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Discover and Repair Pre-Failure and Vulnerable Nodes in Wireless Sensor Networks

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Abstract- **The focus of this work is on restoring strong connectivity and recovery of lost data at the level of interactor topology. The sensor in wireless sensor-actor networks discovers their surroundings and forward their data to actor nodes. Actor nodes have to coordinate to maintain a strongly connected network topology at all times. A failure of an actor node may cause the network to partition into disjoint blocks . One of the effective recovery methodologies is to automatically reposition the actor nodes to restore the connectivity but the node cannot restore the lost data. This paper overcomes this shortcomings and with a algorithm called DORMS Distributed algorithm for Optimized Relay node placement using Minimum Steiner tree, which can find the reason for the vulnerable node on the topology.**

Index Terms- network recovery, topology management, wireless sensor-actor network (WSAN),interactor topology.

I. INTRODUCTION

A wireless sensor network(WSN) consists of distributed sensors to monitor physical or environmental conditions, such as temperature, pressure etc and they group together to pass their data through the network to a main location. The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. The cost of sensor nodes depends on the complexity of the each sensor nodes. Size and cost of sensor nodes result on resources such as energy,computational speed communications bandwidth and finally memory . The WSN topology can vary from a simple star network to an advanced mesh networks.

In our model we use Wireless sensor actors,

Sensors + Actors ⟶ WSANs.

Wireless sensor and actor network (WSAN) is referred to a group of sensors and actors linked by wireless medium to perform sensing and acting tasks. The power of wireless sensor networks lies in the ability to deploy large numbers of tiny nodes that assemble and configure themselves. The wireless sensor network architecture we present here includes both a hardware platform and an operating system designed specifically to address the needs of wireless sensor networks. Wireless sensor and actor networks (WSANs) refer to a group of sensors and actors linked by wireless medium to perform distributed sensing and actuation tasks. Recent years have witnessed a growing interest in applications of wireless sensor and actor networks (WSANs). In these applications, a set of mobile actor nodes are used in addition to sensors in order to collect sensor data and perform specific tasks in response to response for the particular event. In most cases, group of actors have to respond for interactor coordination. Therefore, it is dangerous for maintaining a connected interactor network for the strength of WSANs. However, WSANs are not often used in harsh environments because actors can easily fail or get damaged. So if An actor failure occurs it may lead to division of the interactor network and block the fulfillment of the application requirements.

A typical WSAN consists of a larger set of miniaturized sensor nodes reporting their data to significantly fewer actor (actuator) nodes[1] .Wireless sensor actor network (WSAN) composed of a combination of at least one coordinator node with sensors and actor nodes that communicate wirelessly to perform a specific sensing, actual tasks and monitoring. These technologies of sensing and acting are used widely in agriculture and environment. Greenhouses use WSANs for crops monitoring and to monitor the climate it provides effective solution for crops growth and prevent diseases.

In this work we said about the restoring of strong connectivity at the level of interactor topology[2]. The sensor in wireless sensor-actor networks discovers their surroundings and forwards their data to the actor nodes. Actor nodes have to maintain coordinate operation to maintain a strongly connected network topology at all times. In addition to, the length of the inter-actor communication paths may be forced to meet path length requirements. Actors together have to respond to achieve predefined application mission.

Though, the failure of an actor may affect the network to partition into disjoint blocks and there occurs a loss of data. This considers the connectivity restoration problem subject to path length constraints. In some scenarios they use, some robotic networks and –rescue-and-search operation and the timely coordination between the actors is required, and for covering the shortest path between two actors as a side effect of the recovery process would not be acceptable. A novel Least-Disruptive topology Repair (LeDiR) algorithm is proposed. LeDiR relies on the local view of a node about the network to relocate the least number of nodes and ensure that no path between any pair of affected nodes is extended relative to its prefailure status. LeDiR is a localized and distributed algorithm that leverages existing route discovery activities in the network and imposes no additional prefailure communication overhead.

- Sensors

  – Inactive (passive)element sensing.

  – Limited energy, processing and communication Capabilities.

- Actors

  – Dynamic (active)element sensing.

  – Gamier working and communication.

  – Less consume of energy resources

(Longer battery life or constant power source)

Actor Node Operation

- Actors receive digital data from sensors
- Digital data is processed
- Controller generates action commands based on data
- Digital action command is converted to analog signal Action is performed.

Wireless Sensor versus Actor Networks

Even though actors are present they both have some differences from each other :

- Sensor nodes are small and are inexpensive devices with limited sensing, figuring and wireless communication capabilities, actors are usually resource-rich devices designed with best processing capabilities, stronger transmission powers and longer battery life.

- In WSANs, depending on the application they are very quickly respond to sensor input. To provide right actions, sensor data must be validated at the time of acting. Therefore, the effect of real-time communication is very important in WSANs .

- The number of sensor nodes used here is in the order of hundreds or thousands. However, such a high deployment is not needed for actor nodes due to the different coverage requirements and physical interaction methods of acting task. So here in WSANs the actors are much lower than the number of sensors.

- Sensors and actors must always need a distributed local coordination mechanism in order to provide effective sensing and acting actions.

I. RELATED WORKS

A WSAN consists of a set of miniaturized low-cost sensors that are spread in an area of interest to measure ambient conditions in the vicinity. The sensors serve as wireless data acquisition devices for the more powerful actor nodes that process the sensor readings and put forward an appropriate response. Actors work autonomously and collaboratively to achieve the application mission.

Given the collaborative actors' operation, a strongly connected inter-actor network topology would be required at all times. Actors usually coordinate their motion so that they stay reachable to each other. Though, the failure of an actor can affect the network to partition into disjoint blocks and would thus violate such a connectivity requirement[2].

The main disadvantages in the existing are some of this:

- A failure of an actor may cause the network to partition into disjoint blocks and would thus violate such a connectivity requirement.

- A number of schemes have recently been proposed for restoring network connectivity in partitioned WSANs. All of these schemes have focused on reestablishing severed links without considering the effect on the length of prefailure data paths.

In this it considers the connectivity restoration problem subject to path length constraints. A Least-Disruptive topology Repair (LeDiR) algorithm is proposed. LeDiR relies on the local view of a node about the network to relocate the least number of nodes and ensure that no path between any pair of affected nodes is extended relative to its pre-failure status. 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 results demonstrate that LeDiR showed on the existing schemes is focused terms of communication and relocation overhead.

We consider the problem of placing nodes in the monitoring area and assigning roles to them so that the lifetime of the system is maximized and covers all the regions of interest is covered by at least one sensor node[4]. In Topology Aware Placement and Role Assignment for Energy-Efficient Information Gathering in Sensor Networks, here they found the new algorithm for topology aware placement and for assignment of nodes in a sensor network, where the regular gathering of information from an area of interest and transmitting this information to a base station. They present DARA, a Distributed Actor Recovery Algorithm, which restores the connectivity of the inter-actor network by efficiently relocating some actors when failure of an actor happens[5].

II. PROPOSED SYSTEM

This paper considers the connectivity restoration problem subject to path length constraints and also to find the reason for the vulnerable node on the topology**.** Basically, in some applications, such as combat robotic networks and search-and-rescue operation, timely coordination among the actors is required to find the shortest path between two actors as a side effect of the recovery process would not be acceptable.

Least-Disruptive topology Repair (LeDiR) algorithm is used. LeDiR relies on the local view of a node about the network to relocate the least number of nodes and ensure that no path between any pair of affected nodes is extended relative to its prefailure status. LeDiR is a localized and distributed algorithm that leverages existing route discovery activities in the network and imposes no additional prefailure communication overhead. And week nodes are repaired using DORMS algorithm.

The performance of this work is validated both analytically and through simulation.

The problem found on the existing system was that they used UDP connection this work has TCP connection so that the lost data send can be easily known.

ADVANTAGES OF PROPOSED SYSTEM

- 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.
- Furthermore, tolerance of node failure cannot be orchestrated through a centralized scheme given the autonomous operation of the network.
- To avoid the excessive state-update overhead and to expedite the connectivity restoration process, prior work relies on maintaining one- or two-hop neighbor lists and predetermines some criteria for the node’s involvement in the recovery.
- One-hop-based schemes often impose high node repositioning overhead, and the repaired inter-actor topology using two-hop schemes may differ significantly from its prefailure status.
- Sensors are inexpensive and highly constrained in energy and processing capacity. On the other hand, actors are more capable nodes with relatively more onboard energy supply and richer computation and communication resources.

- The broadcasting range of actors is fixed and significantly less than the dimensions of the utilization area.
- An actor employs ranging technologies and localization techniques to determine its position relative to its neighbor.

A. Establishing Sensor-Actor

The sensor in wireless sensor-actor networks probe their surroundings and forward their data to actor nodes. Actor nodes have to coordinate their operation to maintain a strongly connected network topology at all times. Here we establish a required topology with sensors and actors node.

B.Recovering from a Node Failure

One of the effective recovery methodologies is to autonomously reposition a subset of the actor nodes to restore connectivity. Existing recovery methods either impose high node relocation overhead or extend some of the inter-actor data paths. In this recovering from node failure we use Least-Disruptive topology Repair (LeDiR) algorithm. LeDiR focus on the the view of a node about the network to formulate a recovery plan that relocates the least number of nodes and ensures that no path between any pair of nodes is extended.

C. Detecting prefailure communication

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. One-hop-based schemes often impose high node repositioning overhead, and the repaired inter-actor topology using two-hop schemes may differ significantly from its prefailure status.

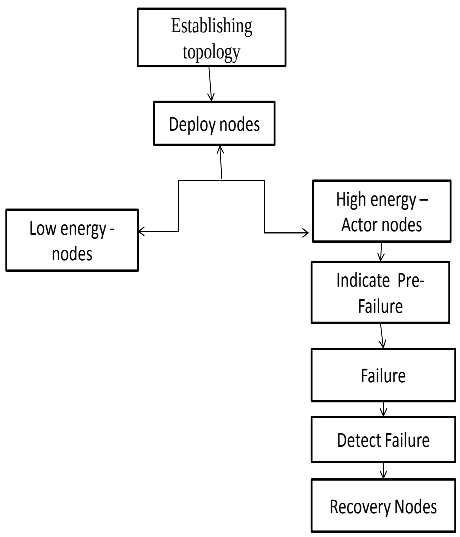
D.Detecting Attack

After detecting prefailure communication we will be processing the failed actor nodes to find out the reason for the failure. The failure may be caused due to vulnerability like privilege access, one shot attacked, etc. These types of vulnerability are detected using various algorithms and we will be displaying the total amount of attack has been caused to the sensor actor node.

E.Recovery by Placement of Relay Nodes

The foregoing algorithms aim to restore the network connectivity by efficiently relocating some of the existing nodes. However, in some setups, it is not feasible to move the neighbors of the failed node due to physical, logistical, and coverage constraints. Therefore, some schemes establish connectivity among the disjoint network segments by placing new nodes. He published schemes generally differ in the requirements of the newly formed topology. For example, Spider Web and Distributed algorithm for Optimized Relay node placement using Minimum Steiner tree (DORMS) opt to not only reestablish the network connectivity but also achieve a certain quality in the formed topology. Basically, both schemes try to avoid the introduction of cut vertices so that some level of robustness, i.e., load balancing and high node degree, is introduced in the repaired network topology.

System Architecture



III. CONCLUSION

In recent years, wireless sensor and actor (actuator) networks (WSANs) have started to receive growing attention due to their potential in many real-life applications. This paper has tackled an important problem in mission critical WSANs, that is, re-establishing network connectivity after node failure without extending the length of data paths and the lost data is also recovered . We have used a new distributed LeDiR algorithm that restores connectivity by careful repositioning of nodes. LeDiR focus only on the view of the network and also checks for the pre-failure nodes. And in this method we use tcp connection so that data received at the destination node can be acknowledged by the sender. We use DORMS algorithm to find and repair the vulnerable nodes. Our simulation results shows that by using actors ,LeDir and DORMS algorithm we can discover the pre-failure nodes, recover the lost data and repair the week nodes without extending the topology in wireless sensor networks.

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