Discrete Path Assortment Techniques Combined with Genetic Algorithm to Recover Fault Node in WSN

R.S.Malarvizhi and S.Seedhanadevi

PG Scholar, Department Of Computer Science and Engineering ,Sri Vidya College Of Engineering and Technology, Virudhunagar, India
Assistant Professor,Department Of Computer Science and Engineering ,Sri Vidya College Of Engineering and Technology, Virudhunagar, India

ABSTRACT

A wireless sensor network (WSN) typically has little or no transportation. It contain of a number of sensor nodes (few tens to thousands) working together to monitor a region to obtain data about the environment. Wireless sensor network are used to producing wireless sensor nodes. It trend to exploit number transferable wireless sensors in wireless sensor networks to enhance the quality of service. The QOS is affricated by the lifetime and breakdown of sensor nodes. The cause of rupture is increase with optimization of sensors nodes. To conserve best QoS under destructive or failing condition finding and expelling such flaw sensor nodes are mandatory. In the nodes are mandatory. In the proposed method faculty sensor is recognized by detached or discrete path assortment technique by comparing the actual RTT with present prevented by the genetic algorithm. Genetic algorithm blending of five steps which strengthen fault node. It enhances the number of functional nodes, lesson the rate of data loss by 99% and slash down the rate of energy intake.

Keywords:-*WSNs, round trip time, round trip path, Flaw sensor node, function Sensor Node.*

I. INTRODUCTION

Over the past years the count of application in WSN Swiftly increased. WSNs can be enrolled in battle field application such as rift based maintainer application on military, vehicle health management space platforms and industrial. In military, a main locus on the area of monitoring for security and surveillance application .Due to ample growth in electronic technology it is possible to produce the manageable sensor nodes al low cast with good result and sensitivity. Hence massive number of portable sensor nodes can be deployed in the area to increase the quality of service of such network. Consumption of more sensor node has the chance failing sensor nodes. In the WSNs the sensor node failure because of several reasons such as battery failure, natural disaster hardware failure.etc [4].The failure and impairment of sensor node identifying in network based on the similarity between neighboring nodes. Initially, this method [1]is analyzed and defined on six wireless sensor nodes. This method uses discrete path technique to find the flaw sensor node. Hereby assorting minimum count of sensor nodes in the RTP will decrease the RTP time .this method [1].the round trip path (RTP) IN WSNs is formed by forming minimum 3 sensor nodes. So in this concept the round trip time is increased .In this method it can't disclose malignant nodes, it only detects the dead node. The proposed method is to find the flaw and malfunctioning sensor nodes in the network, by creating a circular topology with eight sensor nodes. In this network communication is done between the sensor nodes. The round trip delay time can be measurement by correlating the present RTT with the actual RTT, if the present RTT, then it show that delay was occur.

After enumerating delay was occur in the RTP thus the system can assume faculty and malfunctioning sensor node occur in the network. To find the faculty and malfunctioning sensor node by uses discrete path selection technique.

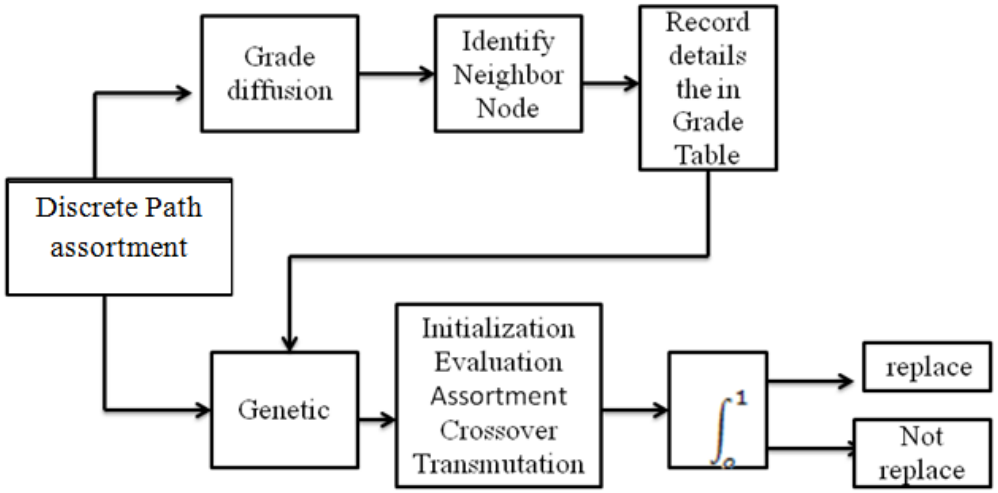
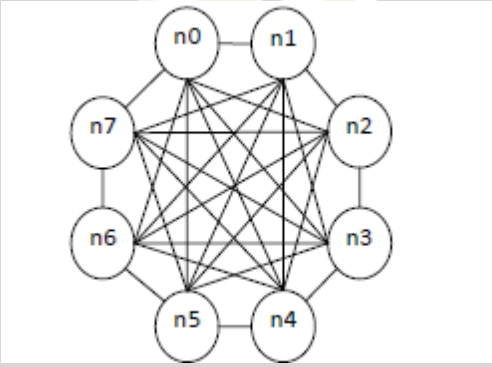


