Indian J. Res. Found., (2016) 5, 5-8. ISSN 2454-6577

INDIAN JOURNAL OF RESEARCH FOUNDATION

www.indianjournal.net

RESEARCH ARTICLE

An alternate fault node recovery algorithm for a wireless sensor networks

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Received 6 October, 2015; Accepted 09 February 2016
Available online 09 February 2016

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. Sensors have issues related to energy routing and coverage. These failures are inevitable due to the lack of monitoring and unattended deployment. Sensor nodes are exposed to make fiasco. In order to address this problem, a fault node recovery algorithm is proposed for enhancing the lifetime of wireless sensor network and to increase the fault tolerance of the node. the genetic algorithm 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 algorithm combines the grade diffusion algorithm with the genetic algorithm. It enhances the number of functional nodes, lesson the rate of data loss by 99% and slash down the rate of energy intake.

Keywords

Wireless sensor network
Fault node recovery
Ladder diffusion
Antcolony optimization
Grade diffusion

Introduction

Wireless sensor network (WSN) occupies a dispersed autonomous sensors to monitor physical or environmental conditions such as hotness, coldness, sound, shear, etc to cooperatively pass their data through network[1]. Some nodes has very limited computation power to transfer the events to the sink node. The placement of the sink node has a great impact on the energy consumption and lifetime of WSN's[7]. When the energy of the sensor node is exhausted, WSN leak will appear and the failed nodes will not relay data to the other nodes during transmission processing. It is the main reason for wireless network leaks. Thus the other nodes will be burdened with increased transmission processing. It is important to address the lack of monitoring and unattended deployment problem [8]. The coverage optimization and maintenance scheme is used to substitute the nonviable nodes with the viable nodes.

Problem description

In earlier approaches to sensor network routing include directed diffusion and grade diffusion algorithm. The goal of our system is to provide habitat monitoring, target tracking, surveillance and security tracking,

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surveillance and security management. The functional node is a real challenging task to complete.

Experimental

Directed diffusion algorithm

The region requires event monitoring deploy sensors forming a distributed network .Directed diffusion consists of several elements interest data messages, gradients and reinforcements. An interest message is a query or an interrogation which specifies what a user wants. In directed diffusion the data is named using attribute values pairs. This dissemination sets up gradients within the network designed to “draw” events. Specifically a inclination is direction state created in each node that receives an interested. The inclination direction is set toward the nearby node from which the interest is received [4].

Proposed system

Grade diffusion

It solves the sensor node’s transmission problem and the sensor node’s loading problem in wireless sensor networks by to arrange the sensor node’s routing. In addition them, the sensor node also can save same backup nodes to reduce the energy consumption. The grade diffusion algorithm can save 28.66% energy and increase 76.39% life time [4]. A grade diffusion algorithm improve upon the LD_ACO algorithm to enhance the node life time, raise transmission efficiency and solve the problem of node broadcast grade completely and quickly creates package from the sink node to every node in the wireless sensor network by the LD_ACI algorithm. The grade diffusion algorithm overcomes the disadvantages of direct diffusion algorithm by broadcasting the nearby nodes to the first acquaintance set. The fault node recovery algorithm replaces the non-functional node with functional node. It also reclaims the most routing path to enhance the WSN lifetime [3].

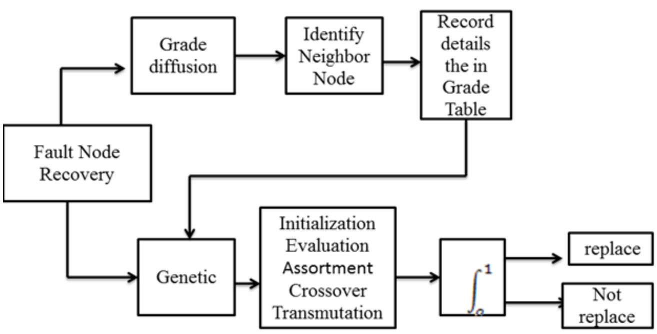

Fig 1 Architecture of fault node recovery

Fault node recovery (FNR) is the blending of grade diffusion and genetic algorithm is shown in **Fig 1**. Grade diffusion used to identify the neighboring node. It also records the details of the node in the grade table. Then it gets into the stage of genetic algorithm which has five steps to proceed. After the completion of five steps, it will mutate the fault node into strengthen node. The strengthen node can again perform the transmission of data. If there is no fault node is found then it will terminate the process.

