

# Survey on Faulty Node Detection and Recovery Algorithm for WSN

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**Abstract**— In Faulty Node Detection and Recovery Algorithm for WSN critical problems like fault tolerance created. Earlier fault tolerance mechanism consume significant extra energy to detect and recover from the failure or having additional hardware and software resources. Lifetime of sensor node is enhanced because of using diffusion algorithm combined with the genetic algorithm. When some node get faulty in network then this algorithm is useful to avoid performance related data transfer. Wireless sensor networks are having tendency to fail of sensor, due to the energy depletion, failure of hardware's, conditions of network environment.

We sure that that type of algorithm used then result is replacements of sensor nodes and more reused routing paths. Time for data transfer is depend on active nodes that's why we detect a routing path with faulty node. Power consumption is affect the hierarchy of active nodes that's why data is not transferred surely. In this proposed algorithm reduces the rate of data loss by approximately 98.8%, and reduces the rate of energy consumption by approximately 31.1%.

**Keywords**-component; *Wireless Sensor Network (WSN), Grade Diffusion (GD), Directed Diffusion (DD) Algorithm, Genetic Algorithm (GA), Graph Based Genetic Algorithm (GB-GA), Ladder Diffusion Ant Colony Optimization (LDACO) Algorithm, A Reduce Identical Composite Event Transmission (RIET) Algorithm.*

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## I. INTRODUCTION

In Faulty Node Recovery Algorithm Using WSN critical problems like fault tolerance created. Earlier fault tolerance mechanism consumes significant extra energy to detect and recover from the failure or having additional hardware and software resources. Lifetime of sensor node is established because of using diffusion algorithm combined with the genetic algorithm. When some node get faulty in network then this algorithm is useful to avoid performance related data transfer. Wireless Sensor Network having number of sensor node that node having same advanced in processor, memory and radio technology. It is small and cheap node capable for sensing communication. In Wireless Sensor Network Directed Diffusion Algorithm [1],[11],[15] act as routing protocol or it user for communication for sensor node, how message or data can flow source to sink. When the energy of a sensor node is exhausted, wireless sensor network leaks will appear, and the failed nodes will not relay data to the other nodes during transmission processing. Thus, the other sensor nodes will be burdened with increased transmission processing.

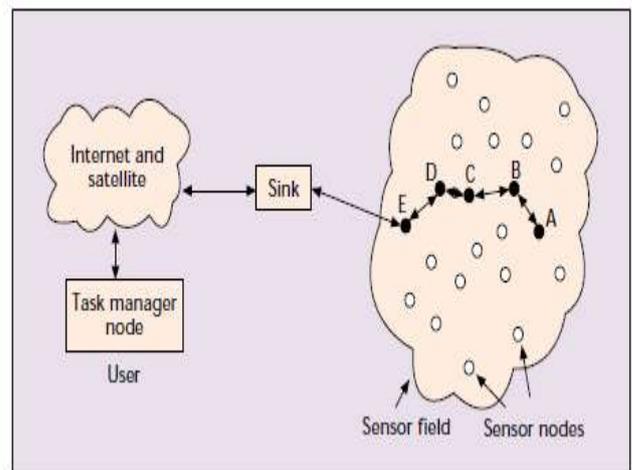


Fig 1: Typical Wireless sensor Network.

## II. RELATED WORK

We Study Followings techniques for WSN. Traditional techniques to sensor network routing including the Directed Diffusion Algorithm [1],[11],[15], Grade Diffusion [1],[8], Genetic Algorithms [1],[5], Graph Based Genetic Algorithm [5], Ladder Diffusion Ant Colony Optimization Algorithm [7]. These optimization will ultimately enhance the WSN lifetime and reduce sensor node replacement cost.

A. Directed Diffusion Algorithm.

A series of routing algorithms [1],[11], [15] for wireless device networks have been planned in recent geezer hood. C. Intanagonwiwat et al. presented the Directed Dispersion (DD) rule [1], [10] in 2003. The content of the DD rule is to limit the aggregation passage coefficient counts for cognition management. The DD rule is a query-driven transmittal protocol. The unanimous collection is transmitted only if it matches the query from the imbed node. In the DD rule, the lapse symptom provides the queries in the gathering of attribute-value pairs to the other sensor nodes by medium the ask packets to the whole meshing. Later, the device nodes transfer the collection wager to the depression client exclusive when it fits the queries.

