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A modified Fault Diagnosis Scheme in Wireless Sensor Networks

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***Abstract*—** The sensor nodes in wireless sensor networks may be deployed in unattended and possibly hostile environments. In addition, node failures and environmental hazards cause frequent topology changes, communication failures, and network partitioning. This in turn adds a new dimension to the fragility of the network topology. In this paper we propose the modified distributed algorithm that can detect the faulty nodes present in the network and upon detection removes those in order to safeguard the faulty data may arrive the wireless network. The algorithm works with twofold former one is to check for the node observations and related with them previous observations to make sure for consistency of data and later is to publish to the neighboring nodes to know the status of the error and eliminates completely from the network.

Keywords: Fault, fault detection, fault nodes, WSN

I. INTRODUCTION

In recent days with improvements in equipment and remote system innovation, minimal effort, low-control and different capacity sensor gadgets are accessible in handy utilize. A wireless sensor nodes (WSN) comprises of more intensity of sensor nodes spreading over a topographical region [11]. The principle utilizations of wireless sensor nodes incorporate ecological checking, security, region observation, fabricating, and automation in the industries, and so forth [12]. With advancement the sensor node is subtle for the reason that of unforgiving conditions and restricted energy resources, the sensor nodes may neglect to perform redress activities. In addition, the association between sensor nodes is inclined to transitory or lasting disappointment under extreme situations. Then again, organize correspondence depends on bundle switchings among sensor nodes. Node failure can seriously impact arrange execution. It is important to give a conclusion instrument to testing the operational sensor organize, with the end goal that the system framework [18], [19] can be checked and kept up based on framework status data got from the finding component. In this paper, we deliberate a modified faulty node detection system for WSNs. The analysis system is occasionally propelled to screen every node progressively and recognize faulty nodes.

As delineated in Fig. 1, fault recognition strategies for wireless sensor nodes can be comprehensively arranged into concentrated and disseminated approaches. In particular centralized methodologies, usually accepted that a directing authority is accessible to examine the analytic messages and spread symptomatic data. The usage of such a methodology would put a restricted access on the system lifetime. Thus, the circulated analysis has been presented and considered.

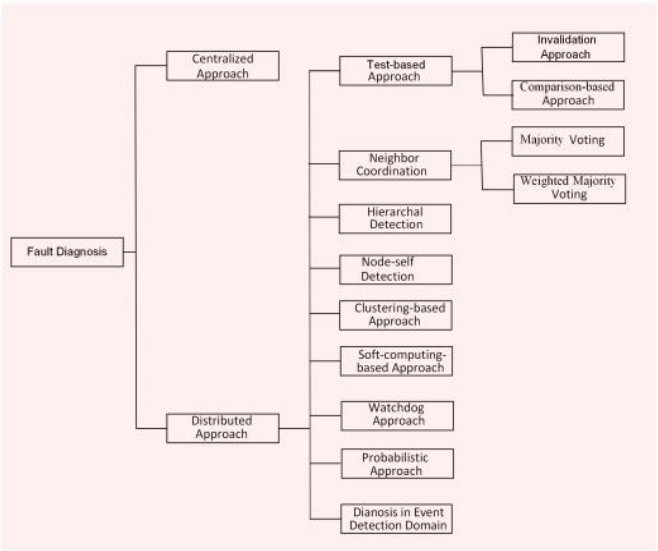

Figure 1. Nomenclature framework for fault detection techniques

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As appeared in Fig. 2, specific faults could be each level of six individual segments of a node: registering motor, handset, memory subsystems, vitality source, sensors, and actuators which outcomes in the node failure. In remote sensor systems, because of constrained battery control, inside least time, detecting ought to be appropriated and error free and faulty nodes must be evacuated when they are recognized. In this paper, we depict and decide a fault location calculation and assess the execution of the proposed calculation utilizing the given parameters like threshold values, connectivity and Time excess.

