FAULT NODE RECOVERY ALGORITHM FOR TOPOLOGY CHANGES IN WIRELESS SENSOR NETWORKS

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ABSTRACT: **A wireless detector network gathering an outsized range of small sensor nodes which is capable to perform native computations supported by gathering sensor data and communicating with alternative sensor nodes within the network.The fault node recovery (FNR) algorithm, grade diffusion algorithm combined with the genetic algorithm finds the dead node and shortest path with the help of following parameters like Average delay, Energy Consumption, packet delivery Ratio .The FNR algorithm requires replacing non-functioning nodes and reuses the most routing paths, for increasing the WSN lifetime. The expected result increased the speed of packet delivery Ratio &throughput. This system will give recovery of failure nodes with lesser cost and lesser Energy consumption. This system output displayed with NAM animator or x-graphs usingNS-2.**

Keywords: Least-Disruptive topology Repair algorithm (LeDiR), Fault tolerance, network recovery, topology management, Fault Node Recovery Algorithm(FNR), wireless sensor-actor network (WSAN).

1. INTRODUCTION

A wireless sensor network (WSN) is a wireless network consisting of spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants, at different locations. The development of wireless sensor networks was originally motivated by military applications such as battlefield surveillance. However, wireless sensor networks are now used in many civilian application areas, including environmentand habitat monitoring, healthcare applications, home automation, and traffic control. In addition to one or more sensors, each node in a sensor network is typically equipped with a radio transceiver or other wireless communications device, a small microcontroller, and an energy source, usually a battery. A sensor network normally constitutes a wireless ad-hoc network, meaning that it each sensor supports a multi-hop routing algorithm for several nodes may forward data packets to the base station.

Depending on the size of the sensor network and the complexity required of individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computation also speed and bandwidth. A sensor network normally constitutes a wireless ad-hoc network, meaning that it each sensor supports a multi-hop routing algorithm for several nodes may forward data packets to the base station.

A few years ago, the applications of WSN were rather an interesting example than a powerful technology. Nowadays, this technology attracts still more and more scientific audience. Theoretical works from the past, where WSN principles were investigated, grew into attention-grabbing applications practically integrated by this time in a real life. It could be said, that countless application fields, from military to healthcare, are already covered by WSN. Together with this technology expansion, still new and new tasks and interesting problems are arising. Simultaneously, such application actions stimulate the progress of WSN theory that at the same time unlocks new application possibilities. The typical examples are developments within the “Internet-of-Things” field as well as advancements in eHealth domain with

WBAN IEEE 802.15.6 standard progress.

Mali, G [1] et al proposed a distributed topology management scheme in wireless multimedia sensor networks (WMSNs) ensures coverage of an event, prolongs network lifetime, and maintains connectivity between camera sensor (CS) nodes. However, the deployment of WMSNs in unattended environments makes the nodes vulnerable to security attacks. Hence, security issues should be considered, along with topology management, in WMSNs. we propose a trust-based distributed topology management scheme, named TRAST, for use in WMSNs.

TRAST exploits the received signal strength of the control packets, which are then used to construct the distributed topology. In a non-secure distributed topology, the use of trust helps in providing coverage of an event, and maintaining connectivity, even in the presence of malicious attacks. The proposed topology management scheme achieves higher average coverage ratio and average packet delivery ratio than those corresponding to the LDTS and T-Must schemes, in the presence of malicious attacks.

Gembali [2] et al proposed a novel beam forming based scheme for interference aware topology management in MIMO Wireless Sensor Networks. Topology Management techniques are aimed at achieving network topologies that guarantee energy efficient connectivity and coverage, thus leading to maximization of the lifetime of the WSN. In this context, we propose a scheme which finds a minimum spanning tree together with the optimal set of beam formers at the MIMO equipped wireless sensor nodes. For this purpose, we formulate a link metric which takes into consideration the interference at other nodes belonging to its coverage area in the WSN. Subsequently, employing the formulated metric in the WSN, we find a spanning tree which maximizes the sum-metric, thus minimizing the interference. We also determine the optimal set of beam formers considering multi-node interference and cooperative transmission among sensor nodes in the WSN spanning tree based topology. Simulation results demonstrate that the above schemes lead to a significant improvement in the overall SNR of the links in the WSN topology.