A. Grade Diffusion Algorithm

H. C. Shih *et al.* presented the Grade Diffusion (GD) algorithm [8] in 2012 to improve the ladder diffusion algorithm using ant colony optimization (LD-ACO) for wireless sensor networks [7]. The GD algorithm not only creates the routing for each sensor node but also identifies a set of neighbor nodes to reduce the transmission loading. Each sensor node can select a sensor node from the set of neighbor 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. Whether the DD or the GD algorithm is applied, the grade creating packages or interested query packets must first be broadcast. Then, the sensor nodes transfer the event data to the sink node, according to the algorithm, when suitable events occur. The sensor routing paths are shown in Fig No. 2. Routing Path [10]

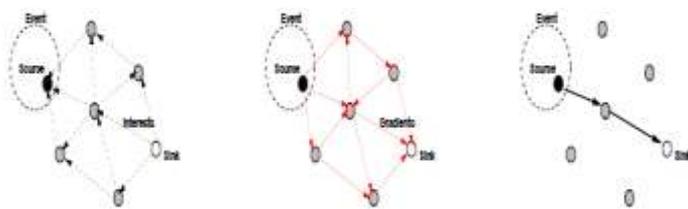


Fig.2. Routing path [10]

1. Interest:

Sink node broadcasts an interest message to each of its neighbor. This initial interest contains the specified rest and duration attributes, but it contains much longer interval attribute. Now this interest may be thought of as exploratory every node maintains an interest cache. After receiving an interest node may decide to resend interest to some subset of neighbors. The simplest alternative is to rebroadcast the interest to all neighbors.

2. Gradient.

In this case interest is reach to source node it generate gradients notice that every pair of neighboring node establishes a gradient toward each other.

3. Data Propagation.

A sensor node that is within specified rest processes to save power sensor are off until tasked Furthermore the intensity of signal amplitude measure the intensity of the sampled waveform.

B. Genetic Algorithms.

Genetic Algorithms (GAs) are adaptive heuristic search algorithm based on the evolutionary ideas of natural selection and genetics. As such they represent an intelligent exploitation of a random search used to solve optimization problems. Although randomised, GAs are by no means random, instead they exploit historical information to direct the search into the region of better performance within the search space. The basic techniques of the GAs are designed to simulate processes in natural systems necessary for evolution; especially those follow the principles first laid down by Charles Darwin of "survival of the fittest". Since are in nature, competition among individuals for scanty resources results in the fittest individuals dominating over the weaker ones.

1. Initialization

In the initialization stage, the genetic algorithm created chromosomes, and each chromosome is a supposed bleach. The numerate of chromosomes is settled according to the assemblage size, which is definite by the human. Each chromosome is a compounding whitener, and the chromosome size is the product of device nodes that are depleted or not active. The elements in the genes are either 0 or 1. A 1 substance the client should be replaced and a 0 agency that the thickening module not be replaced. Show in Fig No. 3 Represent Chromosome [1].

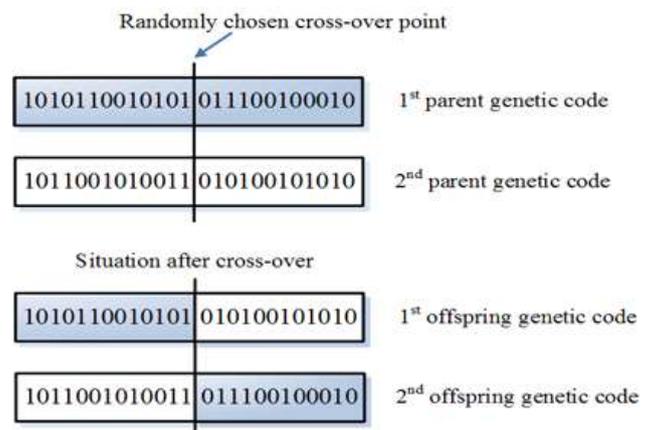


Fig3. Represent chromosome [1].