Expansive scale organization of ease sensor nodes in uncontrolled, vicious or threatening conditions is the innate property of WSNs. Usually for the sensor nodes to end up defective and problematic. The typical task of a WSN experiences damaged information since it diminishes the judgment exactness of the base station, it expands the activity in the systems, and it wastes more-restricted energy [13]. Likewise, the sensors are regularly used to process control activities, where sensor deficiencies can cause disastrous events [20]. For example, the National Aeronautics and Space Administration was compelled to prematurely end the dispatch of the space carry "Disclosure" as a result of the disappointment in one of the sensors in the sensor system of the bus outside the container (the failure was found through human assessment) [14]. Therefore, fault diagnosis in WSNs has pulled in much consideration in WSN look into network since a decade ago. In a quality compelled network like WSNs, fault conclusion fills in as an instrument that upgrades information dependability, occasion revealing, and viable transmission capacity usage of the system. Specifically, it helps in expanding the system lifetime and reconfiguring the system for better information conveyance. For instance, if a faulty sensor node is permitted to take an interest in the system action, at that point mistaken information created by it will be directed to the sink node or base station.

As per above views intermediate sensor nodes will disperse vitality in handing-off this off base data. For a high failure rate, the system lifetime and system data transmission are seriously destroyed. For interactive media sensor organizes, this turns out to be surprisingly more dreadful. This is on account of image information requires a transmission data transfer capacity that is the request of extent higher than accessible sensors. In the domain of image processing require complex equipment and make the vitality utilization for calculation practically identical to correspondence vitality dissemination [15]. In a cluster-based routing, if the part sensor nodes are ignorant of the failure at the head sensor node, they send information and along these lines, dissipate energy [16]. Also, the incorrect choice may prompt pointless energy utilization because of recuperation and re-grouping of the system. Fault analysis in WSN tends to these issues by giving a rundown containing all conceivable faulty sensor nodes. With such a rundown, assist recuperation forms to end up conceivable, for example, rectifying faulty readings, replacing breaking down sensor nodes with great ones, or separating defective sensor nodes from a system that has adequate excess [17].

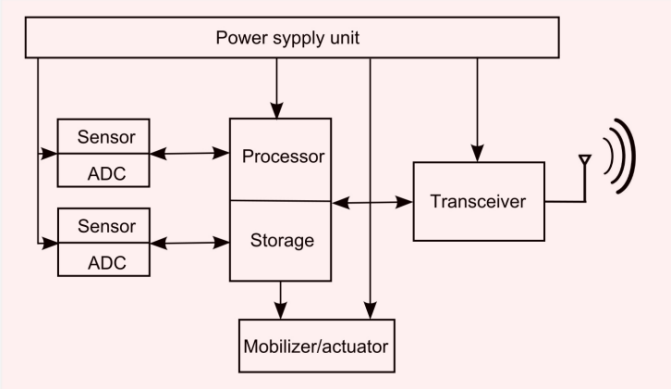

Fig. 2. Typical sensor node

The main contributions and organization of this paper are summarized as follows: In section II we describe literature review of different fault mechanisms. The section III proposed work. Finally in section IV we concluded the paper.

II. Literature Review

Remote sensor frameworks are directly a-days creating as stages for watching diverse common conditions including remote topographical locale, office structures, and mechanical plants. They are made out of an extensive number of little sensor center points outfitted with compelled handling and correspondence skills. Since insignificant exertion sensor centers are as often as possible passed on in an uncontrolled and brutal topographical space, are slanted to have defects. It is in like manner verifiable to find, locate the fault sensor center points, and evade them from the framework all through run of the mill task except if they could be used as correspondence sensors without sensor usefulness [7].

The execution of the restricted diagnosis, be as that may, is constrained due to the arbitrary idea of degree/availability of

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the conveyed sensors. Fault-enduring event location calculation is likewise furthermore been proposed in [1]. The authors have proposed a fault-tolerant vitality productive event identification calculation for WSN [3]. For a given recognition mistake bound, least neighbors are chosen to limit the correspondence volume in the system [1]. A dispersed fault location calculation for WSN has been proposed in [3]. It utilized nearby examinations with an altered greater part casting a ballot to close the fault status, where every sensor node settles on a choice dependent on correlations between its very own detected information and neighbors' created information, while considering the occasion zone of its neighbors [4]. The calculation, in any case, is somewhat confusing in the manner in which that data trade between neighboring nodes happen twice before a nearby choice dependent on a limit is come to. Also, it anticipates transient faults in sensor perusing for an internode correspondence, which could have happened for the vast majority of the typical without fault sensor nodes [4]. Transient faults in detecting and correspondence have been researched in the paper. A straightforward disseminated calculation has been suggested that endures transient faults in the fault recognition process. Some other fault administration plans can be found in the study composed creators in [2].