Qiang Zhang [3] et al proposed a underwater nodes provide measurements for target tracking based on underwater wireless sensor networks (UWSNs), node topology, which is made up of the underwater nodes, may affect the performance of target tracking. But all existing target tracking schemes do not consider this effect. This study effect of node topology on the target tracking in UWSNs. Firstly, by using the knowledge of geometry, the effects of four typical topologies on target tracking based on UWSNs are analyzed qualitatively. The four typical topologies include four nodes form a square, four nodes are in line, four nodes are close to each other, and four nodes form a regular tetrahedron. Secondly, to evaluate the arbitrary topology, the relationship between the posterior Cramer-Rao lower bound (PCRLB) and node's position is derived. Thirdly, our target tracking scheme consisting of the optimal topology selection scheme by minimizing PCRLB, the optimal fusion center selection scheme by minimizing energy consumption, and the multi-sensor particle filter (PF) is designed. Last, simulation results show the effectiveness of the proposed scheme.

Li Tian [5] et al proposed The typical routing protocol of wireless sensor network is Low Energy Adaptive Clustering Hierarchy (LEACH) protocol, which uses self organizing and dynamic cluster formation, so it has a problem that more or less cluster headers may have a bad effect on the network. we will discuss that the quality of network can be optimized through controlling the number of cluster headers in LEACH protocol via the NS2 simulation, and then illustrate that setting optimal cluster headers can lower energy consumption and extend the lifecycle of network.

Miao Zhao. [6] et al proposed a maximize network coverage and to provide a reliable, energy-efficient monitoring depends on selecting minimum number of sensors in active mode to cover all the targets. This power saving technique can be regarded as Set Covering Problem (SCP). Designing for a minimum set of nodes where node selection procedure is based on the energy of each node in a set, provide energy-efficient sensor network. The performance analysis through simulation results show that the algorithm proposed is selects less working nodes than the other algorithms and maximize the network lifetime as well. In the evolving of Wireless Technology the system designers are faced with a challenging set of problems that stem from access mechanisms, energy conservation, a required low error rate, transmission speed characteristics of the wireless links and mobility aspects such as small size, light

weight long battery life and low cost.

Baiping Li. [7] et al proposed an open source, architecture reasonable network simulation tool, NS2 has been widely used in wireless and wired network research. NS2 is fairly easy to use once you get to know the simulator, it is quite difficult for a first time user, because there are few user-friendly manuals. Even though there is a lot of documentation written by the developers which has in depth explanation of the simulator, it is written with the depth of a skilled NS user. Meanwhile, NS2 runs on Linux operating system and the difficulty of development, many beginners can do not know how to use it. The purpose of this paper is to give a new user some basic idea of how the simulator works, how to setup simulation networks. The introduced principle, procedure, process and tool of NS2 through the example of develop the routing protocol of wireless sensor network.

Wang.c[8] et al proposed a TRAST exploits the received signal strength of the control packets, which are then used to construct the distributed topology. In a non-secure distributed topology, the use of trust helps in providing coverage of an event, and maintaining connectivity, even in the presence of malicious attacks. The proposed topology management scheme achieves higher average coverage ratio and average packet delivery ratio than those corresponding to the LDTS and T-Must schemes, in the presence of malicious attacks. However, the deployment of WMSNs in unattended environments makes the nodes vulnerable to security attacks. Hence, security issues should be considered, along with topology management, in WMSNs. we propose a trust-based distributed topology management scheme, named TRAST, for use in WMSNs.

