ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Event Based Cut Detection in Wireless Sensor Networks Using DOS and CCOS Methodology

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Abstract:

A classical problem caused by separation of network is partitioning. Predicting those positioning from where the network get separated into the different partition could be a very useful feature that can be provided to applications in a wireless sensors network environment. Indeed, being aware of a future disconnection in the network can help to ensure a better quality of service by adapting the application behavior. We propose a distributed algorithm to detect "cuts" in sensor networks, i.e., the failure of a set of nodes that separates the networks into two or more components. The algorithm consists of a simple iterative scheme in which every node updates a scalar state by communicating with its nearest neighbors. In the absence of cuts, the states converge to values that are equal to potentials in a fictitious electrical network. When a set of nodes gets separated from a special node, that we call a "source node", their states converge to 0 because "current is extracted" from the component but none is injected. These trends are used by every node to detect if a cut has occurred that has rendered it disconnected from the source. Although the algorithm is iterative and involves only local communication, its convergence rate is quite fast and is independent of the size of the network.

Index Terms:

Wireless networks, sensor, positioning cut, DOS,CCOS,DSSD.

I. INTRODUCTION:

owever, several challenges have to be overcome to achieve the potential of WSNs. One of the challenges in the successful use of WSNs come from the limited energy of the individual sensor nodes.

Significant current research has therefore been directed at reducing energy consumption at the sensor nodes. In the hardware front, energy efficient components have been developed, and in the software front, power aware routing, low complexity coding, and low power data processing algorithms have been examined. WIRELESS sensor network (WSN) typically consists of a large number of small, low-cost sensor nodes distributed over a large area with one or possibly more powerful sink nodes gathering readings of sensor nodes. The sensor nodes are integrated with sensing, processing and wireless communication capabilities. Wireless sensor networks (WSNs) have emerged as a promising new technology to monitor large regions at high spatial and temporal resolution. Virtually any physical variable of interest can be monitored by equipping a wireless device with a sensor and networking these sensors together with the help of their on-board wireless communication capability. Although these advances are expected to increase the lifetime of the wireless sensor nodes, due to their extremely limited energy budget and environmental degradation, node failure is expected to be quite common.

This is especially true for sensor networks deployed in harsh and dangerous situations for critical applications, such as forest fire monitoring. In addition, the nodes of a sensor network deployed for defense applications may be subject to malicious tempering. When a number of sensors fail, whether due to running out of energy, environmental degradation, or malicious intervention, the resulting network topology may become disconnected.That is, as a result of failure of a set of nodes, a subset of nodes that have not failed become disconnected from the rest of the network. The state of a node converges to a positive value in the absence of a cut. If a node is rendered disconnected from the source as a result of a cut, its state converges to 0.

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By monitoring its state, therefore, a node can determine if it has been separated from the source node. In addition, the nodes that are still connected to the source are able to detect that, one, a cut has occurred somewhere in the network, and two, they are still connected to the source node. We call it the Distributed Source Separation Detection (DSSD) algorithm.Since the algorithm is iterative, a faster convergence rate is desirable for it to be effective.

The convergence rate of the proposed algorithm is not only quite fast, but is independent of the size of the network. As a result, the delay between the occurrence of a cut and its detection by all the nodes can be made independent of the size of the network.

This last feature makes the algorithm highly scalable to large sensor networks. We consider the problem of detecting cuts by the nodes of a wireless 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; the reason for this particular name is the electrical analogy introduced . 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.

When a node u is disconnected from the source, we say that a Disconnected frOm Source (DOS) event has occurred for u. When a cut occurs in the network that does not separate anode u from the source node, we say that Connected, but a Cut Occurred Somewhere (CCOS) event has occurred for u.

By cut detection we mean 1) detection by each node of a DOS event when it occurs, and 2) detection of CCOS events by the nodes close to a cut, and the approximate location of the cut. By "approximate location" of a cut we mean the location of one or more active nodes that lie at the boundary of the cut and that are connected to the source. Nodes that detect the occurrence and approximate locations of the cuts can then alert the source node or the base station.

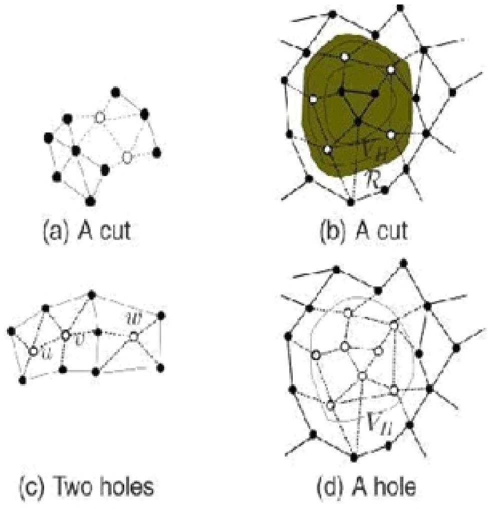

Figure 1: Examples of cut and Holes

2. EXISTING SYSTEM:

Wireless Multimedia Sensor Networks (WMSNs) has many challenges such as nature of wireless media and multimedia information transmission.Consequently traditional mechanisms for network layers are no longer acceptable or applicable for these networks. Wireless sensor network can get separated into multiple connected components due to the failure of some of its nodes, which is called a —cut. Existing cut detection system deployed only for wired networks.

