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Research paper

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 could notice the defective nodes existing pool system 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 node; diagnosis system; wireless sensor networks*

1. 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 switching 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.

As appeared in Fig. 2, specific faults could be present in every corner of the elements present in the node likewise at ADC stage, sensors stage, the processor stage and the actuator stage apparently that detect the failure rate in the nodes of a system.

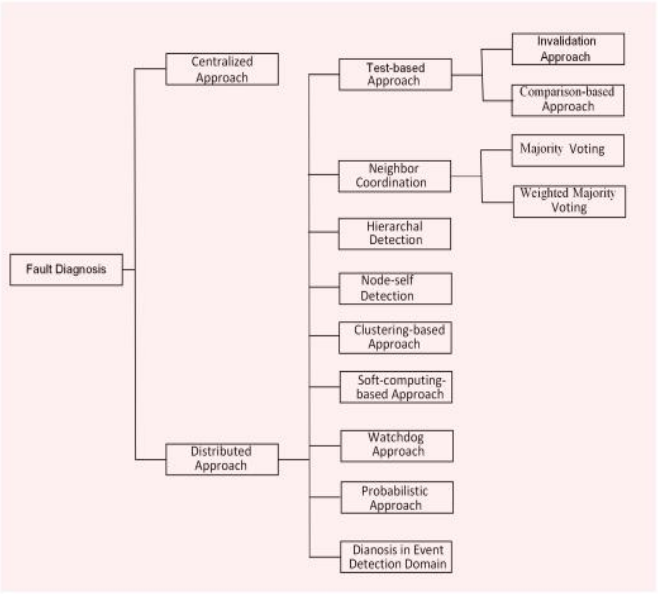

Fig.1: Nomenclature framework for fault detection techniques

In remote sensor systems, because of constrained battery control, inside least time, detecting ought to be appropriated defectives nodes could 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.

In [13], the authors worked how to check the wastage of the energy in the WSN during the defective of the particular nodes to be found in the community and inform to its nearby base station of the status of the node failure so that necessary actions can be taken. In [20], the authors similarly worked on process mechanism of the nodes at the defective stage so that there should not be a catastrophic events may happen in the node [21]. In [14], the authors

pulled consideration in WSN look into network, defect conclusion fills in the instrument upgrades information dependability, occasion revealing, and viable transmission capacity usage of the system. Specifically, it expand system span for better information transportation.

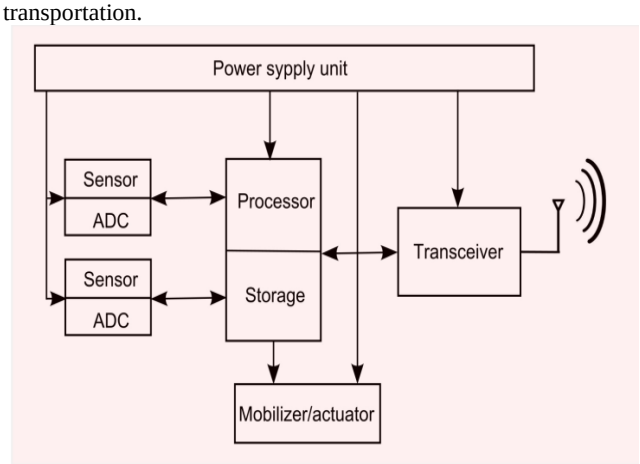

Fig. 2: Typical sensor node

As per above views intermediate sensor nodes will disperse vitality in handing-off this off base data. In presence of high failure intensity, there could be system span data transmission could be seriously destroyed. On behalf of 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 field necessitate multifarious equipment vitality utilization can be calculation practically identical to correspondence vitality dissemination [15].

In [16], the authors suggested that especially, the nodes which are ignorable at the base station of the node due to defective can able to send data along these paths can consumes more energy and dissipation rate be high. Also, the incorrect choice may prompt pointless energy utilization because of recuperation and regrouping of the system. Fault analysis in WSN tends to a rundown comprehending conceivable defective nodes. However it is clear that the rundown, assist recuperation forms to end up conceivable, for example, rectifying faulty readings, replacing breaking down nodes with that of higher ones, or separating defective nodes in the pool which as adequate excess [17].

The main contributions and organization of this paper are summarized as follows: In section 2 we describe background details of different fault mechanisms. The section 3 proposed work. The section 4 deliberates results and discussions. Finally in section 5 we concluded the paper.

2. Background work

Nowadays strictly speaking the WSNs are monitoring the node groups with leverage power that incorporate office buildings indoor and all other industrial places outdoor that makes work easier to complete the job very easily with less effort. Meanwhile, insignificant exertion node 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 the run of the mill task except if they could be used as correspondence sensors without sensor usefulness [7].
In [1,3], the authors try to work on how to necessary diagnosis in the regular manner for the faultiness in the nodes with less effort and less time so that can fix very easily, they suggested the scheme in which it try to find the error bound with least number of neighbour nodes to reduce the overall system burden. Similarly the authors in [3] worked over the exact location of fault computation in WSN in which it have the ability to investigate the status of the faultiness intensity close to its node and the other neighbour nodes based on the correlations amid its very individual detected information and neighbours' created information, while considering the occasion zone of its neighbours [4].