2. BLOCK DIAGRAM

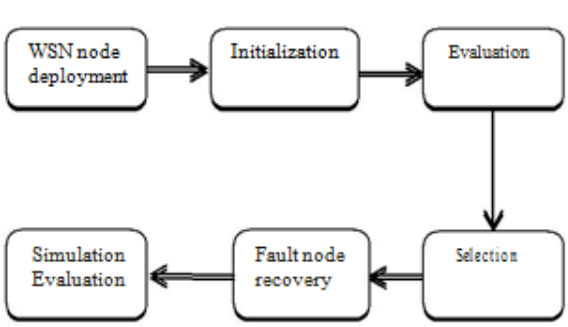

Fig.1.Block Diagram

A. Input Method

Input design is the process of connecting WSN nodes into given network topology.In the first step every nodes should be initialized to the sink (base station) then nodes are Evaluated based on their path length.Nodes are selecting shortest path for sending the information to sink.The non-functioning node (Fault node) will be recovered by using Fault Node Recovery algorithm then the system was simulated.

B. Least Disruptive Topology Repair Algorithm

The goal for LeDiR is to restore the connectivity without extending the length of the shortest path among nodes compared to the pre-failure topology. The LeDiR algorithm first detects the faulty node and finds whether it is a cut vertex by using the partially populated Shortest-path Routing Table (SRT) and go to the recovery process. Then the faulty node is replaced by the neighbor of the failed node which belongs to the smallest block. After that the child nodes which are directly connected to the parent node are also relocated for recovering the connectivity.

C. Fault Node Recovery Algorithm

Fault node recovery (FNR) algorithm for WSNs based on the grade diffusion algorithm combined with the genetic algorithm. The FNR algorithm creates the grade value, routing table, neighbor nodes, and payload value for each sensor node using the grade diffusion algorithm. In the FNR algorithm, the number of nonfunctioning sensor Nodes is calculated during the wireless sensor network

operation.

D. Topology Formation

In this phase constructing project design in ns2 should takes place. Initially the Base Station will broadcasts Topology-Discovery packets to all the sensor, which makes each sensor should be aware of its local topology namely neighboring nodes, and paths to reach base station.

E. Genetic Algorithm

In the current approach, a route discovery approach is proposed which reduces amount of power consumption and number of nodes becoming obsolete (dead) will be less as compared to Grade Diffusion algorithm. The proposed algorithm will also determine set of nodes known as "grades" which has two values namely 0 or 1. Each node will become 0 if node is greater than threshold otherwise it will be 1. This process of finding the set of nodes whose node is greater than threshold is called Fault Node Determination. The nodes will be replaced with new nodes of same node id this process is called Fault Node Recovery.

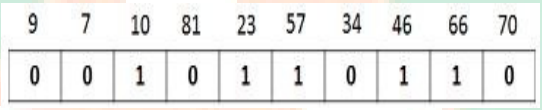

Fig. 2.Chromosome and its gene

In the GA, crossover step is used to change the individual chromosomes. One point crossover strategy is used in this algorithm to create new chromosomes; two individual chromosomes are selected to produce two new offspring. A crossover point is selected between the first and last genes of the parent individual then the fraction of each individual on either side of the crossover point is exchanged.

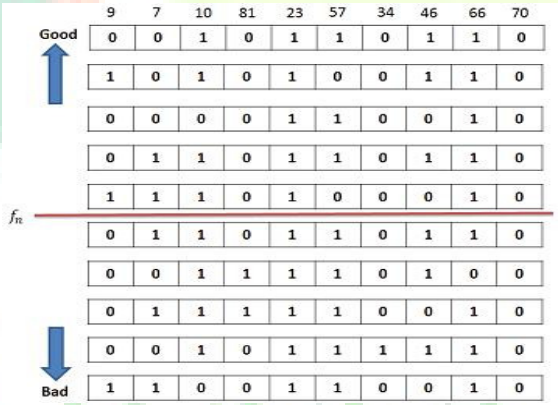

Fig.3.Selection step

In this algorithm, mutation step is to flip a gene randomly in the chromosome. The chromosome with the genes of 1 replaces the sensor node to extend the network lifetime.The body with the most effective fitness price is that the answer once the iteration. The FNR formula can replace the device nodes in the body with genes of one to increase the WSN life.

