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OPTIMIZED SENSOR NODES OF WIRELESS SENSOR NETWORK BY FAULT NODE RECOVERY ALGORITHM

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Abstract - *This paper proposes an issues FNR algorithm to upgrade the lifetime of a remote sensor system when a few of the sensor nodes close down. The calculation depends on the grade diffusion algorithm joined with the genetic algorithm. The calculation can bring about fewer substitutions of sensor nodes furthermore, more reused routing ways. In our simulation, we describe the packet delivery ratio and packet drops for different active and faulty nodes using grade diffusion algorithm and genetic algorithm. Here increase the packet delivery ratio and decrease the packet drop.*

Key Words: **Genetic algorithm, grade diffusion (GD) algorithm, directed diffusion algorithm (DD), wireless sensor networks (WSNs)**

1. INTRODUCTION

Late advances in smaller scale preparing, remote and battery innovation, and savvy sensors have upgraded information preparing remote correspondence, and discovery capacity. In sensor arranges, every sensor node has constrained remote computational energy to process and exchange the live information to the base station or information accumulation focus. Subsequently, to build the sensor range and the transmission range the remote sensor arrange more often than not contains numerous sensor nodes. By and large, every sensor node has a low level of battery power that can't be recharged. At the point when the vitality of a sensor node is depleted, remote sensor system breaks will show up, and the fizzled hubs won't transfer information to alternate hubs amid transmission handling [1] [4] [7]. Along these lines, the other sensor nodes will be loaded with expanded transmission preparing.

This paper proposes an issue FNR algorithm upgrade the lifetime of a remote sensor system (WSN) when a portion of the sensor nodes close down, either in light of the fact that they no more have battery vitality or they have come to their operational edge. Utilizing the FNR calculation can bring about less substitutions of sensor nodes and more reused steering ways. Hence, the calculation not just improves the WSN lifetime be that as it may, likewise lessens the expense of supplanting the sensor nodes.

2. RELATED WORK

2.1 Directed Diffusion Algorithm

C. Intanagonwiwat et al. introduced the Directed Diffusion (DD) algorithm. The guided directed diffusion algorithm fundamental mean to decrease the information transfer transmission to control power utilization. Directed Diffusion is intended for heartiness, scaling and vitality effectiveness. The DD algorithm is information driven and question driven transmission convention. In the DD algorithm, first the sink node gives intrigued inquiries in type of credit quality sets to other sensor node by television the question parcels to whole system. At that point, the sensor nodes just send the gathered information back to the sink node when it coordinates the questions [7].

The wireless sensor system may come up short because of a taking after reason, including the accompanying: the WSN detecting range may encounter a release; the directing way may encounter a break; the batteries of some sensor nodes may be exhausted; requiring more hand-off nodes or the nodes wear out after the WSN has been being used a drawn out stretch of time.

2.2 Grade Diffusion Algorithm

The grade Diffusion algorithm is presented by H.C.Shin in 2012 [5]. The Grade Diffusion algorithm not only creates the routing for each sensor node but also identifies a set of nearest neighbor nodes. The GD algorithm broadcast grade completely and quickly creates package from sink node to every node in WSN. The GD algorithm increases the sensor node's lifetime and the

sensor nodes transmission effect. In Grade Diffusion algorithm the source hub will show the information parcels to all neighbors and after that the neighbors will telecast it its neighbors and after that information bundles got by the sink hub. The sensor hubs transmit the outcome information to sink hub as indicated by GD calculation. The Fig.1 demonstrates the sensor hubs steering ways. In the event that the WSN might be come up short because of assortment of variables that is appeared in Fig.2. The outside hubs exchange occasion information to sink hubs through within hubs in WSN.

The Grade Diffusion algorithm is proposed to settle the force utilization and transmission directing issue in WSNs. In GD algorithm dole out the evaluation for the sensor hubs and upgrade the directing table for every hub. Here, the information transmission happens from higher evaluation nodes to lower grade nodes. The Grade Diffusion algorithm is quick and totally makes the evaluation table in every sensor node taking into account the whole wireless sensor system [4].

