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Node Failure Recovery in Wireless Sensor Networks

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Abstract: In some of these applications, such as search and rescue and battlefield reconnaissance, a set of mobile nodes is deployed in order to collectively survey an area of interest and / or perform specific surveillance tasks. Such collaboration among the sensors requires inter-node interaction and thus maintaining network connectivity is critical to the effectiveness of WSNs. In WSAN sensors probe their surrounding and put forward their data to actor's node. Since actors have to coordinate their operation, it must to maintain a strongly connected network topology at every times our proposal overcomes these shortcomings and presents an improved Least-Disruptive topology Repair (LeDiR) algorithm. Improved LeDiR is a localized and distributed algorithm that leverages existing route discovery activities in the network and imposes no additional pre-failure communication overhead. The SRT table is used for identifying the block's size. The SRT table is furnished with Depth First Search (DFS) algorithm, in proposed system node priority assigning and size of block will find and recover multiple node failure.

Keywords – Fault Tolerance, Wireless sensor actor Network, Network Recovery, Topology Management, Assign node priority, Actor coordination.

I. INTRODUCTION

A wireless sensor and actor network (WSANs) is a group of sensors and actors linked by wireless medium to act a distributed sensing and actuation task. Initially sensors gather information about the physical world, while actors take decisions and then performing appropriate actions upon the environment, that allows remote, automated interaction with the environment.

[1]The meaning of the term actors differs from the more conventional notion of actuator. Actuator is a device to convert an electrical signal to a physical action, and constitutes the mechanism by which an agent acts upon the physical environment. An actor, besides being able to acts on the environment by means of one or several actuators, is also network entities that perform networking-related functionalities, i.e. process, receive, transmit and relay data. Hence, actor devices including robots, unmanned aerial vehicles (UAVs), and networked actuators such as water sprinklers, pan / tilt cameras, etc.

Applications of wireless sensor and actor networks may include team of mobile robots that perceive the environment from multiple disparate view points based on the data gathered by a sensor network, a smart parking system that redirects driver to available a distributed (HV) heating, ventilating system based on wireless sensors. In this paper, focusing recovering from a node failure in wireless sensor network failure of an actor or node may cause the network at the time replacing the node is impossible , at the time only powerful mechanism is reposition is the replacing the node is possible.

II. EXISTING SYSTEM

In WSANs, Actors usually coordinates their motion so that they stay reachable to each other with strong topology. However, a failure of an actor may cause the network to partition into disjoint blocks and would thus violate such a connectivity requirement.

To restore the node connectivity for failure stage, they used many contemporary recovery schemes such as Distributed Actor Recovery Algorithm (DARA) and Partition Detection and Recovery Algorithm (PADRA) but it will extend the length of data paths. [2] After introducing Least-Disruptive topology Repair (LeDiR) algorithm but it will work only for single node failure at a time.

DARA: DARA pursues a probabilistic scheme to identify cut vertices. A best candidate (BC) is selected from the one-hop neighbors of the dead actor as a recovery initiator and to replace the faulty node. The BC selection criterion is based on the least node degree and physical proximity to the faulty node. The relocation procedure is recursively applied to handle any disconnected children. In other words, cascaded movement is used to sustain network connectivity.

PARA: PADRA identifies a connected dominating set to determine a dominate node. The dominate does not directly move to the location of the failed node; instead, a cascaded motion is pursued to share the burden.[3] In the focus is also on recovering from the failure of a cut vertex. Only a special case is considered where the failure causes the network to split into two disjoint blocks. To re-link these blocks, the closest nodes are moved toward each other.

III.PROPOSED SYSTEM

System architecture is the conceptual model that defines the structure and/or behavior of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structure of the system which comprises system components, the externally visible properties of those components, the relationships between them, and provides a plan from which products can be procured, and systems developed, that will work together to implement the overall system.

Improved Least-Disruptive topology Repair (LeDiR) algorithm is used to restore connectivity without extending the length of the shortest path among nodes compared to the pre-failure topology. [4]This algorithm is to pursue block movement instead of individual nodes in cascade. To limit the recovery overhead, in terms of the distance that the nodes collectivity travel, and it identifies the smallest among the disjoint blocks.