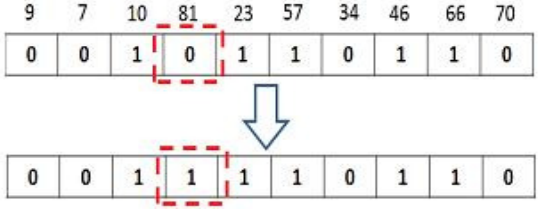

Fig.4.Mutation step

F. Directed Diffusion Algorithm

The goal of the DD algorithm is to reduce the data relay transmission counts for power management. The DD algorithm is a query-driven transmission protocol. The collected data is transmitted only if it matches the query from the sink node. In the DD algorithm, the sink node provides the queries in the form of attribute-value pairs to the other sensor nodes by broadcasting the query packets to the whole network. Subsequently, the sensor nodes send the data back to the sink node only when it fits the queries.

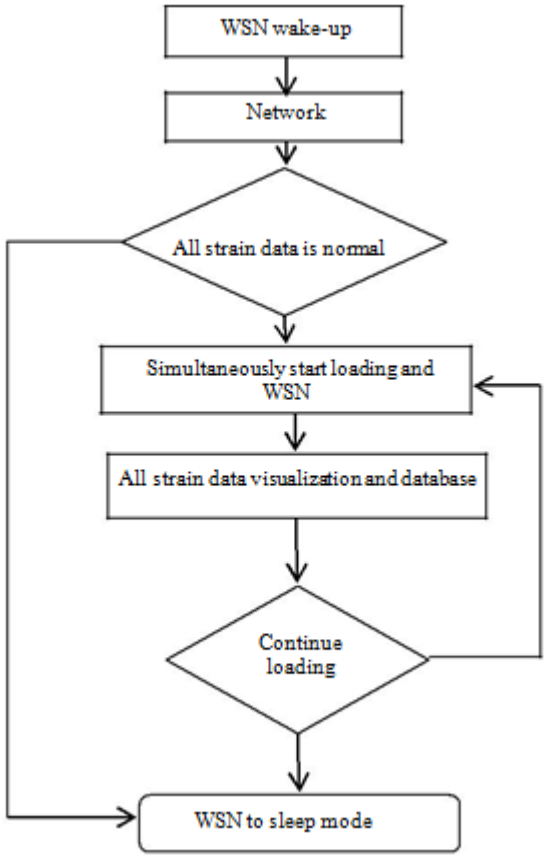

Fig.5.Flowdiagram of FNR

G. Grade Diffusion Algorithm

The GD algorithm not only creates the routing for each sensor node but also identifies a set of neighbour nodes to reduce the transmission loading. Each sensor node can select a sensor node from the set of neighbour nodes when its grade table lacks a node able to perform the relay. The GD algorithm can also record some information regarding the data relay. Then, a sensor node can select a node with a lighter loading or more available energy than the other nodes to perform the extra relay operation. That is, the GD algorithm updates the routing path in real time, and the event data is thus sent to the sink node quickly and correctly.

3. RESULTS AND DISCUSSION

The differentiation between critical nodes and normal nodes in the network has also shown in Fig.6 and Fig.7, which helps to easily locate the failure nodes. In final result the better algorithm will recover the failure node with less battery, power consumption and less cost.

