A COMPREHENSIVE SURVEY ON FAULT TOLERANCE SCHEMES IN WSN

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Abstract: ***In recent years there has been quick advancement in the field of Wireless Sensor arrange. These days it has turned into the most dynamic research region in the field of systems administration. WSN comprises of cooperative sensor nodes used to observe the zone and excerpt data about the atmosphere. Sometimes, these networks are deployed to get sensitive information from the environment. In such conditions, it is required that the network works for longer duration of time. The network is usually deployed in the hostile conditions. These nodes become faulty due to number of reasons. Common types of failure include node failure, link failure, and node shut down. Therefore, if any sensor node goes faulty, replacement of the sensor nodes becomes a tedious task. This paper presents brief review of the existing fault tolerance schemes and algorithms that focus at improving the lifespan of the network and make network more resistance towards the faults.***

Keywords: WSN, Node failure, clustering, Network lifetime, Energy efficiency.

I. Introduction

Wireless Sensor Networks (WSN) has most common architecture known as OSI model which basically comprises of five layers in the network. These layers are physical layer, application layer, network layer, data link layer, transport layer. WSN involve minor, moveable, cheap devices so-called as sensors. A WSN generally will have slight or not any structure. The figure below shows the architecture of wireless sensor network.

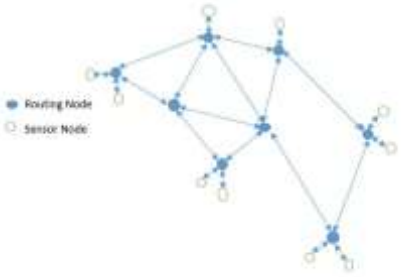

Fig 1: WSN Architecture

Figure 1. Shows a normal wireless sensor network consisting of nodes and gateway. The network consists of two types of nodes, routing and sensor nodes. The latter collects data from the environment and forwards it to

the gateway (commonly known as base station) via relay nodes.

Nodes have restricted regions of exposure, encouraging placement of a huge quantity of those to seize precise info for advance processing. As the quantity of sensors in the arena rises, the likelihood of failure of sensors owing to hardware inadequacy will likewise surge [1]. Common types of failure include node failure, link failure, and node shut down [2]. Consequently, noticing node failure process desires healthy approaches. The method has to be precise and quick which will not interrupt the real meaning of the placement of the system in the arena. Node failure in the system might lead to indifferent performance of the node that may be affected by interruption in radio antenna, extreme energy exhaustion, and uncharacteristic restart in the network.

Since the network is usually deployed in the hostile conditions, if any sensor node goes faulty, replacement of the sensor nodes becomes a tedious task.

The rest of this paper is sorted out as it takes after: Section II of the paper surveys the related work, Section III depicts the present patterns and difficulties, Section IV portrays the outcomes we got from the work i.e conclusion, and Section IV describes the future work.

II. Literature Survey

Numerous plans have just been proposed with respect to adaptation to non-critical failure in WSN to accomplish unwavering quality, unpredictability, vitality sparing and so forth. There are a portion of the papers discussed here which have talked about adaptation to internal failure methods.

Huaiyuan Wang et. al, [3] suggested a complete explanation to discourse the difficulties of node disaster (solitary and numerous). CSFR is offered to resolve the difficulty of sole node disaster simply with supportive communiqué, however CSFR-M, which is the addition of CSFR, supports the sole node disaster difficulty efficiently with node mobility. Furthermore, CCRA is suggested based on supportive communiqué and node mobility to reestablish network connectivity when numerous nodes fail. CSFR-M and CCRA are sensitive approaches that start the connectivity reinstatement after perceiving the node disaster(s). With the aim of minimalizing the energy consumption, CCRA chooses to make things easier in the recovery procedure by gridding. Furthermore, the distance that a distinct sensor desires to travel for the

duration of recovery is abridged by picking the adjoining appropriate contenders. Lastly,
wide simulations authenticate the presentation of CSFR, CSFR-M and CCRA.

Sherihan Abuelenin et. al, [4] proposed failure retrieval procedure based on Grade Diffusion by means of Shortest Save Route. The node can organize the transmission and save few standby nodes dependent on the direct route to diminish the energy depletion for the re-looking routing. In situation where the course is selected based on the extent of energy necessary, the sensor node's
transmission is damaged. In the experimentation, the projected process is measured by energy depletion, error-finding precision, quantity of hops, amount of dead nodes, and amount of neighbor nodes.

The Failure Detection procedure centred on Fuzzy Neural Network (FDD-FNN) technique is suggested in [5] for efficient discovery of WSN system disasters. In this technique, the failure discovery technique for network and the smallest deviation optimization prototype centred on the PCA-BDA and feature info entropy are suggested. Input level, fuzzy level, fuzzy instruction level and uncertainty level are considered, and the procedure is presented. Lastly, the effects of important elements of suggested technique were examined by means of experiments and its presentation was associated with those of orthodox procedures. The consequences showed outstanding compliance of FDD-FNN.