Fig: Architecture of fault node recovery

1. Round Trip path and Round Trip time Analysis:

Round trip delay time of the RTP will change sue to faculty sensor node it will be either less than or greater than the threshold value. The sensor node which is faulty can be detected by blending the present RTT with actual RTT.



1.1. Round Trip Time Estimation

Round Trip Time mainly depends upon the number of sensor node present in the round trip path and distance between them.

Hence the minimum Round Trip Time of RTP with four sensor node is given by:

$$\tau RTD = \tau 1 + \tau 2 + \tau 3 + \tau 4 \qquad (1)$$

where τ1, τ2 , τ3 and τ4 are the delays for sensor node pairs [8] (1,2), (2,3), (3,4), (4,1) respectively. Here circular topology with eight sensor nodes is shown in above Fig.1. In this system four consecutive sensor nodes in each RTP are almost equidistance because of circular topology. Let „τ" be the uniform time delay or all sensor nod pairs n RTPs i.e. $\tau = \tau 1 = \tau 2 = \tau 3 = \tau 4$. So the uniform sensor node pair delay is obtained by referring equation (1) as

$$\tau RTD = 4\tau \qquad (2)$$

1.2 Evaluation of Round Trip Paths

Faulty sensor node is identified by comparing the specific RTPs to which it belongs. Then this way to find delay of the fault detection process. The numbers of RTPs formed with „v" sensor node is given by

$$P = U (U - v)$$

Where „P" is the numbers of RTPs. „U" is the number of sensor nodes in wireless sensor network, and „v" is the number of sensor nodes in RTP, to find the fault detection method the time to measure the RTD times of all RTPS in the WSNs. Finally addition of all Round Trip Delay times. Then the equation for P number of RTPs is given by

$$\tau ANL(U) = \tau RTD{-}1 + \tau RTD{-}2 + \tau RTD{-}P$$

$$\tau ANL = \tau RTD pi - i$$

Optimum value of RTD time of RTP is referring (2) is obtained by considering only four sensor nodes. Then all the RTPs in WSNs are formed by selecting only four sensor nodes (v = 4).
Equation (5) can be written with the equal RTD time as

$$\tau ANL = P * \tau RTD$$

Referring equation (2) and equation (6) then, sensor node pair delay is

$$\tau ANL = P * 4\tau.$$

The minimum numbers of sensor nodes used to form RTP will create large number of RTPs. The maximum possible round trip paths PV created by four sensor nodes per RTP are obtained by substituting v=4 in equation (3) and is given by

$$PV = U(U-4)$$

Analysis time τANL (V), to detect by referring equation (7) and (8) as follows

2. Fault Node Recovery:

Fault node recovery for WSN's based upon the combination of grade diffusion and the genetic algorithm. The FNR also creates the grade values. Payload value, routing table for each sensor node using grade diffusion algorithm. It is proposed to solve the power inhalation and communication routing problems in wireless sensor networks .The first in FNR algorithm is to initiate the grade diffusion algorithm node transmission problems[6]. Then it will stop into the sensor network. The sensor node transfers the event data to the sink node according to the FNR algorithm. It B_{th} is larger than zero, the algorithm will be evoke and substitute the nonfunctioning sensor nodes by functioning nodes selected by the genetic algorithm.

