Cut Detection in Wireless Sensor Network

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ABSTRACT

Wireless sensor network can get separated into multiple connected components due to the failure of some of its nodes, which is called a "cut." In this paper, we consider the problem of detecting cuts by the remaining nodes of a wireless sensor network. We propose an algorithm that allows 1) every node to detect when the connectivity to a specially designated node has been lost, and 2) one or more nodes (that are connected to the special node after the cut) to detect the occurrence of the cut. The algorithm is distributed and asynchronous: every node needs to communicate with only those nodes that are within its communication range. The algorithm is based on the iterative computation of a fictitious "electrical potential" of the nodes. The convergence rate of the underlying iterative scheme is independent of the size and structure of the network.

KEYWORDS: CUT DETECTION,NETWORK SEPERATION,SENSOR NETWORK,ITERATIVE COMPUTATION.

I. Introduction

Wireless sensor networks (WSNs) are a promising technology for monitoring large regions at high spatial and temporal resolution. However, the small size and low cost of the nodes that makes them attractive for wide spread deployment also causes the disadvantage of low-operational reliability. A node may fail due to various factors such as mechanical/electrical problems, environmental degradation, battery depletion, or hostile tampering. In fact, node failure is expected to be quite common due to the typically limited energy budget of the nodes that are powered by small batteries. Failure of a set of nodes will reduce the number of multi-hop paths in the network. Such failures can cause a subset of nodes—that have not failed—to become disconnected from the rest, resulting in a "cut." Two nodes are said to be disconnected if there is no path between them[1].

In this paper, we propose a distributed algorithm to detect cuts , named the Distributed Cut Detection (DCD)algorithm. The algorithm allows each node to detect DOS events and a subset of nodes to detect CCOS events. The algorithm we propose is distributed and asynchronous: it involves only local communication between neighboring nodes, and is robust to temporary communication failure between node pairs. A key component of the DCD algorithm is a distributed iterative computational step through which the nodes compute their (fictitious) electrical potentials. The convergence rate of the computation is independent of the size and structure of the network[2].The DOS detection part of the algorithm is applicable to arbitrary networks; a node only needs to communicate a scalar variable to its neighbors. The CCOS detection part of the algorithm is limited to networks that are deployed in 2D euclidean spaces, and nodes need to know their own positions. The position information need not be highly accurate. The proposed algorithm is an extension of partially examined the DOS detection problem [3].

II. Distribution Cut Detection

The algorithm we propose is asynchronous and distributed: it involves communication between neighboring nodes, and is robust to temporary communication failure between node pairs. A key component of the DCD algorithm is a distributed iterative computational step through which the nodes from sensor network compute their electrical potentials.[2]

A. Cut

Wireless sensor networks (WSNs) are a promising technology for monitoring large regions at high spatial and temporal resolution. In fact, node failure is expected to be quite common due to the typically limited energy budget of the nodes. Failure of a set of nodes will reduce the number of multi-hop paths in the network. Such failures can cause a subset of nodes – that have not failed – to become disconnected from the rest, resulting in a "cut". Two nodes are said to be disconnected if there is no path between them.[1]

B. Source node

We consider the problem of detecting cuts by the nodes of a wireless sensor network. We assume that there is a specially designated node in the network, which we call the *source node*. The source node may be a base station that serves as an interface between the network and its users. Since a cut may or may not separate a node from the source node, we distinguish between two distinct outcomes of a cut for a particular node [1]

C. CCOS and DOS

When a node u is disconnected from the source, we say that a DOS (Disconnected frOm Source) event has occurred for u. When a cut occurs in the network that does not separate a node u from the source node, we say that CCOS (Connected, but a Cut Occurred Somewhere) event has occurred for u. By cut detection we mean (i) detection by each node of a DOS event when it occurs, and (ii) detection of CCOS events by the nodes close to a cut, and the approximate location of the cut.[1]

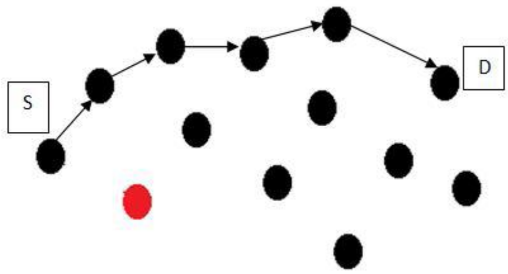
III. DCD Algorithm

Comes with provable characterization on the DOS detection accuracy CCOS events detection can be identified

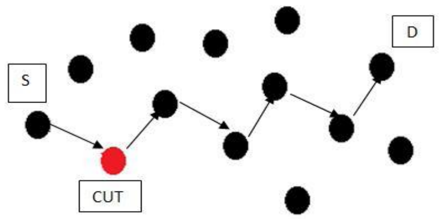
DCD algorithm enables base station and also every node to detect if it is disconnected from the base station.