2.1 E-linear cut detection:

Cut detection in wireless networks has been proposed, an algorithm that can be employed by a base station to detect an e-linear cut in a network. An e- linear cut is a separation of the network across a straight line so that at least en of the nodes (n is the total number of nodes in the network) are separated from the base station. The base station detects cuts when they occur based on whether it is able to receive messages from specially placed sentinel nodes.

2.2 Flooding based scheme:

A flooding based scheme may also be used for detecting separations. Under node to- base flooding approach, every node periodically sends a time-stamped message to the base station. If the base station does not receive a new message from node i for a certain

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time interval, it can declare that i isdisconnected from it. Base station floods the network withtime-stamped beacon packets periodically. A node detectsthat it is disconnected from the base if the length of time during which it hasn't received a new packet from the base exceeds a threshold value.

Critical node detection:

A critical node is one whose removal renders the network disconnected.

2.4 DISADVANTAGES:

Algorithm proposed only for detecting linear cuts in the networkIn flooding based technique, routes from the nodes to the base station and back have to be recomputed when node failures occur.Critical node detection uses relatively lower communication overhead come at the cost of high rate of incorrect detection.

• High false positives

• It should be emphasized that a cut can occur even if there are no critical nodes in network, when multiple non-critical nodes fail.

• Critical node detection algorithms mentioned above are designed to detect critical nodes before any node failure occurs; while the problem we address is detecting a cut after it occurs.

• Unsuitable for dynamic network reconfiguration.

• Single path routing approach

3.PROPOSED SYSTEM:

• DCD algorithm is applicable even when the network gets separated into multiple components of arbitrary shapes, and not limited to straight line cuts.

• DCD algorithm enables not just a base station to detect cuts, but also every node to detect if it isdisconnected from the base station.

• CCOS event detection part of the algorithm is designed for networks deployed in 2D regions, the DOS event detection part is applicable to networks deployed in arbitrary spaces.

3.1.ADVANTAGES :

• 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

• The DCD algorithm is distributed and asynchronous. It is robust to the temporary communication failure between the node pairs. The algorithm is iterative and has a fast convergence rate which makes it independent of size of network. Elimination of redundant information at destination nodeThe source node has the ability to detect theoccurrence and location of a cut which will allow it to undertake network repair. The ability to detect cuts by both the disconnected nodes and the source node will lead to the increase in the operationallifetime of the network as a whole.

4. ASSUMPTIONS MADE

We assume that there is a specially designated node in thenetwork, which we call the source node. The source nodemay be a base station that serves as an interface between the network and its users. We can create a topology which consists of n' number of nodes. The number of nodes created can be done user preferences.

5. MODULE DESCRIPTION:

5.1 DISTRIBUTED CUT DETECTION:

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.

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5.2 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 bequite 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.

5.3 CUTS IN WIRELESS SENSOR NETWORKS:

One of the unique challenges in mobile adhoc networking environments is the phenomenon of network partitioning, which is the breakdown of a connected network topology into two or more separate, disconnected topologies.[3] Similarly sensors become fail for several reasons and the network may breaks into two or more divided partitions so can say that when a number of sensor fails so the topology changes.

A node may fail due to a variety of conditions such as mechanical or electrical problems, environmental degradation, and battery reduction. In fact, node failure is expected to be quite common anomaly due to the typically limited energy storage of the nodes that are powered by small batteries. Failure of a set of nodes will reduce the number of multichip paths in the network. Such failures can cause a subset of nodes that have not failed to become disconnected from

the rest of the network, resulting in a partition of the network also called a ―cut. Two nodes are said to be disconnected if there is no path between them. And As we know that sensors has Disconnectivity from the network is normally referred as a partition of the network of cut in the wireless sensor network, which arise many problems like unreliability ,data loss, performance degradation. Because of cuts in wireless sensor network many problems may arise like a wired networkmeans data loss problem arises, meansdata reach in a disconnected route.

5.4 SOURCE NODE:

We consider the problem of detecting cuts by the nodes of a wireless 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.

5.5 NETWORK SEPERATION:

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. Because of cut, some nodes may separate from the network, that results the separated nodes can‘t receive the data from the source node.