III SIGNIFICANCE

Genetic algorithm:

The genetic algorithm is one of the best energy efficient algorithms in wireless sensor networks. It optimizes the signal strength of sensor nodes[1]. This algorithm also helps in reducing the energy consumption and thus increases the lifetime of WSN

i) Initialization
ii) Evaluation

iii) Assortment
iv) Crossover
v) Transmutation

i)Initialization

In this step, the genetic algorithms evoke chromosomes which are treated as solutions. The number of chromosomes is obtained according to the association problem. Each chromosome length is used to determine the number of sensor nodes that are depleted or nonviable. The contents in the genes are either 0 or 1. Here 1 means the node should be substituted, and a 0 means that node will not be substituted. The chromosome length has maximum of 10 and the gene is 0 or 1.

$\tau ANL(V) = U (U - 4) * 4\tau$

The number of chromosome described here will randomly detect node sensors. The total number of chromosomes found in this step will be dead nodes and alive nodes [14].

ii)Evaluation

The second step in Genetic algorithm is Evaluation. The fitness of the gene is estimated in this evaluation .The parameters of the fitness function are the genes[13]. Fitness function in the fault node recovery cannot accept genes directly. Because the genes of the chromosomes cannot simply replaced. In the FNR algorithm, the goal is to reclaim the most used routing paths. Hence the number of routing paths available in the nonfunctioning sensor nodes is calculated by

$fn=(Pi\times TP-1max\{gr\}=1)/(Ni\times TN-1) \times i-1$

Where,
Ni – no of sensor nodes that are replaced with respect to grade value
Pi – no of reusable routing paths grade value i

TP – total no of routing path in wireless sensor networks
TN – total no of sensor nodes in wireless sensor networks Power consumption can be calculated using below equation

$Tpc = Pcili=1$

Where,

$Pc = Pt\ 1+d$

iii)Assortment

The third step is assortment. The assortment step will eliminate the chromosome with the lowest coherence values and retain the rest. The main aim of this step is to select the chromosomes having the highest coherence value. First it selects the pair of chromosomes from the node[12]. Then it eliminates the chromosomes which is having lowest coherence value and holds the chromosomes having high coherence value. The selected chromosomes which is having highest coherence value will be send to the coupling process to produce new set of chromosomes which will happen in the crossover step.

iv)Crossover

The Crossover step in Genetic algorithm is to cross over or to change the dependent chromosome. One-Point crossover strategy has been utilized in the genetic algorithm. The two particular chromosomes will be selected from the coupling process to generate a new set of descendants [15]. A one-point crossover is assorted from the two parents and then the fraction of each of the particular chromosomes are mingled at the crossover point according to the roulette wheel assortment process.

v)Transmutation

The purpose of transmutation in GAs is preserving and introducing diversity. This flips the gene in the chromosomes. The traits of the chromosome are not observed in the dependent real ones and prevents the algorithm from being overlapped. We simply swapped a gene in the chromosome. The changeover of the nonviable into viable nodes is completely executed in the transmutation process. The Fault node recovery will change the genes numbered 1 into 0.The enlarge substitution of sensor nodes on a governed field renders node transmission and better network lifetime

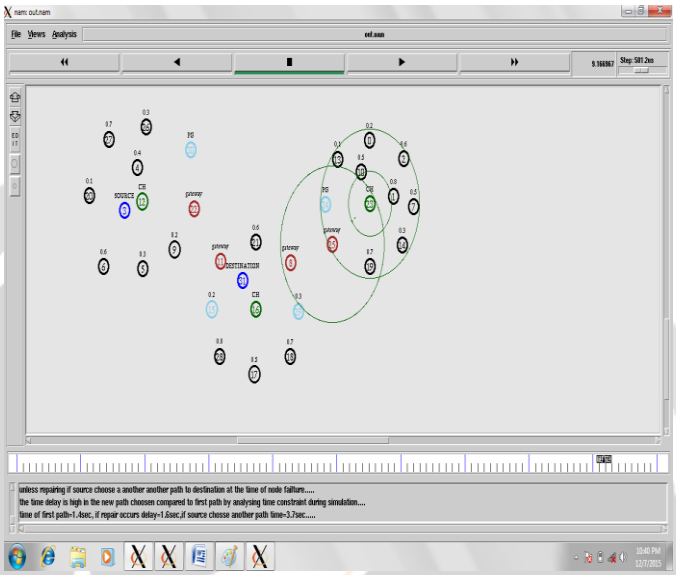


Fig-2: Result in Grade diffusion Algorithm

IV RESULTS AND DISCUSSION

In this method description to detect the faulty node is successfully implemented and tested. In WSNs large number of sensor nodes like 10, 20, 30 and 100 are implemented and tested in NS2 tool. In the above example, Fig. 4 is detect faulty senor node and to prove the efficiency of the proposed method. As various time delays are simulated with this proposed method are listed below