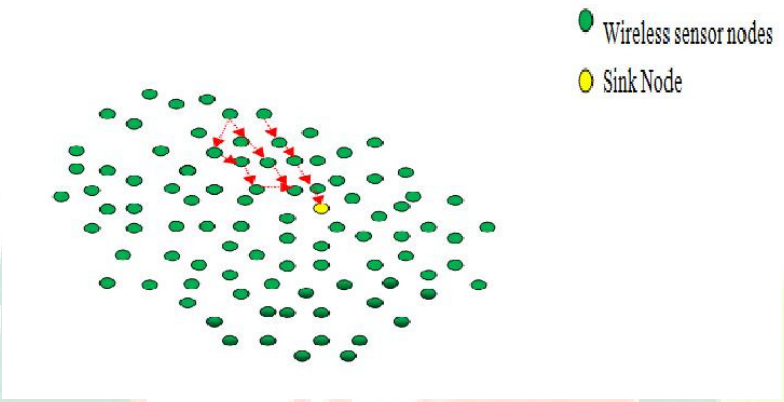

Fig.6. Wireless sensor routing nodes

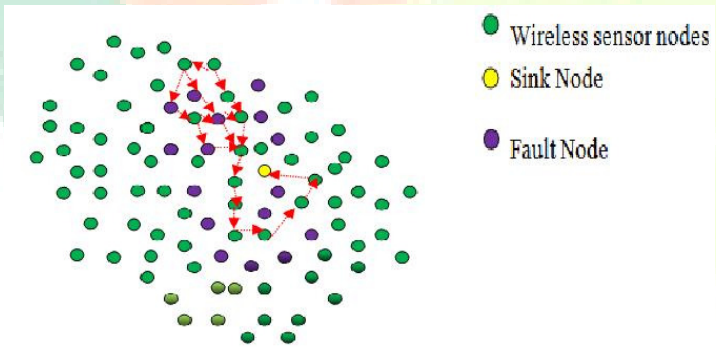

Fig.7. Wireless sensor routing path when some nodes are failed

I. AVERAGE DELAY

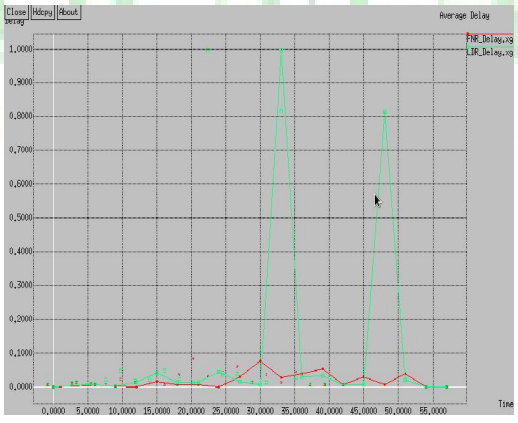

Fig.8. Simulation Results for Average Delay

Figure 8 shows that the simulation results for average delay will be reduced with minimum time period.

II. PACKET DELIVERY RATIO

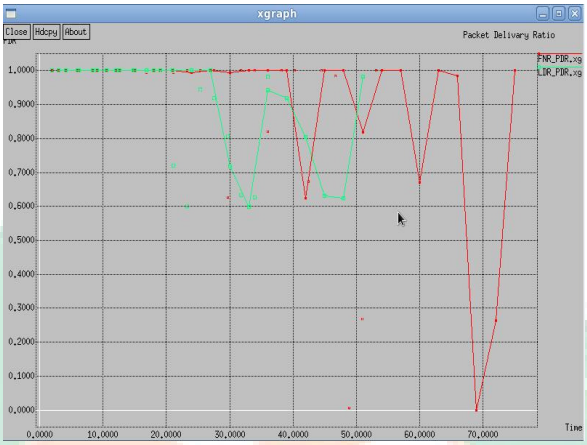

Fig.9. Simulation Results for Packet Delivery Ratio

Figure 9 shows that the Simulation Results for Packet Delivery Ratio will be very high compared with existing algorithm.

III. ENERGY CONSUMPTION

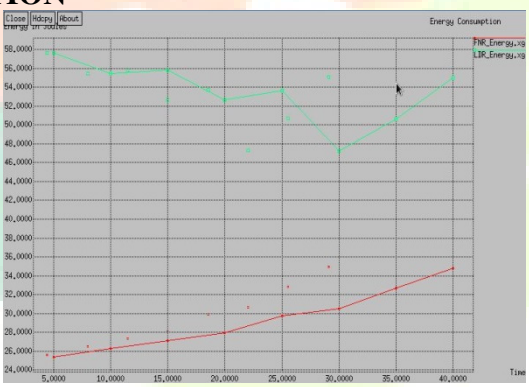

Fig.10.Simulation Results for Energy Consumption

Figure 10 shows that the Simulation Results for Energy Consumption will be reduced using Genetic algorithm.

4. CONCLUSION

The proposed system will work on two failure node recovery algorithms in WSN: LeDiR and FNR. We compare the both algorithms with the help of following parameters: Average delay, packet delivery ratio, energy consumption. The output system displayed with NAM animator or x-graphs to easily locate the failure nodes. This system will give us sure recovery of failure nodes with lesser cost and lesser Energy consumption using ns-2.

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