5.6 PROBLEM DEFINITION:

When sensor wants to send data to the source node has been disconnected from the source node. Without the knowledge of the network‘s disconnected state, it may simply forward the data to the next node in the routing tree, which will do the same to its next node, and so on. However, this message passing merely wastes precious energy of the nodes; the cut prevents the data from reaching the destination. Therefore, on one hand, if a node were able to detect the occurrence of a cut, it could simply wait for the network to be repaired and eventually reconnected, which saves on-board energy of multiple nodes and prolongs their lives. On the other hand, the ability of the source node to detect the occurrence and location of a cut will allow it to undertake network repair. Thus, the ability to detect cuts by both the disconnected nodes and the source node will lead to the increase in the operational lifetime of the network as a whole.

5.7 PROBLEM SOLUTION:

Distributed algorithm to detect cuts, named the Distributed Cut Detection (DCD) algorithm can serve as useful tools for such network repairing methods. The algorithm allows each node to detect DOS events and a subset of nodes to detect CCOS events.

The algorithm proposed 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.

6. DISTRIBUTED CUT DETECTION ALGORITHM:

6.1 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.

A .DOS Detection:

We say that a Disconnected from Source (DOS) event has occurred for u. The algorithm allows each node to detect DOS events. The nodes use the computed potentials to detect if DOS events have occurred (i.e., if they are disconnected from the source node). The approach here is to exploit the fact that if the state is close to 0 then the node is disconnected from the source, otherwise not.

In order to reduce sensitivity of the algorithm to variations in network size and structure, we use a normalized state.DOS detection part consists of steady-state detection, normalized state computation, and connection/separation detection. A node keeps track of the positive steady states seen in the past using the following method. Each node computes the normalized state difference () as follows:

xi(k) – xi(k-1) xi(k)= -------------------, if xi(k – 1)>€ zero Xi(k-1) ∞, otherwise,

Where, zero is a small positive number.A node keeps a Boolean variable Positive Steady StateReached (PSSR) and updates PSSR(k) 1 if /( )| < for = k– Tguard , k –Tguard +1,… ,k(i.e., for Tguard consecutive iterations),where is a small positive number and Tguard is a Small integer. The initial 0 value of the state is not considered a steady state, so PSSR()=0 for =0,1, … ,Tguard.Each node keeps an estimate of the most recent —steady state observed, which is denoted by ( ). This estimate is updated at every time k according to the following rule: ifPSSR( )=1, then ; otherwise – 1 . It is initialized as ss(0) = ∞.Every node i also keeps a list of steady states seen in the past, one value for each unpunctuated interval of time during which the state was detected to be steady. This information is kept in a vector ( ), which is initialized to be empty and is updated as follows: If PSSR () = 1 but PSSR(−1) = 0, then is appended to ( ) as a new entry. If steady state reached was detected in both and - 1 (i.e., PSSR( ) = PSSR(− 1) = 1, then the last entry of ( ) is updated to ( ) .

B.CCOS Detection:

When a cut occurs in the network that does not separate a node u from the source node, we say that Connected, but a Cut Occurred Somewhere (CCOS) event has occurred for u. detection of CCOS events by the nodes close to a cut, and the approximate location of the cut. By —approximate location of a cut we mean the location of one or more active nodesthat lie at the boundary of the cut and that are connected to the source. To detect CCOS events, the algorithm uses the fact that the potentials of the nodes that are connected to the source node also change after the cut. However, a change in a node‘s potential is not enough to detect CCOS events, since failure of nodes that do not cause a cut also leads to changes in the potentials of their neighbors. Therefore, CCOS detection proceeds by using probe messages.

7. SYSTEM IMPLEMENTATION:

In this section, we describe the software implementation and evaluation of the DCD algorithm. In software the algorithm was implemented using the java language running on windows xp operating system. The system executes in two phases: the Reliable Neighbor Discovery (RND) phase and the DCD Algorithm phase.

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In the RND phase each node is connected to the source node. Upon receiving the message, the mote updates the number of beacons received from that particular sender. To determine whether a communication link is established, each mote first computes for each of its neighbors the Packet Reception Ratio (PRR), defined as the ratio of the number of successfully received beacons and the total number of beacons sent by a neighbor. A neighbor is deemed reliable if the PRR >0:8. Next, the DCD algorithm executes. After receiving state information from neighbors, a node updates its state according to (1) in an asynchronous manner and broadcasts its new state. The state is stored in the database.