Table -1: Delay Time with Number of Sensor Nodes

S. No	Number of sensor nodes in the WSN	Actual RTT	Present RTT	Delay of RTT
1	3	94.3303	94.530	0.20
2	4	167.116	167.536	0.42
3	5	261.388	262.228	0.84
4	6	373.359	374.759	1.40
5	7	502.99	505.09	2.10
6	8	650.308	653.248	2.94

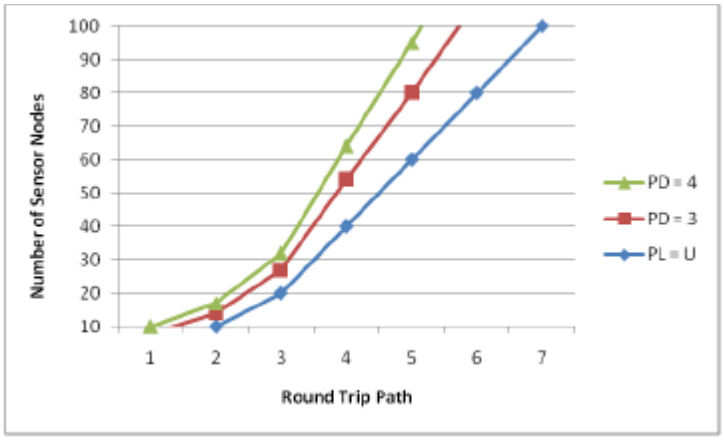


Chart -1: Round Trip Path Vs Number of Sensor Nodes

The simulation of the fault node recovery algorithm is done by estimating or detecting the exhausted nodes. The total data loss can be estimated by plotting a graph against events and data loss. The grade diffusion has the data lapse ranges from 1,00,000 to 7,80,000.The event ranges from 8 to 78 of data loss. The directed diffusion lapsed the data ranges from 100000 to 800000 and the events ranges from 10 to 78.

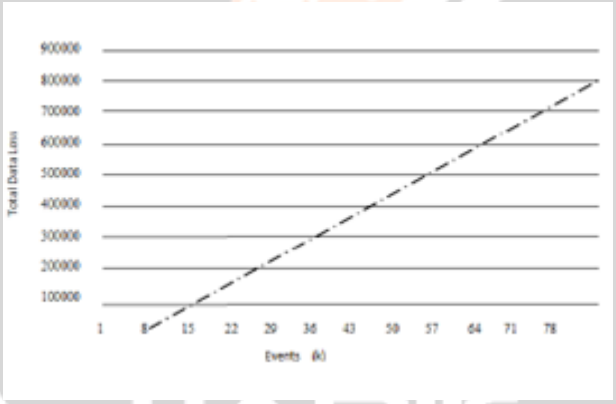


Chart-2: Total data loss

Then the average energy consumption of directed diffused algorithm ranges from 1 to 3200.The grade diffusion algorithm consumes energy ranges from 1 to 3400.The fault node recovery algorithm consumes less energy compared to directed diffusion and grade diffusion methods

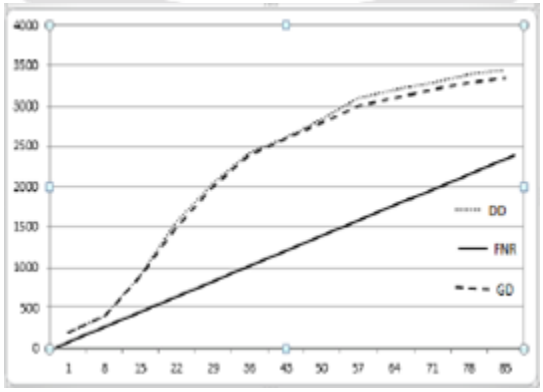


Chart-3: Average energy consumption

V CONCLUSION

In real wireless sensor network the sensor nodes use battery power supplies nodes use battery power supplies and thus have limited energy resource. By using the algorithm consumes less power and energy. It mainly addresses the battery exhaustion lack of monitoring and bandwidth restraint problems. The most routing path's are reused and replaces the non –functional node with the function nodes. The rate of packet is reduced to 97% and the energy consumption is reduced to 70%-80% and it enhances the lifetime of the network.

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