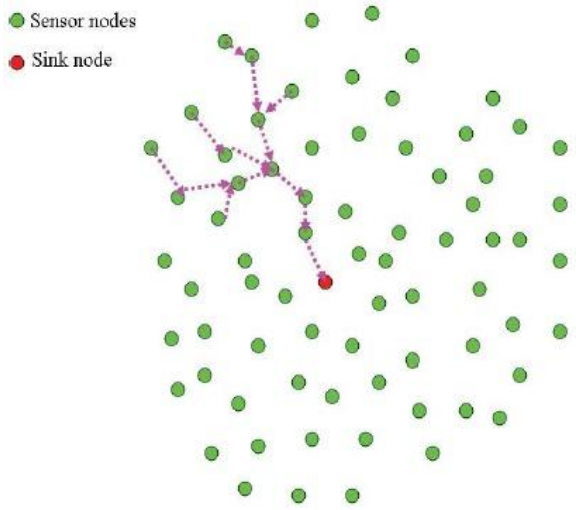

Fig -1: Wireless sensor node routing

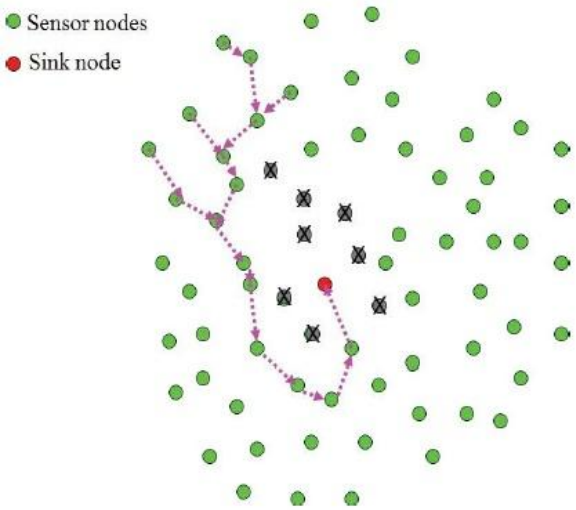

Fig -2: Wireless sensor node routing path when some nodes are not functioning

3. FAULT NODE RECOVERY ALGORITHM

The proposed algorithm is Fault Node Recovery algorithm with the help of Grade Diffusion Algorithm and Genetic Algorithm. The Fault Node Recovery algorithm creates the routing table using DD algorithm and replaces the sensor node using the GA. This algorithm not only reuses the more routing paths to enhance the WSN lifetime but also reduces the replacement cost.

3.1 Bth Calculation

The Fault Node Recovery algorithm for WSNs based on the grade diffusion algorithm combined with the genetic algorithm. In Fig.3, the FNR algorithm creates the grade value, routing table, a set of neighbour nodes and payload value for each sensor node using directed diffusion algorithm.

The DD algorithm transfer event data to sink node then after event is detect in WSN. Then, Bth is calculating according to (1) in the FNR algorithm.

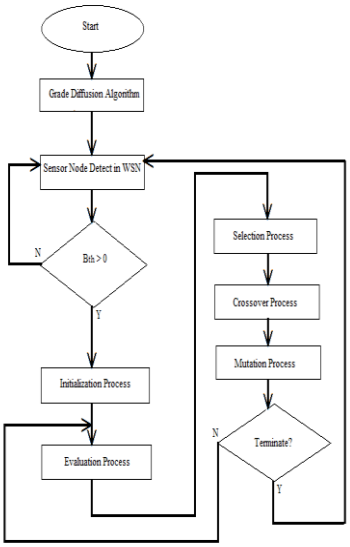

Fig -3: Fault Node Recovery algorithm flowchart

$$B_{\text{th}} = \sum_{i=1}^{\max\{\text{Grade}\}} T_i$$

$$T_i = \begin{cases} 1, & \frac{N_i^{\text{now}}}{N_i^{\text{original}}} < \beta \\ 0, & \text{otherwise.} \end{cases} \quad (1)$$

On the off chance that Bth is bigger than zero the algorithm will be conjured and supplant the non-working sensor nodes by utilitarian nodes chose by the genetic algorithm. At that point the wireless sensor network can bear on to fill in the length of the administrators will supplant sensors. In (1), evaluation is the evaluation estimation of each sensor node. The variable Nioriginal is the quantity of sensor nodes with the evaluation esteem i. The Ninow is the quantity of sensor gestures as yet working at current time with grade value i. The parameter β is set by the client and must have esteem somewhere around 0 and 1. On the off chance that the quantity of sensor nodes that capacity for every evaluation is not exactly β, Ti will get to be 1 and Bth will be bigger than zero. At that point the FNR algorithm will compute the sensor hubs to supplant utilizing genetic algorithm.

3.2 Genetic Algorithm

The 5 steps in the Genetic Algorithm are:

1. Initialization
2. Evaluation
3. Selection
4. Crossover and
5. Mutation

3.2.1 Initialization

In the initialization step, the genetic algorithm produces chromosomes and every chromosome is an expected arrangement. The quantity of chromosomes is resolved by populace size, which is characterized by the client, every chromosome is a mix arrangement and the chromosome length is the quantity of sensor nodes that are exhausted or non-working. The qualities are either 0 or 1. A 1 means the node ought to be supplanted and a 0 implies that the node won't be supplanted. Fig.4. speaks to a chromosome. The chromosome length is 10 and the quality is 0 or 1. Here, there are 10 sensor nodes not working and their node numbers are 9, 7, 10, 81, 23, 57, 34, 46, 66, and 70.