A. DOS DETECTION

As the name of algorithm says its Disconnected from source. To send packets we use Shortest path algorithm, it is based on energy that means at the time of sending packets from source sensors node to destination sensor node, due to throughput or any energy related issue packets are not reaching to destination. And that disturbance is from near to source sensor node [3]. To resolve this problem we use the alternative shortest path. After repairing the cut, packets are transferred from earlier path. Diagram 1(a) shows cut occurred near to the source sensor node. Due to this it find some another alternative path to transferred a packets to destination sensor node. Diagram 1(b) shows alternative shortest path [2].



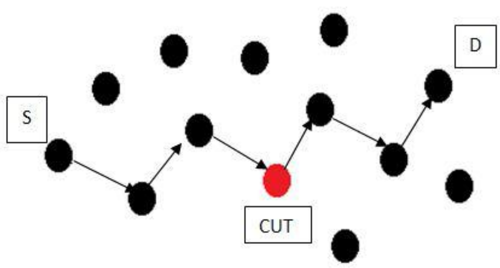
1(a)



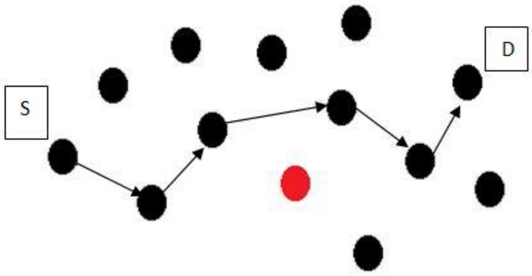
1(b)

B. CCOS Detection

As the name of algorithm says it's Connected but Cut Occurred From Source. At the time of sanding packets cut is occurred somewhere middle in the path. To resolve this problem it uses alternative shortest path. Cut occurred in respective node, i.e. node not having sufficient energy to pass the packets forward. diagram 2(a) shows cut occurred in between the path[1]. To resolve this , it does the same thing as done in DOS.



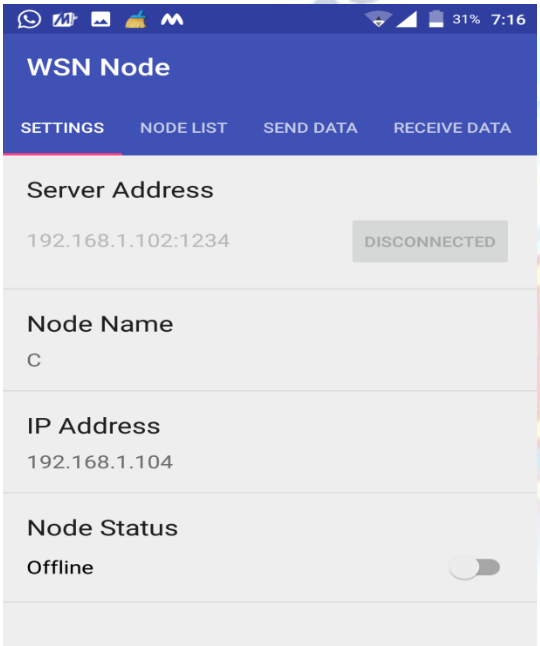
2(a)