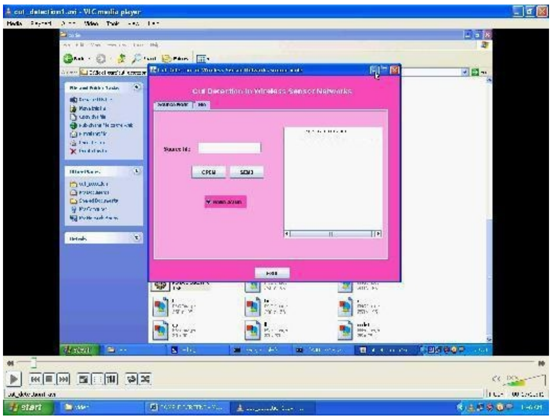

Figure 2: This screen is used for selecting file to send

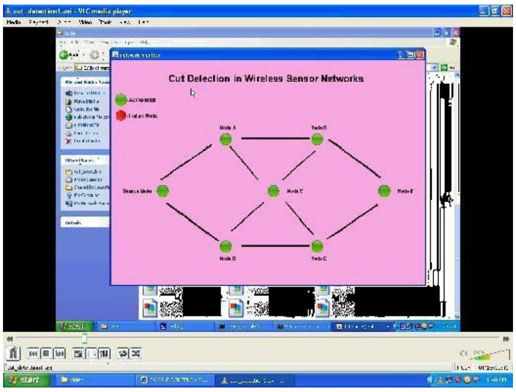

Figure 3: This screen is used for nodes representation

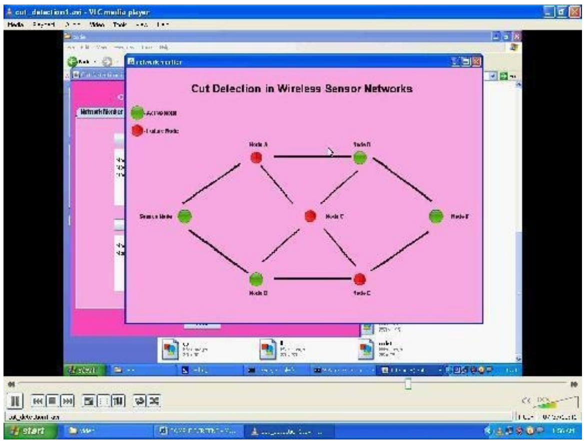

Figure 4: This screen is used for Showing Some Failure Nodes

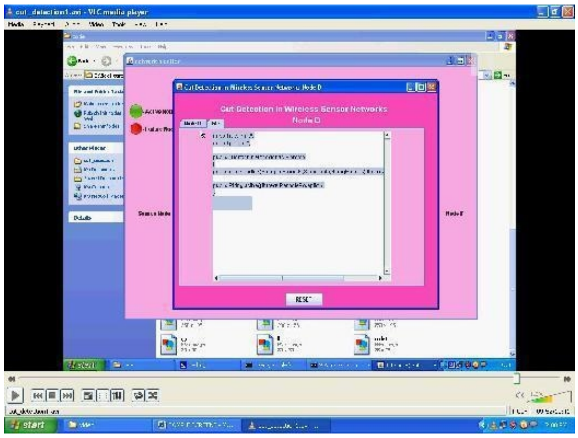

Figure 7: This screen is shows Received File

8.CONCLUSION:

Although we only discussed cut detection in this paper proposed algorithm can also be used for detection of “reconnection”. If a component that is disconnected due to a cut gets reconnected later (say, due to the repairing of some of the failed nodes), the nodes can detect such reconnection from their states. Simulations are reported in that illustrate the capability of the algorithm to (i) detect cuts in mobile networks and (ii) detect re-connections after cuts. There are several issues related to the DSSD algorithm that need to be examined. The first is the appropriate choice of the design parameter s (source strength) in the algorithm. The potentials of nodes far away from the source typically become smaller as the network size increases. To keep the state values become too small – which will affect cut detection – the parameter s has to be chosen as a large number for a large network. Guidelines for choosing s depending on the size of the network,

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and how much a-priori knowledge of the network structure is needed to make the appropriate choice, is being investigated. The states of the nodes computed by the DSSD algorithm are affected by even those node failures that do not lead to cuts. This is intuitive, since the electrical potential of a node in a resistive electrical network is a function of the network structure which changes due to node failures. This feature raises the possibility of designing algorithms to compute "electrical potentials" of nodes in a wireless network so as to detect structural changes that are more complex than simply cuts.

While a protocol that enables nodes to detect cuts is useful, there is also a need for protocols that allow a base station to detect when and where a cut has occurred. We envision a protocol that lies on top of the DSSD algorithm to determine the location of a cut when it occurs. This will the subject of future investigation. Another related issue that merits investigation is secure cut detection, when some of the nodes may "fail" in a malicious mode, such as when nodes are hacked by an adversary to send incorrect state data.

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