9	7	10	81	23	57	34	46	66	70
0	0	1	0	1	1	0	1	1	0

Fig -4: Chromosome and its gene

3.2.2 Evaluation

The qualities of the chromosome give the data about the substitution of node. In the FNR algorithm, the objective is additionally reuse the all the more steering ways and supplant the least sensor nodes. The wellness quality is computing as per a wellness capacity and the parameters of the wellness capacity are the chromosomes qualities. The wellness capacity appeared as (2),

$$f_n = \sum_{i=1}^{\max(\text{Grade})} \frac{P_i \times \text{TP}^{-1}}{N_i \times \text{TN}^{-1}} \times i^{-1}. \quad (2)$$

Where,

Ni = the number of replaced sensor nodes and their grade value at i

Pi = the number of reusable 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

3.2.3 Selection

In the selection step is to choose the chromosomes having the most noteworthy wellness esteem. To start with it chooses the pair of chromosomes from the node. At that point it dispenses with the chromosomes which is

having most minimal fitness value and holds the chromosomes having high fitness value. The chose chromosome which is having most elevated fitness quality will be send to the mating pool. The most exceedingly awful chromosomes will be erased and new chromosomes will be made to supplant them after the hybrid stride, appeared in Fig.5.

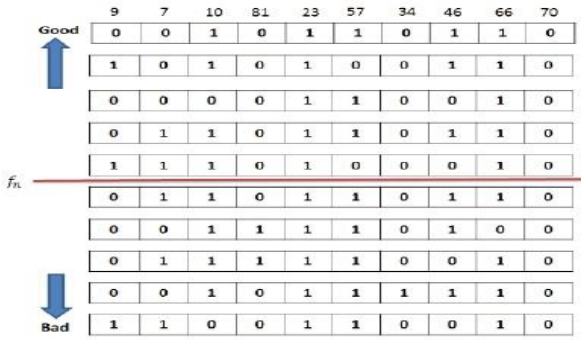

Fig -5: Selection Step

3.2.4 Crossover

The crossover step in Genetic algorithm is to shift the programming of chromosomes from one era to next. One-point crossover system has been utilized here as a part of this algorithm. The two individual chromosomes will be chosen from mating pool to produce another arrangement of arrangement. A cross point is chosen between the first and last qualities of the guardian people and afterward the part of every person on either side of the hybrid point is traded and develop, as appeared in Fig.6.

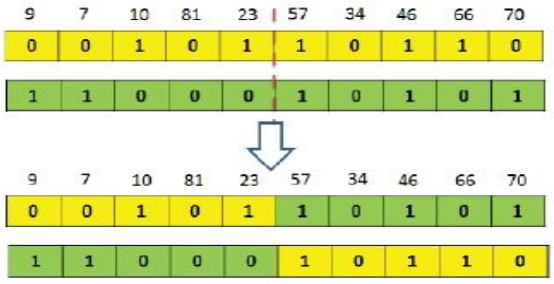

Fig -6: Crossover Step

3.2.5 Mutation

In this algorithm, we just flip a quality arbitrarily in the chromosome, as appeared in Fig.7. The chromosome with the best fitness quality is the arrangement after cycle. The mutation step can present qualities not found in the first people and keeps the GA from meeting too quick. In the proposed algorithm the sensor hubs will be supplant in the chromosome with the quality of 1 all together show signs of improvement system lifetime.

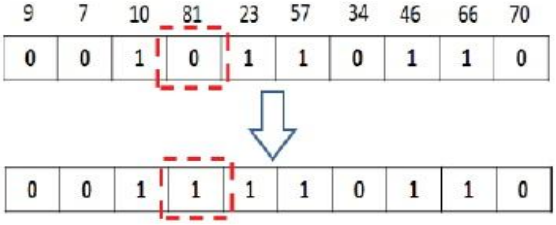

Fig -7: Mutation Step

4. Simulation

The simulation of fault node recovery algorithm described in the below section has been performed to verify the methods and results.

In fig.8 and fig.9 show the different network when all nodes working and the network show the 50 nodes are dead. Here we define the faulty nodes using grade diffusion algorithm.