2. Evaluation

In this step, fitness value is calculate by using fitness function and the parameters of fitness function are the chromosome genes However we cannot put chromosome genes directly into FNR algorithm, because of chromosome genes simply show weather node should be replace. In the FNR algorithm, goal is reuse most routing path with less

sensor node replace. Hence the number of routing path is available and some non-functioning sensor node replaces and calculates Fitness function show in below. (1)

$$f_n = a_0 + \sum_{i=1}^{\max(\text{Grade})} \frac{P_i}{N_i} \times \frac{TP^{-1}}{TN^{-1}} \times x^{-1} \quad (1)$$

In (1):

$N_i$  = the number of replaced sensor nodes and their grade value at  $i$ .

$P_i$  = the number of re-usable routing paths from sensor Nodes with their grade value at  $i$ .

$TN$  = total number of sensor nodes in the original WSN.

$TP$  = total number of routing paths in the original WSN.

In (1), a high fitness value is sought because the WSN Is looking for the most available routing paths and the least number of replaced sensor nodes.

### 3. Selection

The selection step will eliminate the chromosomes with the lowest fitness values. We use the elitism strategy and keep the half of the chromosomes with better fitness values and put them in the mating plash. The worse chromosomes will be deleted, and new chromosomes are made to replace them after the crossover step. Fig. No. 5. shows selection stage [1].

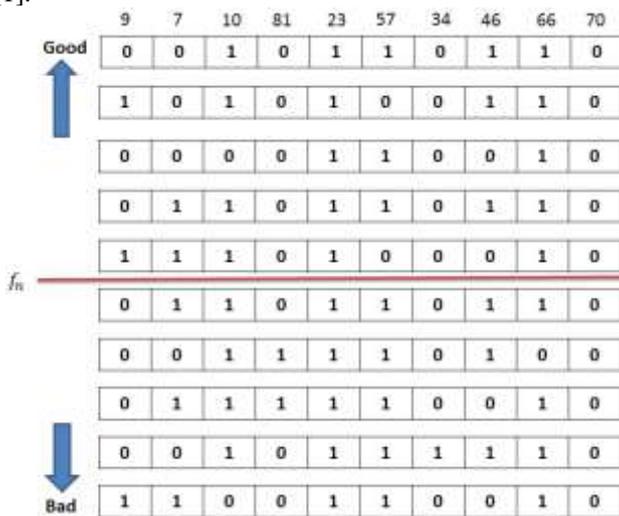


Fig. No. 4. Selection Step [1].

### 4. Crossover

The crossover step is used in the genetic algorithm to change the personal chromosome. In this algorithm, we use the one-point crossover strategy to create new chromosomes, as shown in Fig. No. 5. Crossover step [1].

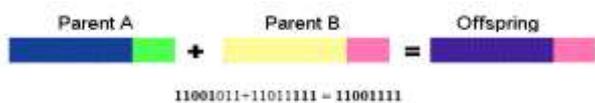


Fig. No.5. Crossover step [1].

One crossover point will be selected, binary string from beginning of chromosome to the crossover point is copied from one parent, and the rest is copied from the second parent.

### 5. Mutation

The mutation step can introduce traits not found in the original individuals and prevents the GA from converging too very fast. In this algorithm, we simply flip a gene randomly in the chromosome, as shown in Fig. No. 6. Mutation step [1].

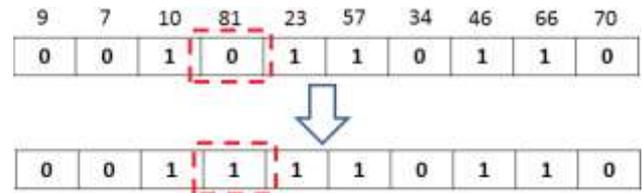


Fig 6 Mutation step [1].

The chromosome with the best fitness value is the solution after the process. The FNR algorithm will replace the sensor nodes in the chromosome with genes of 1 to extend the WSN lifetime.

### C. Ladder Diffusion Ant-Colony Optimization

Dorigo et al. [1, 4-7, 12] proposed ACO in 1997, which imitates the behavior of ant colonies as ants search for the shortest path from their nest to the food source. The method was developed to solve the traveling salesman problem (TSP). Ladder diffusion algorithm that with ladder diffusion with ACO in order to minimize

Power consumption are presented we propose the ladder diffusion algorithm to identify routes from sensor nodes to the sink node and avoid the generation of circle routes using the ladder diffusion process. The LD algorithm is fast and completely creates the ladder table in each sensor node based on the entire wireless sensor network by issuing the ladder create packet that is created from the sink node.