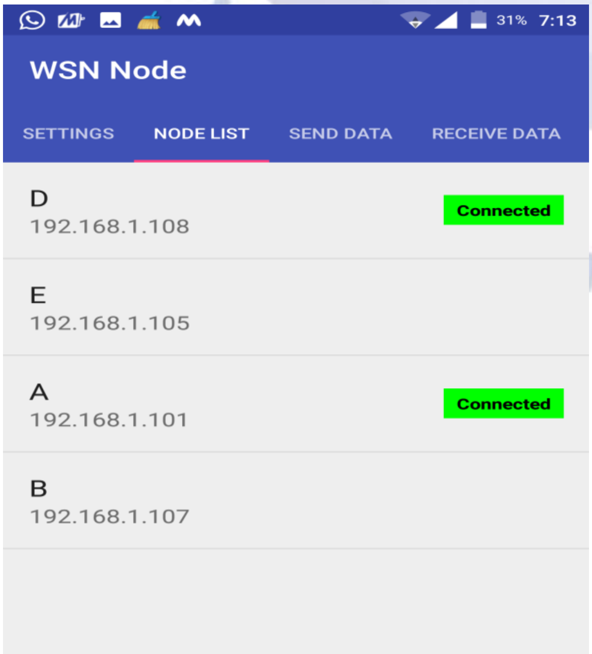


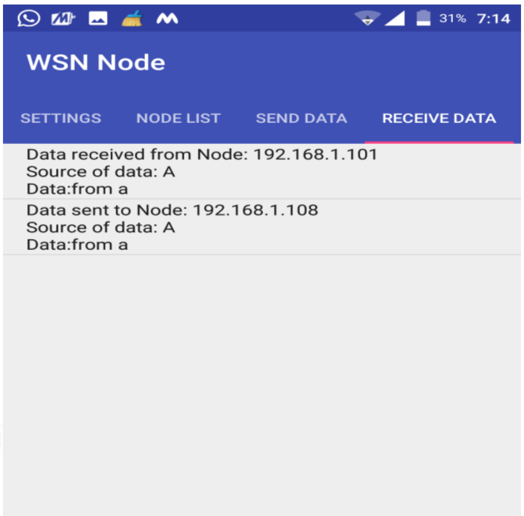
2(b)

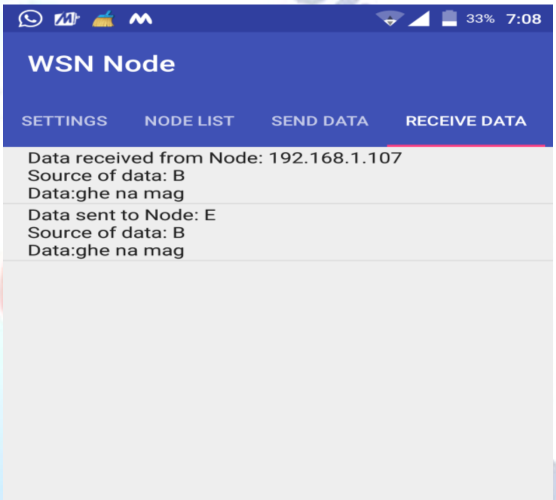
IV. Results

Status of Different Communicating Nodes:

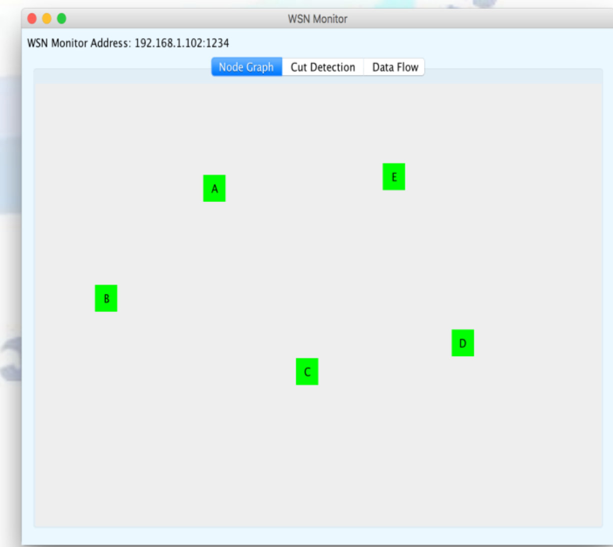


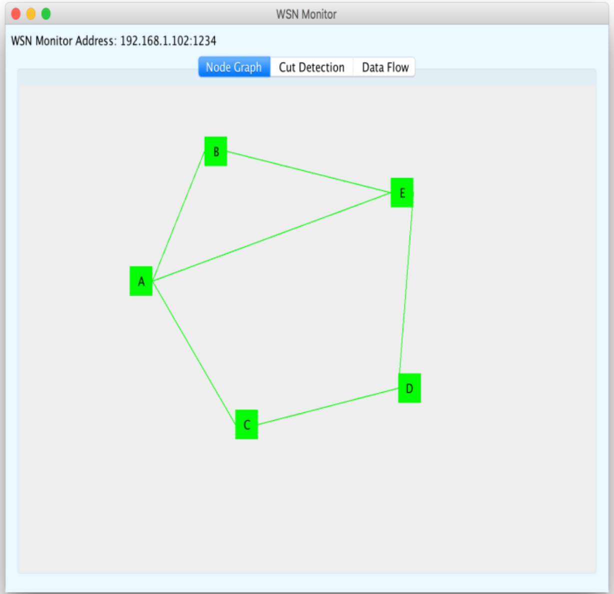


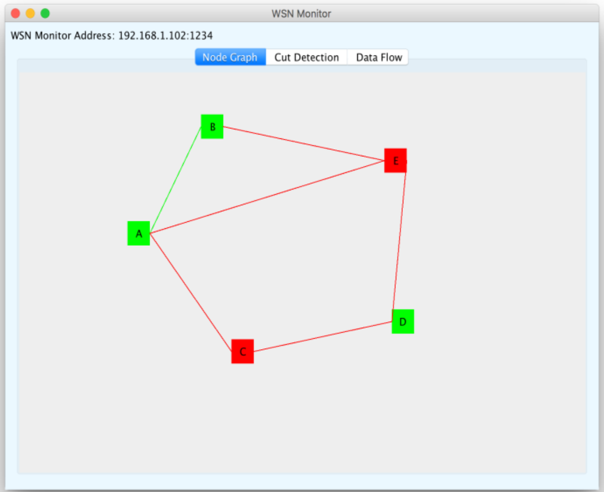


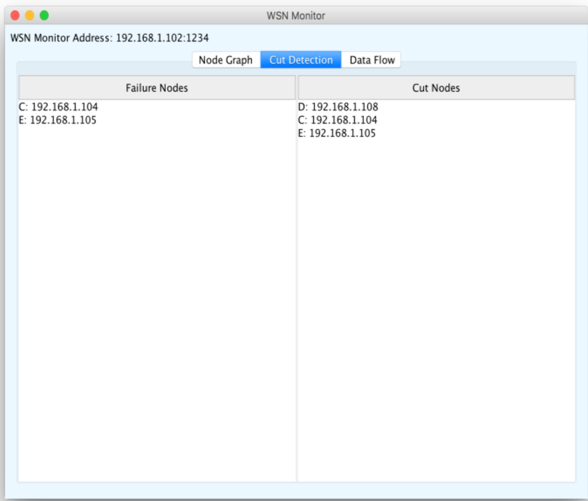


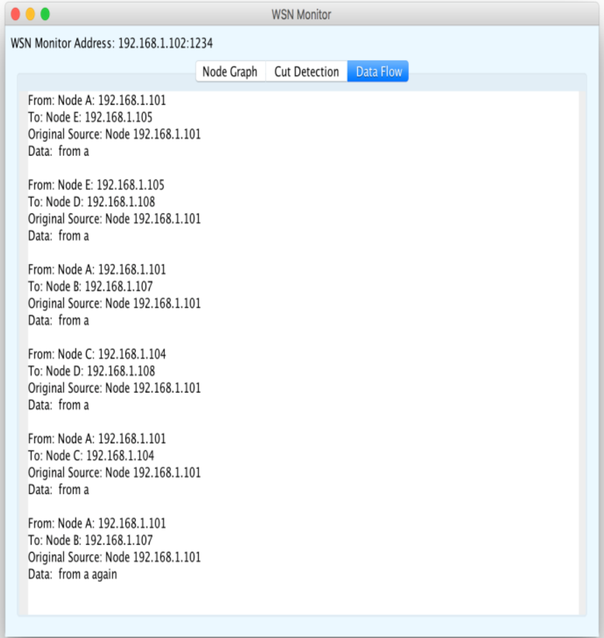
Cut Detection Network Monitor:











V. Conclusion

We conclude that, The DCD algorithm we propose here enables every node of a wireless sensor network to detect disconnected from source event if they occur. Second, it enables the subset of nodes that experiences CCOS event to detect them and estimate the approximate location of the cut in the form of a list of active nodes that lie at theboundary of the cut/hole. A key strength of the DCD algorithm is that the convergence rate of the underlying iterative scheme is quite fast and independent of the size and structure of the network, which makes detection using this algorithm quite fast[5].

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