Junhai Luo et. al, [6] have considered sequential disseminated recognition and combination over noisy frequencies in WSNs with bathtub-shaped failure (BSF) rate of the nodes. In the earlier effort, they used BSF rate to analogous topology and resulted in the Extension Log-likelihood Ration Test law. Even though ELRT is greater to outdated combination law deprived of, bearing in mind failed nodes,
the detection performance declines remarkably in the existence of a huge amount of failed nodes. In this study, they build a sequential topology centered on the device radiation energy reduction prototype, use BSF rate to sequential topology, and develop the equivalent combination law. Contrasting to the equivalent combination, where the native sensors transmit their judgments to the Global Fusion Center in the region of interest straight, nodes in the sequential topology communicate native judgments over multi-hop, short-range
transmissions. Simultaneously, they encompass ELRT to noisy frequencies. Lastly, experimental outcomes demonstrate

the efficiency of the suggested combination laws. To resolve the system performance weakening triggered by system nodes failure conferring to unanticipated and unpredicted ecological variations in WSN, a great

failure-tolerant and energy-effective multipath routing procedure centered on the notion of HEED clustering procedure, entitled HEED-FT is suggested in this study

[7]. To increase the routing consistency and energy equilibrium amid CHs, the HEED-FT procedure initially offers the non-probability waiting period, excess energy besides midpoints to increase the cluster lifespan. Then numerous clustering factors are used with diverse order, which can regulate the idyllic topology dissemination of the CHs. Lastly, MTGG prototype is laid forward to acquire a consistent communiqué linkage with numerous clustering factors, which can guarantee the sensors in a best cluster topology dissemination.

Prasenjit Chanak et. al, [8], reflected the difficulty of enduring system failures realized by positioned sensors in a sensor network. They initially suggest a new clustering procedure for sensor networks, named DEEHC that chooses CHs conferring to the remaining energy of positioned nodes with the help of a subordinate timer. For the duration of the clustering stage, individual node discovers *k*-vertex separate routes to CHs reliant on the energy level of its neighbor nodes. They also suggest a kVDPR procedure where respective CH discovers *k*-vertex separate routes to the BS and communicates their amassed information to the BS. Additionally, they furthermore suggest a new RMM that can restore *k*-vertex separate routes through the observing period. The subsequent network turns out to be tolerant to *k*-1 disasters in the nastiest situation. The suggested system has been comprehensively verified by means of numerous network situations and associated to the prevailing methodologies to demonstrate its efficiency.

Mandeep Kaur et. al, in [9], suggested a procedure to increase lifespan of sensor network by IDFCA. DFCA for fault tolerance has a disadvantage as the burden on adjoining cluster head surges and energy depletion is extra. IDFCA method works to decrease the energy depletion by presenting hierarchy development procedure of picking cluster head and it correspondingly overcome the condition of faulty sensor. The performance of this novel procedure is assessed by experimenting it in NS2 setting and associated with DFCA. Experimental outcomes display that it accomplishes enhanced performance than DFCA and

consequently can extend the lifespan of the system.

M.Yuvraja et.al in [10] suggested to improve a fault discovery and retrieval method where the BS creates an agent packet which forms a query path towards the dead or faulty node. Here, sink periodically broadcasts the Agent packet to all its neighbor nodes. The receiving node randomly makes decision as whetеher to hierarchy development procedure of picking cluster head and it correspondingly overcome the condition of faulty sensor forward packet or not thereby detecting the dead or faulty nodes. After detecting a node failure or dead node, the connctivity is restored using Least-Disruptive Repair without extending the length of the shortest paths among the nodes compare to the pre failure topology, LeDiR replaces the faulty node with block movement.

III Cuurent Trends and Challenges

In view of the writing review done the present patterns and difficulties have been classified beneath in the TABLE I.

TABLE 1 Sumarised Litrature Survey

Paper	Techqniue Used	Pros and Cons
CSFR-M and CCRA	Uses node cooperation and movement. Re-establishes disconnected paths cuased by node failures.	• Topology selforganization method to establish paths is fairly simple. • Technique will not work in complete static network environment.
Grade Diffusion with Shortest Save Path	Nodes save the multiple paths. Death the alternative node is used to reconstruct the path.	• Reconstructs the route from the save routing tables, thus making this method robust. • Saving multiple paths at each node can lead to more overhead.

FDD-FNN	Uses Baiyes discriminant analysis to detect the failure among the nodes.	• Uses features of the nodes during failure state to train the data. • This method is computationally complex.
BSF rate based scheme	Uses multi hop and short range communications	• The scheme works well in the noisy envrionment for sensor networks. • Does not considers faults in the nodes due to energy drainage.
HEED-FT	Uses Gabriel graph model in the cluster. Balance the cluster-heads node energy consumption. Improve the reliability of clusterheads node routing.	• Uses residual energy of the nodes as parameter to select CHs, However other parameters can also be considered for CH selection process for better performance.
DEEHC	Uses k-vertex disjoint routing paths for multi hop comnunication between the nodes to balance the energy.	• Scheme is better as it provides many available disjoint paths to route data to the base station. Route maintainence mechanism Requires exchange of many packets which is energy draining process.
IDFCA	Subsequent rounds to lessen. Uses clustering hierarchy to rotate the cluster heads in energy consumption.	• Scheme improves the network lifetime. • Clustering hierarchy could have been made using other parameters apart from residual energy of the nodes alone.
LeDiR	Uses agent based fault detection procedure	• Repairs the path without extending the length of it. • To check the faulty node, numerous packets are broadcasted which is energy consuming process.

IV Conclusion

From the detailed analysis presented in the above section there are still pros and cons of every method. The need of the optimum solution is still an open issue. Huge numbers of researchers have made utilization of bunching calculations to counter against the deficiencies happening out of battery seepage of the sensor hubs. The main aim of the paper is to lay emphasis on various solutions available to prevent fault tolerance scheme in WSN. So, it is expected that this paper can provide healthy material in compact and effective way that can be used as a reference to develop a mechanism that can be applied to prevent further fault tolerance in WSN.

IV Future Work

In future, we might want to chip away at a similar belief system and further enhance the life expectancy of the system conspire in light of various parameters, for example, bundle conveyance proportion, vitality utilization, throughput and so on. We can contrast existing plan and the adjusted plan in view of parcel conveyance proportion, throughput and vitality utilization.

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