### D. Graph Based Genetic Algorithm.

Implementation of genetic algorithm for instrumentation purpose are presented in this paper. The GA constitutes an initialization module of a decision support system for sensor network design. The method development entitled the definition of the individual's representation as well as the design of a graph based fitness function, along with the formulation of several other ad hoc implemented features.

### E. Ladder Diffusion Ant Colony Optimization

First, the sink node broadcasts the ladder creating packet with the grade value of one, and grade value of one means that the sensor node receiving this ladder creating packet transmits data to the sink node requires only one hop. Then sensor nodes increase the grade value of the ladder-creating packet to two and broadcast the modified ladder-creating packet. A grade value of two means that the sensor node receiving this ladder-creating packet sends data to the sink node requires two hops count.

F. A Reduce Identical Composite Event Transmission (RIET) Algorithm

The DD and GD algorithms consider only a sensor node that sends an event to the sink node when the event takes place. Hence, sensor nodes consume large amounts of power to send the same event if detected. H. C. Shih et al. [15] proposed a Reduce Identical Event Transmission Algorithm (RIET), which can reduce the probability of sending a same event and save the sensor nodes' power. Moreover, the RIET algorithm is based on the GD algorithm.

The RIET algorithm that is used in the wireless sensor network can reduce the probability of sending a same event, save the nodes' power, and enhance the sensor nodes' lifetime by sensor node communication. The sensor node not only has the ability to sense and transfer events, but also can commute with its neighbor nodes when it senses an event. The RIET algorithm uses the finite state machine (FSM) that has a "Sensing State", "Delay State", "Query State", and "Receive Query State" to avoid simultaneous sensor node commutation with neighbor nodes in the algorithm. Hence, a sensor node can query or respond to its neighbor nodes by our algorithm and by the FSM. The FSM's transformation is shown in Fig No. 7. Finite State Machine diagram for RIET Algorithm [15].

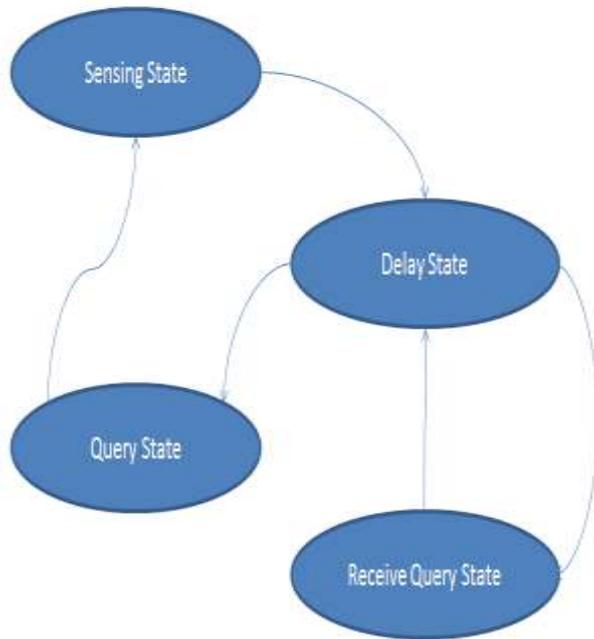


Fig No. 7. Finite State Machine diagram for RIET Algorithm [15].

III. COMPARISON

TABLE1. COMPARISON OF DIFFERENT ALGORITHM [16].

	Algorithm's for WSN				
Title	GD	LD-ACO	CGD-GA	EGD	DD
Techniques	Create routing for each node & find out neighboring nodes.	Using ladder diffusion phase & routing.	Based on genetic algorithm.	Composite event aggregation.	DD paradigm & its key Features.
Energy Efficiency	29.5% energy saving.	52.36% energy consumption.	Not mentioned.	Reduce 52.82% energy consumption.	Batter energy saving.
Time Required for Data Packet Transfer	80.39% lesser time	61.11% data forwarding.	Lesser time needed.	Enhance lifetime 21.67%.	Not mentioned.
Cost	Medium.	High.	60% Saving.	Medium.	High.