LeDiR is assumed, where every node is aware of the entire network topology prior to the failure and thus can build the shortest-path routing table (SRT) for every pair of nodes. SRT can be populated through the route discovery activities in the network, e.g., when an on-demand routing protocol such as AODV is employed. [5] Least-Disruptive topology Repair (LeDiR) algorithm that restores connectivity by careful repositioning of nodes which works both single node failure and simultaneous node failures at a time for recovery process.

In this, Actors will periodically send heartbeat messages to their neighbors to ensure that they are functional, and also report changes to the one-hop neighbors. Missing heartbeat messages can be used to detect the failure of actors. Once a failure is detected in the neighborhood, the one-hop neighbors of the failed actor would determine the impact, i.e., whether the failed node is critical to network connectivity, by using the handshake method.

Block Diagram

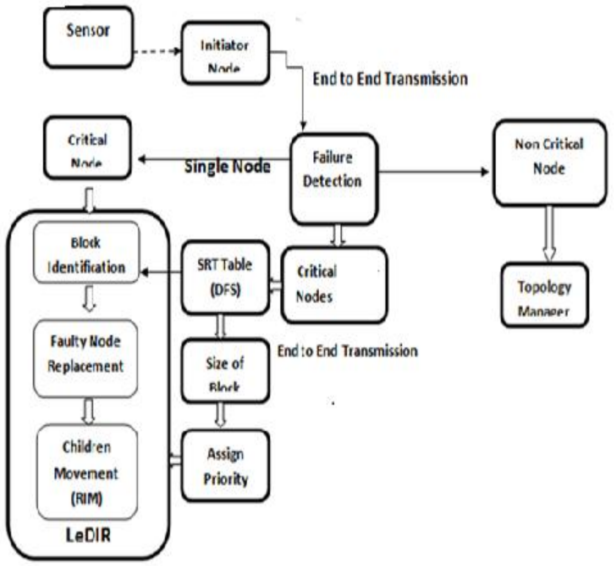

Figure 1.System Architecture

SRT- Shortest-path Routing Table, DFS- Depth First Search, RIM- Recovery through Inward Motion

LeDiR limits the relocation to nodes in the smallest disjoint block to reduce the recovery overhead. The smallest block is the one with the least number of nodes and would be identified by finding the reachable set of nodes for every direct neighbor of the failed node and then picking the set with the fewest nodes.

Since a critical node will be on the shortest path of two nodes in separate blocks, the set of reachable nodes can be identified through the use of the SRT after excluding the failed node. In other words, two nodes will be connected only if they are in the same block by using the depth first search.

Node is considered the gateway node of the block to the failed critical node (and the rest of the network), we refer to it as "parent." A node is a "child" if it is two hops away from the failed node, "grandchild" if three hops away from the failed node, and so on. The reason for selecting to replace the faulty node is that the smallest block has the fewest nodes in case all nodes in the block have to move during the recovery.

In case more than one actor fits the characteristics of a BC, the closest actor to the faulty node would be picked as a BC. Any further ties will be resolved by selecting the actor with the least node degree. Finally, the node ID would be used to resolve the tie by using best candidate selection.

LeDiR opts to avoid that by sustaining the existing links. Thus, if a child receives a message that the parent P is moving, the child then notifies its neighbors (grandchildren of node P) and travels directly toward the new location of P until it reconnects with its parent again.

If a child receives notifications from multiple parents, it would find a location from where it can maintain connectivity to all its parent nodes by applying the procedure used in RIM.

In a size of block are used to identifying the node history of failure states, if in a network some nodes are failures, there possible to disjoint of block and network partition are done, here we have to avoided these type of activities. In a network nodes are failure the network partition into two or more at the time communication also affected, at the time we concentrate both node repositioning and node repositioning are least degree, hop count we can assigning the priority.

CONCLUSION

In this phase, the major problems and assumptions in the existing system (i.e.) to recover only from single node failures at a time and no simultaneous failures would happen to be resolved by an improved Ledir of replacing the faulty node with the help of the base station. The existing system is implemented as well to identify the problems in a detailed manner and to overcome those deficiencies in the proposed system.

To implement the Wireless Sensor Networks thereby recovering from multiple node failures happening at the same time. A failure can happened in a network at same time, we can assign a priority for node recovering in a network.

The advantage of the remote setup in which WSANs often serve makes the deployment of additional resources to replace failed actors impractical, and repositioning of nodes becomes the best recovery option.

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