Fault node recovery

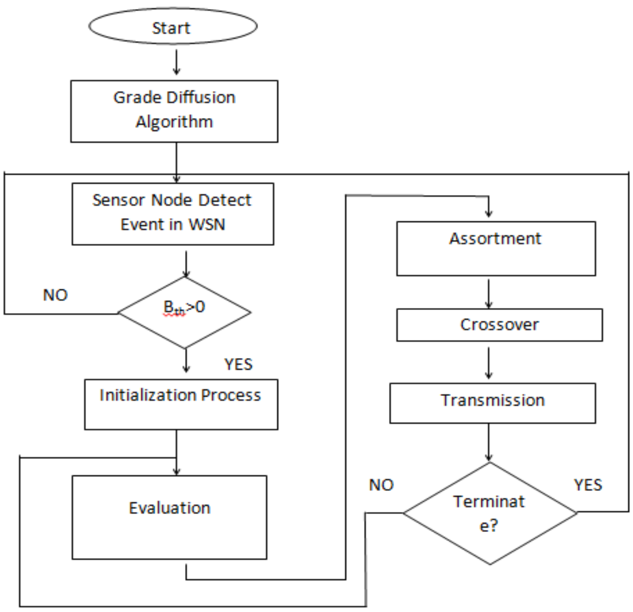

Fig 2 Fault Node Recovery algorithm flow chart

Fault node recovery for WSN’s based on the combination of grade diffusion and the genetic algorithm is shown in **Fig 2**. The FNR 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. The WSN can continue to work as long as the operators are willing to replace sensors.

$$B_{th} = \sum_{I=1}^{Max\{Grade\}_{Ti}} \quad Ti = 1, \quad \frac{N_i^{Now}}{N_i^{Original}} < B$$

$$= 0, \text{ otherwise} \qquad (1)$$

In (1), Grade is the sensor node's grade value. The variable $N_i^{original}$is the number of sensor nodes with grade value i. The variable N_i^{now} is the numbers of sensor nodes shill functioning at the current time with grade value i. The parameter of B is set between 0 and 1. If the number of sensor nodes that function for each grade is less than B, Ti will become 1 and B_{th} will be larger than zero. Then the algorithm will calculate the sensor or node to substitute using the genetic algorithm.

Significance

Genetic algorithm

The genetic algorithm is one of the best energy efficient algorithms in WSN. 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.

Initialization

In this step, the genetic algorithm 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.

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].

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

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

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

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**.**

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.

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.

Results and discussion

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 **Fig 3**. 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.

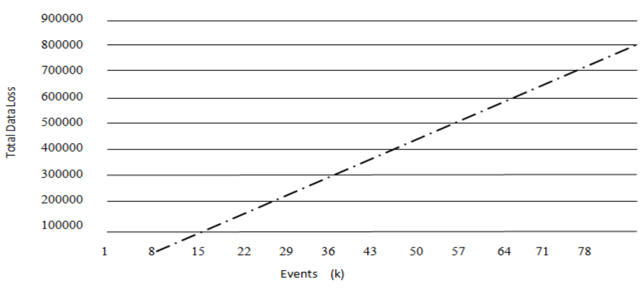

Fig 3 Total data loss

Then the average energy consumption **Fig 4** 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

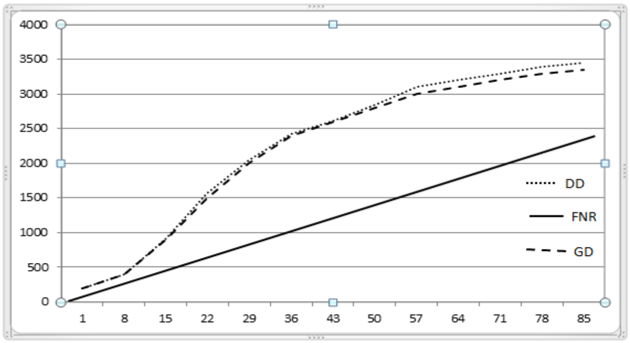

Fig 4 Average energy consumption

Conclusion

In real WSN the sensor nodes use battery power supplies nodes use battery power supplies and thus have limited energy resource. By using the fault node recovery 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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