III. Routing Techniques.

There are different Routing Techniques or Protocol used for Wireless Sensor Network, We Study some of them like Ad-Hoc, MANET etc.

1. Topology Control for Wireless Sensor Networks.

Topology control process for ANs (Application Node) and BSs (Base Station), which constitute the upper tier of a two-tiered WSN. We propose approaches to maximize the topological network lifetime of the WSN, by arranging BS location and inter-A relaying optimally. Based on an algorithm in Computational Geometry, we derive the optimal BS locations under three topological lifetime definitions according to mission criticality. Show in Fig No. 8. Topology Control iterations for WSN

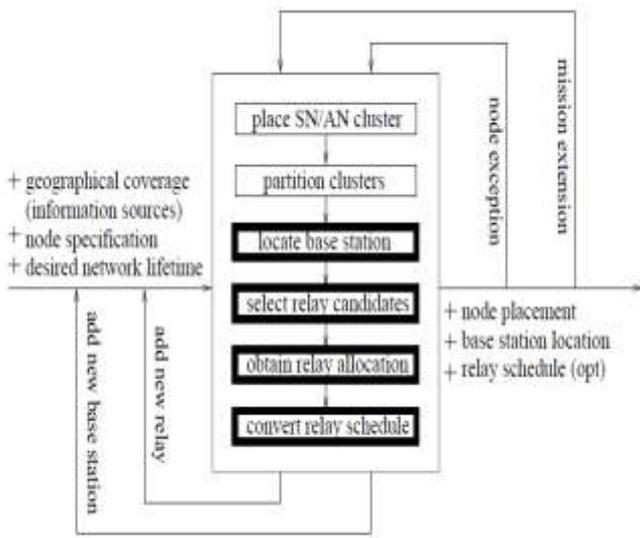


Fig. No. 8. Topology Control iterations for WSN [12].

2. Various Routing Protocols for MANETs

Routing protocols for MANETs should be evaluated on both qualitative and quantitative metrics. Qualitative metrics describe desirable protocols attributes that make them efficient. Show in Fig No. 9. A Mobile Ad hoc Network [14].

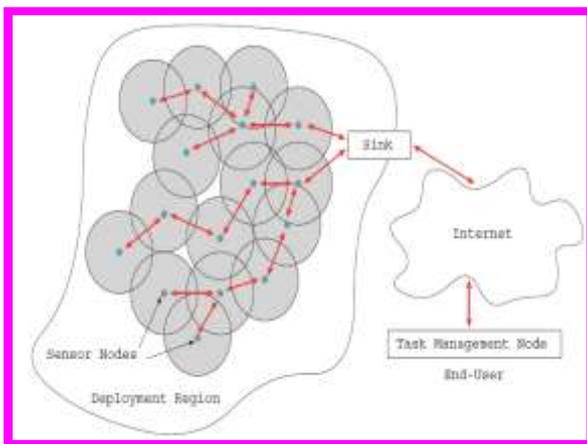


Fig No. 9 A Mobile Ad hoc Network [14].

TABLE2. COMPARISON OF REACTIVE ROUTING PROTOCOLS [14].

Routing Protocols for Wireless Sensor Network			
Parameters	AODV	DSR	TORA
Route updating	Non-Periodic	Non-Periodic	High routing overhead
Performance Metrics	Speed	Shortness	Speed
Routing Overhead	High	High	High

Multipath	No	Yes	Yes
Throughput	High	Low	Low
Catching Overhead	Low	High	Medium

CONCLUSION

We Study differed Algorithm and Routing Protocol In real Wireless Sensor networks, the sensor nodes use battery power supplies and thus have limited energy resources. In wireless sensor networking large number of nodes connected to each other with related energy, efficiency. Some basic problem encountered like power consumption, large distance that's why work is dismissed or avoided. This type of problem is faced using fault node recovery algorithm for WSN based on the grade diffusion algorithm combined with genetic algorithm. We sure that that type of algorithm used then result is replacements of sensor nodes and more reused routing paths. Time for data transfer is depend on active nodes that's why we detect a routing path with faulty node. Power consumption is affect the hierarchy of active nodes that's why data is not transferred surely. In this proposed algorithm reduces the rate of data loss by approximately 98.8%, and reduces the rate of energy consumption by approximately 31.1%.

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