Perimeter routing is introduced to route around stuck nodes in Local minimum problem. [7]. Some of the other Geographic routing algorithms are presented in [8-10]. Several works have addressed the issue of coverage hole detection in WSNs. Kun Bi et al. [11] used the basic fact that neighbors of a node sitting on hole boundary will always be less in number than other nodes which are well connected from all directions. There is huge communication overhead involved in this scheme. Peter Corke et al. [12] presented two distributed coverage hole detection schemes namely, local and global. In Local detection, a ping request is send by each node to collect its neighbor information. If acknowledgement is received then it is added to neighbor table. Thereafter, neighbors are pinged at regular intervals to verify connectivity. If no reply is received from a neighbor then it is considered as dead and is added to a list of dead nodes. When number of dead nodes surpass dead threshold, then node mark itself as hole boundary node. In global detection scheme, a randomly selected node broadcast a diagnostic packet in the network. When packet arrives at destination, the straight line distance from source to destination is divided by actual distance travelled by packet to get path density. If path density value is below threshold then a hole is present in the network. Jianjun et al. proposed HDAR [13] algorithm for adaptive routing and hole detection. When angle spanned by adjacent edges of a node becomes greater than 120 degrees [14], then node begins hole detection procedure. The location of hole is advertised to neighboring nodes so than they can avoid such paths. Babaie et al. [15] created a triangle like structure by joining centers of every three adjacent nodes. Some mathematical calculations helped to identify the area inside triangle which is not covered by sensing range of these three nodes. This exposed area is called hole [16].

3. Neighbor Adjacency Based Adaptive Routing

In this section, we state our assumptions, Neighbor Adjacency based Adaptive Routing algorithm (NA2R) and describe working of our algorithm for detecting holes in WSNs.

3.1. Assumptions

We assume that sensor network is deployed in controlled manner with the goal to form grid topology. Unit length of grid is known to all nodes in the network. Nodes are static and each sensor is assumed to be geographically localized through some localization mechanisms. The assumptions regarding neighbors of a node are as follows:

دریافت فوری ← متن کامل مقاله

ISIArticles
مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات