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Fault Detection and Correction in Wireless Network

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ABSTRACT

Now a day's wireless technologies are very famous and frequently used technology in the worldwide. The wireless network is a collection of various nodes with wireless communications and networking potential, which help everyone for data communication in the network. Due to connectionless infrastructure, each node is capable to move freely in the network. In wireless network data transmission is very quickly and easily done as compared to the connection-oriented network but due to open network and dynamic movement of nodes there are many errors and security problem occurs. In this paper we are trying to find the various faults of the networks and trying to fix those problems which help out to improve the network efficiency, performance, and reliability.

Keywords: Wireless network, Mobile ad hoc network, Network performance, Lifetime, Security.

I. INTRODUCTION

A wireless network is a connectionless network between network nodes. Wireless networking is a technique by which we reduce the network cost. Wireless ad hoc network is a decentralized wireless network in which we don't have any pre-existing infrastructure. It is also very convenient for accessing the resources from any location as well as we can easily and quickly install it.

Fault detection in wireless Networks is an extremely challenging assignment. Detection algorithm should be well-organized and sufficient to locate the status of each node in the network. The fault detection is basically two type i.e. static fault or dynamic fault. Dynamic fault detection is very difficult as well as more complex as compared to static fault detection.

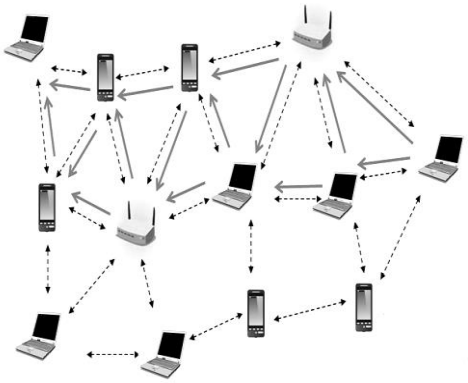

Figure 1. Wireless Network.

In the wireless network, if the faulty node exists in the networks then it affects the network performance, efficiency as well as throughput, which is harmful to the network and it also makes the network inconsistent. Faulty nodes cannot easily communicate with the other nodes. Faulty nodes are not capable to behave like normal nodes and also the results of faulty nodes are unexpected. Due to this the energy is also unnecessarily lost and the network becomes inconsistent.

Data sending and receiving mechanism in wireless networks is essentially faulty as well as unpredictable also. There are so many reasons which occurs fault in the wireless network:

1. Dynamic Changes in the network topology.
2. Due to lack of residual energy of the nodes in the network.
3. Due to network congestion, data packets are lost.
4. Large network size.

Various Faults in wireless network

Based on the Time period

1. Temporary fault.
2. Irregular fault.
3. Permanent fault.

Based on the actions

1. Soft Fault.
2. Hard fault

Based on the incidence

1. Static fault
2. Dynamic fault

Other Faults

1. Omission failures
2. Commission failures

II. RELATED WORKS

In wireless networks, communication is finished from node to node. Each node acts as an intermediate node i.e. like router during data transmitting and receiving to or from other nodes. Due to connection less mechanism, connection of nodes in the wireless network is temporarily for data transmission.

In 2001, I.F. Akyildiz, W. Su, Y. Sankarasubramaniam, E. Cayirci, studied about wireless sensor networks in which they illustrate the idea of sensor networks which has been completed practicable by the convergence of micro-electro-mechanical systems technology, wireless communications, and digital electronics. First, the sensing responsibilities and the prospective sensor network applications are explored, and a review of factors influencing the design of sensor networks is provided.

In 2004, Raquel A.F. Mini, Antonio A.F. Loureiro, Badri Nath develops the distinctive design characteristic of a wireless sensor network: the energy map in which The key challenge in the design of a wireless sensor network is maximizing its lifetime. This is a fundamental problem and new protocol engineering principles needing to be established in order to achieve this goal. The information about the quantity of obtainable energy in every part of the network is called the energy map and can be helpful to increase the lifetime of the network. They propose using the energy map as a protocol engineering principle for this kind of network. They argue that an energy map can be the basis for the entire design trajectory including all functionalities to be included in a wireless sensor network. Furthermore, they show how to construct an energy map using both probabilistic and statistical predictions-based approaches.

In 2005, Daniele Puccinelli and Martin Haenggi studied Wireless Sensor Networks: Applications and Challenges of Ubiquitous Sensing, in which Sensor networks offer a powerful combination of distributed sensing, computing, and communication. They provide themselves with immeasurable applications and, at the similar time, propose several challenges due to their peculiarity, primary the stringent energy constraints to which sensing nodes are typically subjected.

In 2008 Zoran S. Bojkovic, Bojan M. Bakmaz, and Miodrag R. Bakmaz deal with some security issues over wireless sensor networks (WSNs). A survey of recent trends in general security requirements, typical security threats, intrusion detection system, key distribution schemes and target localization is presented. In order to facilitate applications that require packet delivery from one or more senders to multiple receivers, provisioning security in group communications is pointed out as a critical and challenging goal. Presented issues are crucial for the future implementation of WSN.

In 2009, Peng Jiang, A New Method for Node Fault Detection in Wireless Sensor Networks in which Wireless sensor networks (WSNs) are an important tool for monitoring distributed remote environments. As one of the key technologies involved in WSNs, node fault detection is indispensable in most WSN applications. It is well known that the distributed fault detection (DFD) scheme checks out the failed nodes by exchanging data and mutually testing among neighbor nodes in this network., but the fault detection accuracy of a DFD scheme would decrease rapidly when the number of neighbor nodes to be diagnosed is small and the node's failure ratio is high. In this paper, an improved DFD scheme is proposed by defining new detection criteria. Simulation results demonstrate that The improved DFD scheme performs well in the above situation and can increase the fault detection accuracy greatly.

In 2011, Abolfazl Akbari, Arash Dana, Ahmad Khademzadeh and Neda Beikmahdavi Study about Fault Detection and Recovery in Wireless Sensor Network Using Clustering in which Some WSN by a lot of immobile node and with the limited energy and without further charge of energy. Whereas extension of many sensor nodes and their operation. Hence it is

normal. Inactive nodes miss their communication in network, hence split the network. For avoidance split of network, they proposed a fault recovery corrupted node and Self Healing is necessary. In this Thesis, they design techniques to maintain the cluster structure in the event of failures caused by energy-drained nodes. Initially, node with the maximum residual energy in a cluster becomes cluster heed and node with the second maximum residual energy becomes secondary cluster heed. Later on, selection of cluster heed and secondary cluster heed will be based on available residual energy. They use Matlab software as simulation platform quantities like, energy consumption at cluster and number of clusters is computed in evaluation of proposed algorithm. Eventually they evaluated and compare this proposed method against previous method and they demonstrate our model is better optimization than other method such as venkata raman, in energy consumption rate.

In 2012, Seo Hyun Oh, Chan O. Hong, Yoon-Hwa Choi studies about A Malicious and Malfunctioning Node Detection Scheme for Wireless Sensor Networks in which Wireless sensor networks are often used to monitor physical and environmental conditions in various regions where human access is limited. Due to limited resources and deployment in hostile environment, they are vulnerable to faults and malicious attacks. The sensor nodes affected or compromised can send erroneous data or misleading reports to base station. Hence identifying malicious and faulty nodes in an accurate and timely manner is important to provide reliable functioning of the networks. In this paper, they present a malicious and malfunctioning node detection scheme using dual-weighted trust evaluation in a hierarchical sensor network. Malicious nodes are effectively detected in the presence of natural faults and noise without sacrificing fault-free nodes. Simulation results show that the proposed scheme outperforms some existing schemes in terms of mis-detection rate and event detection accuracy, while maintaining comparable performance in malicious node detection rate and false alarm rate.