In [5], the authors research the three-stage fault administration process, that is, fault recognition, finding, and recuperation. They examine express and verifiable recognition, unified and appropriated approaches, neighbor coordination, grouping, and circulated discovery strategies. In [6], the authors additionally give a study to fault management in WSNs. They portray fault avoidance, location, and seclusion, ID, and recuperation strategies independently. In [8], the creators arrange fault location strategies into four classes: manage based techniques, estimation strategies, time arrangement examination based techniques, and learning-based techniques. In [9], the authors present a model including different kinds of WSN oddities. They outline an arrangement of abnormality recognition methodologies and partition them as indicated by concentrated, dispersed, and crossover designs. They additionally give a few structure rules for inconsistency recognition procedures. In [10], the authors assess fault diagnosis apparatuses in WSNs in a relative way. The correlation structure comprises of structural, practical, and dynamic angles as different measurements.

III. PROPOSED FRAMEWORK

The proposed scheme calculates the connectivity of every node and computes the range of faulty associated nodes as a percent of total connectivity and subsequently prevents the detection accuracy being reduced with time. In this paper the system suggested computes for each and every node for connectivity to the network as well number of faulty nodes present in the network, so the detection probability increases. It also checks for interminable faults nodes and thus eliminated from the given network, on the other hand temporary faulty nodes in the network and let them provide readings for certain time slot set by the threshold value. When the node find to be faulty it is immediately removed from the network.

Fault recognition: Consider the network so that the sensor node can be treated as a binary variable that can store its location, so that we can run the operation of the node faulty location with the assisted network.

Modified algorithm:

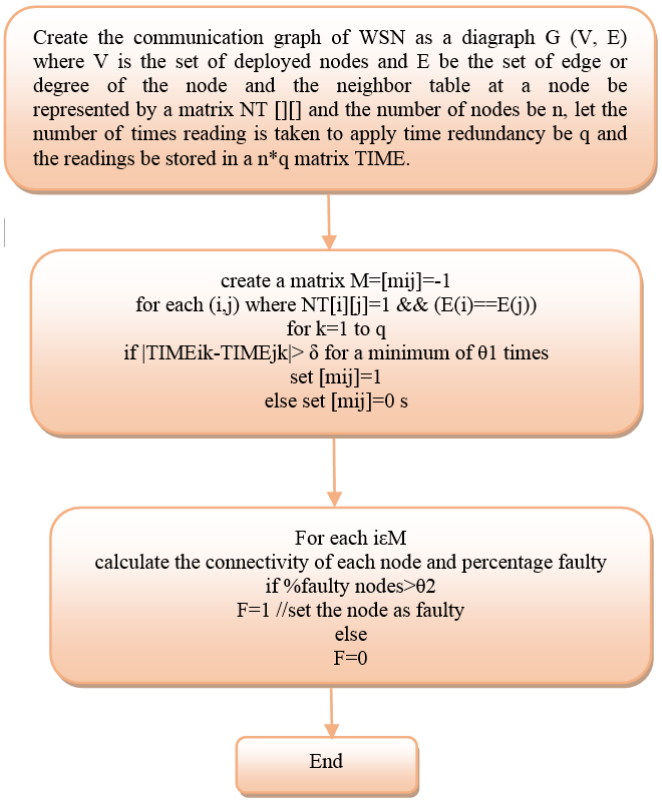

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Fig.3. proposed flow chart

Fault detection: Contemplate the given network be signified with the assistance of a digraph *G (V, E)*, where the variable *V* signifies collection of sensor nodes inside the network and *E* signifies the collection of edges or connectivity of the sensor nodes in the network.