A straightforward disseminated calculation suggested that endures momentary faultiness in the suggested process. Round about other faultiness administration plans are visible to the study composed by authors suggested 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, neighbour 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.

3. 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.

3.1. Modified algorithm:

The algorithm explained with the aid of flow diagram as below.
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.

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 present in the inside community and E signifies collection of boundaries of the particular nodes in the network.

Threshold test: With this test every node should relates their data with other neighbour 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, easily one can notice faultiness intensity grade with the degree of faultiness present in the edges present in the network. If the detected quantity seems to be below the threshold value, treated to be faulty node.

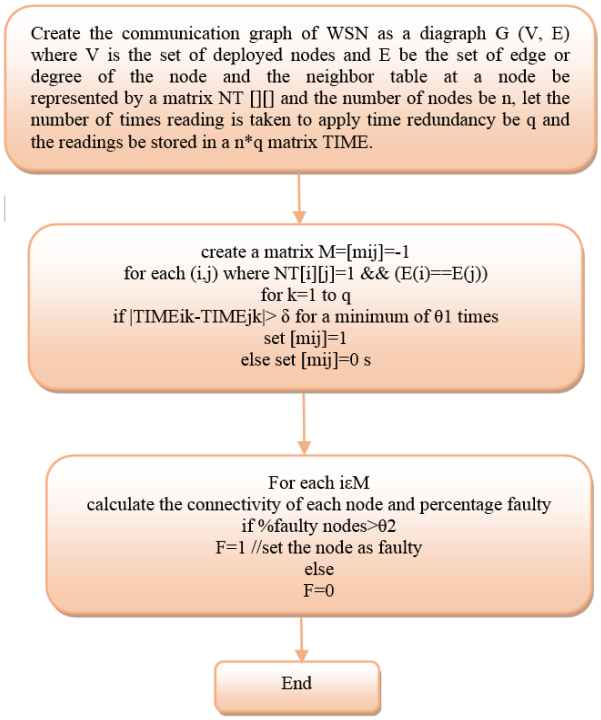

Fig.3: Proposed flow chart

4. Results and discussion

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

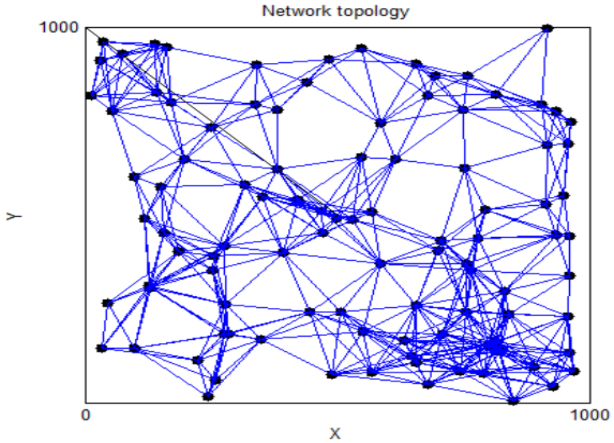

Fig.4: Network topology size 1000X1000

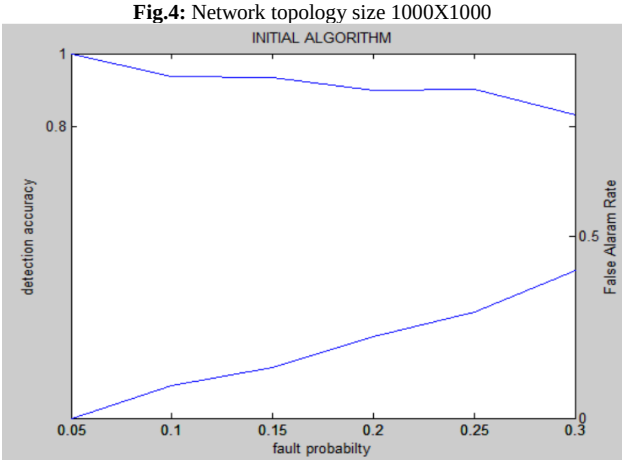

Fig.5: Simulation curve of FAR and Detection accuracy

From figure 5, it is clear for the improvement in the considerable accuracy and fast growth in FAR due to presence of random observations below the threshold value.

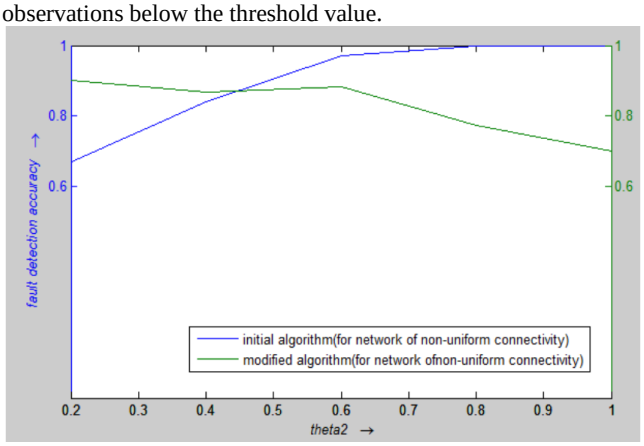

Fig.6: Comparison of traditional and modified algorithms

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.

5. 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 expressions of detection correctness, FAR. The simulated outcomes gave satisfactory results.

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