In 2013, Er. Saurabh and Dr. Rinkle Rani Aggarwal, A Review of Fault Detection Techniques for Wireless Sensor Networks in which Today wireless sensor networks (WSNs) emerge as a revolution in all aspects of our life. WSNs have unique specifications of themselves that describe them different from other networks. Fault tolerance is one of the most significant of many challenges in these networks. Five key features need to be considered when developing WSN solutions: scalability, security, reliability, self-healing and robustness. In this paper the main objective is to provide a comparative study of fault detection techniques using different approaches. Sensor nodes have various energy and computational constraints. To provide quality service by coverage protocols, there arises a need for developing protocols to provide fault tolerance, event reporting, and maintain energy efficiency.

In 2014, B Victoria Jancee, S Radha and Nandita Das analysis of non- binary fault tolerant event detection In wireless sensor networks, A distributed non-binary fault tolerant event detection technique is proposed for a wireless sensor network (WSN) consisting of a large number of sensors. The sensor nodes may be faulty due to harsh environment and manufacturing reasons. In the existing works on event detection, the detection of event is decided by only one threshold level. The objective of this paper is to extend the fault recognition and correction algorithm for non-binary event detection. The analysis presented here takes into account both the symmetric and non-symmetric error in a straightforward manner. In addition, simulation is done for Symmetric error and 75 percentages of the errors can be corrected. The theoretical analysis shows that more Than 95 percentage of symmetric errors can be corrected and almost 92 percentage of non-symmetric errors An be corrected (for k=2, i.e. Half of the neighbors give correct decision), even when as many as 10 Percentage of the sensor nodes are faulty.

In 2015, Nagalgaonkar Pramod, Dhanraj Biradar and Gaikwad Ranjit Sharnappa, examine on Fault detection and Recovery in WSN in which In recent due to advance research, applications of wireless sensor networks (WSNs) have been enlarged in different applications. In wireless sensor networks, sensor nodes are operated in unattended mode. In WSNs, it is essential to maintaining the communication between sensor nodes for all the time. Failure of the node affects the consistency of the network. One of the design challenge efficient fault management solutions to recover network from unanticipated failures. In this paper, they discuss different types of faults, detections techniques and fault recovery algorithms.

III. DETECTION MODEL

Detection Model

In this proposed model, a network consists of a collection of n self-governing heterogeneous nodes which organized via wireless links. Every node will send the response periodically during the analysis phase of the detection session to identify the status of the nodes.

Analysis Phase

The main part of the fault detection model is Analysis Phase, which analyzes that which node having fault and which node is free from fault

In this phase, we consider that the initial node is fault free and analytical data packet is to respond to the node in the network during the analysis phase. All the nodes receive analytical data packet and initially set as fault free.

In this phase, we check all the nodes and categories into two groups i.e. fault free group and faulty group.

During the transmission, we check that which node drops the data packet or modifies the data packet. In the network if a node drops a data packet when it comes to the faulty group. Similarly, if a node drops the data packet then it also comes from the same group.

After this process, we cannot include the faulty nodes in our network group. Now we are ready for data transmission, so we broadcast our data packet in the group using spanning tree methodology.

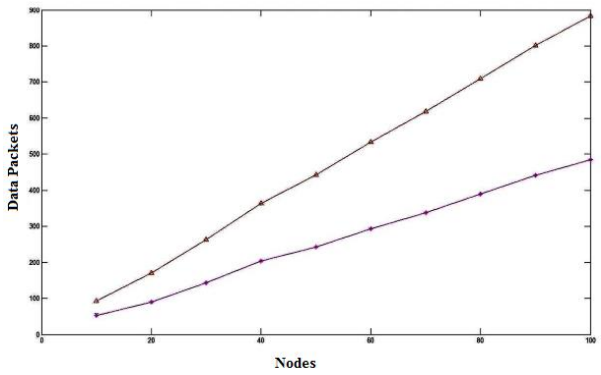

Figure 2. Nodes Vs Data Packets

IV. CONCLUSION AND FURTHER DEVELOPMENT

In present time wireless technology is widely used for data communication .We discuss about the wireless network faults and how to improve our network which helps to improve performance, energy and efficiency of the network.

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