Threshold test: With this test every node should relates their data with other neighbor node in the network. If the error maintained seems to be above threshold value δ, they are treated to be faulty nodes.

Dissemination test: With this test, a node can notice fault status with the degree of faulty edges present in the network. If the detected quantity seems to be below the threshold value, treated to be faulty node.

The algorithm was simulated on 1000X1000 grid size on Matlab tool with 100sec simulation time run with 10Iterations to evaluate the performance of the network.

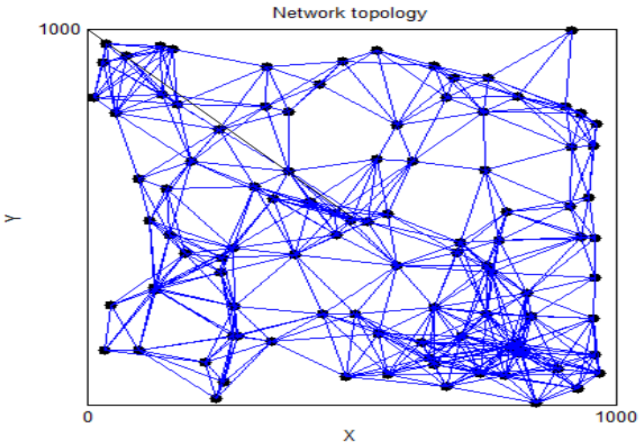

Figure 4. Network topology size 1000X1000

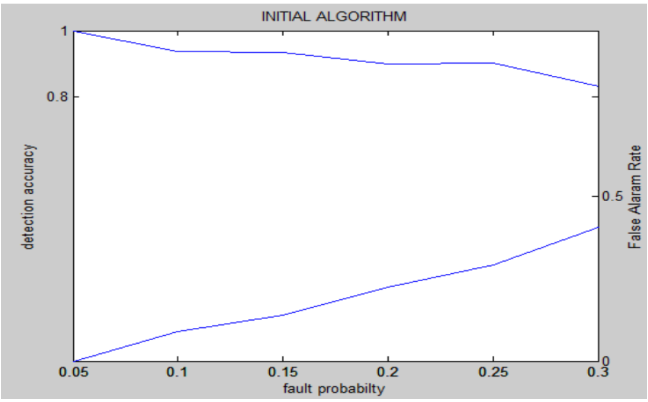

Figure 5. Simulation curve of false alarm rate and Detection accuracy

From figure 5, it is clear that there is gradual improvement in the detection accuracy and fast growth in false alarm rate due to presence of random observations below the threshold value.

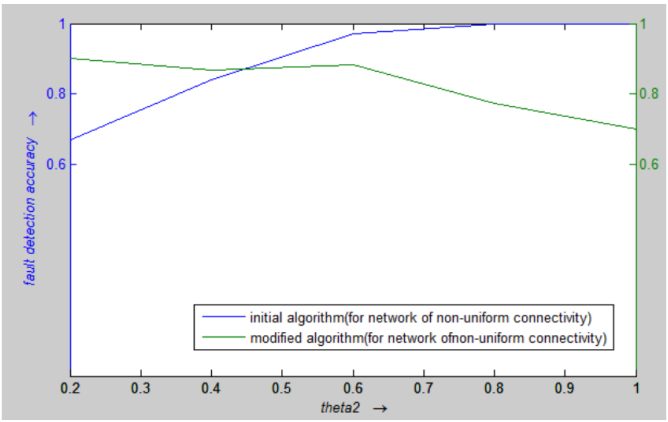

Figure 6. Comparison of traditional and modified algorithms

From figure 6, it is clear that Θ_2 is the number of faulty nodes to total connectivity of the nodes. The modified algorithm detection accuracy is outperformed related to the initial algorithm.

IV. CONCLUSION

With the advancement of wireless applications sensor nodes can be treated to be great use today. From the above discussions there is more chances of faulty nodes growth increase day by day, so there is need of detection scheme that can able to capture faulty nodes. In this paper modified distributed algorithm is implemented and compared with traditional initial algorithm and evaluate its performance in terms of detection accuracy, false alarm rate. The simulated results gave satisfactory results.

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