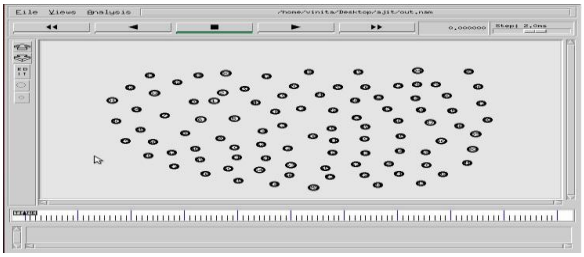

Fig -8: When all nodes working

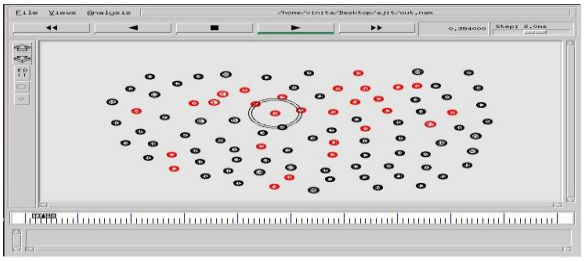

Fig -9: When 50 nodes dead

In the fig.10 show the 50 dead nodes using grade diffusion algorithm and then after we given genetic algorithm for this network and show the simulation for parameters. Also in fig.11used genetic algorithm for 25 faulty nodes and show the simulation of packet delivery ratio and packet drops.

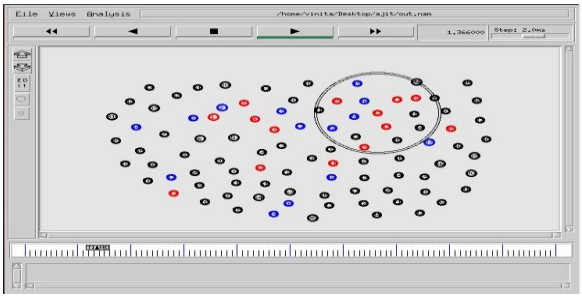

Fig -10: When 50 nodes given Genetic

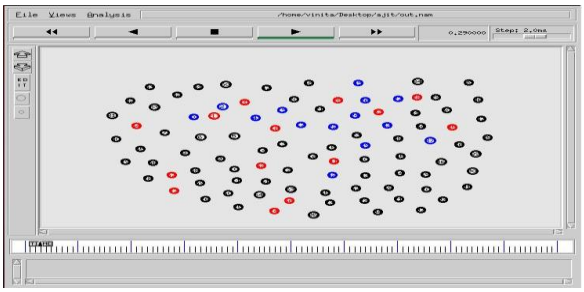

Fig -11: When 25 nodes given Genetic

In the below simulation plots we describe the packet drop and packet delivery ratio for different network stages.
In the stage 1when all nodes are working then highest packet delivery ratio and lowest packet drop calculating. In the stage 2 when 50 nodes are dead then show the lowest packet delivery and highest packet drop. In the stage 3 when 50 nodes given to Genetic then packet deliver ratio more than stage 2 and less then stage 1 and also packet drop is less then stage 2 more than stage 2. In the stage 4 when 25 nodes given to Genetic then packet delivery more than stage-3 and less then stage-1, and also show the packet drop is less then stage 3 more than stage 1.

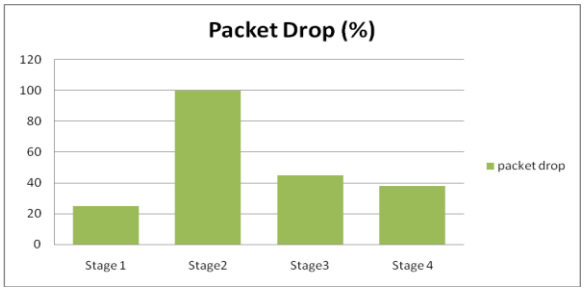

Fig -12: Time Vs Packet Delivery Ratio

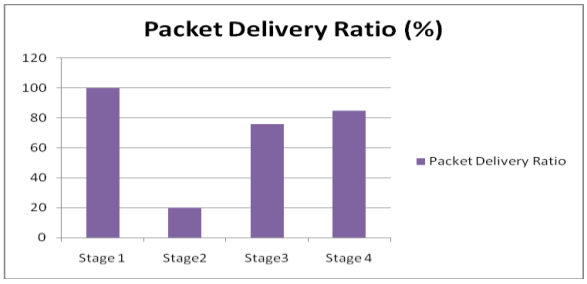

Fig -13: Time Vs Packet Drop

5. CONCLUSIONS

In the real wireless sensor networks organizes, the sensor nodes use battery power supplies and accordingly have restricted vitality assets. Our system proposes a faulty node recovery and replacement algorithm for WSN based on the grade diffusion algorithm combined with genetic algorithm. The FNR algorithm, requires replacing fewer sensor nodes and reuses the most routing paths, increasing the WSN lifetime and reducing the replacement cost.

In the simulation, using the fault node recovery algorithm we describe the packet delivery ratio and packet drop for the different network when few nodes are working and dead. We increase the packet delivery ratio and decrease the packet drop for wireless sensor network.

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