ROUND TRIP DELAY AND PATH APPLICATIONS FOR FAULTY NODE DETECTION IN WIRELESS SENSOR NETWORK

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ABSTRACT
For some years, wireless sensor networks (WSNs) applications have increased because of its great potential to connect the physical world with the virtual world. Likewise, advances in microelectronic manufacturing technology reduce the cost of making portable wireless sensors. It becomes a fashion to apply the large number of portable wireless sensors to WSN to improve quality of service (QoS). QoS such WSNs is mainly influenced by the failure of sensor nodes. The likelihood of increased mote increases with increasing number of sensors. In order to maintain the best QoS in fault conditions, identification and release of such failures are essential. In the proposed method, the defective sensor node is detected by measuring the round trip delay (RTD) of discrete round trip paths (RTP) and comparing the threshold value. There are two nodes of sensors and a master node, communication between these nodes is established through Zigbee wireless technology.

KEYWORDS: Wireless network, Faulty node, delay, path, etc.

INTRODUCTION
Wireless Sensor Networks (WSNs) with a large number of portable sensor nodes have huge applications in a variety of industries such as surveillance, national security, military operations, environmental and industrial medical monitoring. Due to the rapid growth of electronics production technology, it is possible to realize the low-cost portable mote with greater precision and sensitivity. Therefore, a large number of portable sensor nodes can be deployed in the field to increase the quality of service (QoS) of such wireless sensor networks. Use a large number of sensor nodes to increase the probability of defects in such WSN sensor nodes. Data analysis based on this defective node sensor will become inaccurate or deviate from the mean value. This eventually collapses WSN's quality of service (QoS). The WSN may fail due to various reasons such as battery failure, environmental effects, hardware or software malfunctions. A better quality of service (QoS) by discarding the data of these defective sensor nodes in the analysis is achieved. This will require efficient and accurate detection of defective WSN sensor nodes. Improper identification of sensor nodes is based on the comparison between neighbors' nodes and the dissemination of the decision made to each node. Algorithm proposed in this method that cannot detect malignant nodes. The error header cluster error recovery algorithm used to detect the defective node has data loss due to cluster head transfer. The redundancy path technique suggests detecting a defective sensor node. Redundancy increases power consumption and reduces the number of correct responses in network life. Excessive redundant paths WSNs slow down the fault detection process. Detecting circuit breaks based on the monitoring cycles (MCs) and monitoring circuits (MPS) is presented. Three-way connectivity in the network, length separately for each monitoring cycle and wave position control are the limits of this method. The proposed fault detection method is based on RTD time measurement of RTPs. Times RTP discrete RTP are compared with the threshold time to determine the failed mote or malfunctions. Initially, this method is tested and verified in three wireless sensor nodes, implemented using microcontrollers and Zigbee.

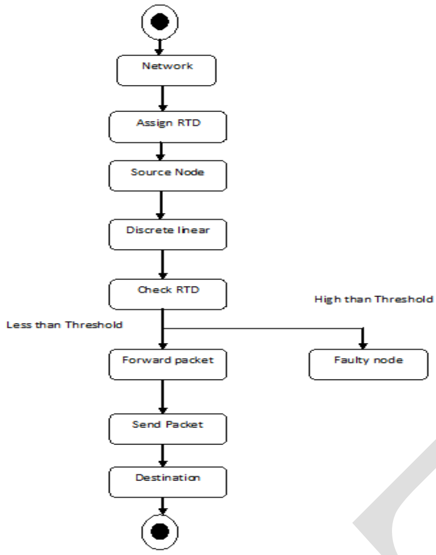

FIGURE 1: Proposed Activity Diagram

LITERATURE REVIEW

Ravindra Navanath Duche and Nisha P. Sarwade described document to detect failures is successfully implemented and tested in hardware and software. Due to the hardware deployment complexity, the WSN with a large number of sensor nodes cannot be run to verify the suggested method. WSNs with various node sensors such as 10, 20, 30, 40, 50 and 100 are implemented and tested software [1].

Irfan Al-Anbagi, Melike Erol-Kantarci, and Hussein T. Mouftah survey on the state is about QoS over cross-layer wireless sensor ground to delay limits and reliability in critical applications is presented. Our work provides a classification of quality of service unique approaches are intersected in WSN that allows you to study many studies that clearly layers. In addition, the main application issues QoS protocols for wireless sensor networks and presents an overview of WSN QoS applications [2].

Lukman Rosyidi, Hening Pram Pradityo, Dedi Gunawan, Ruki Harwahyu, Riri Fitri Sari examines the method of faulty detection nodes in the network ZigBee loop. The ZigBee network is commonly used for low power distribution and low cost wireless data transmission. Node fault localization is required to maintain network reliability. Common methods of fault detection based on network capabilities of the ZigBee network [3].

R. Morello, C. De Capua, A. Meduri proposes a network of wireless sensors to verify the structural integrity of the building, monitoring the transmitted vibration levels. Specifically, the network can assess whether vibration levels can cause damage to the building or need further study. Vibration levels are compared with fixed thresholds suggested by studies and regulations. Attention has focused on the reliability of measurement results and, for this purpose, two algorithms have been implemented. The first takes into account the measurement uncertainty of each node in the sensor network to verify that the fixed threshold is exceeded by using the appropriate decision-making process rules [7].

RESEARCH METHODOLOGY

Bidirectional path timing for RTP will change due to the defective node. It will be infinite or higher than the threshold. Fault sensor unit is detected by comparing RTP time with RST threshold. The threshold value is calculated when the entire network is in the right place, depending on the response of each node, a threshold for fixing is selected. The common time-specific RTP infinity RTD time is detected as successful. If this time is higher than the threshold, the sensor unit is detected as a malfunction. Time to detect dead bugs depends on RTP and RST time. Therefore, RTD time measurement and RTP evaluation should minimize recovery times.

We recommend using a separate RTP to determine the general model of failure detection for WSN analysis time. RTD conducted various experiments based on time measurement hardware and software. The analysis of failure detection time in all cases is determined by the generalized model. The results of the analysis show that in both cases the hardware and software, RTD time measurement results are quite real; verify the applicability of this method in real time.

TYPES OF FAULTS

The status of sensor nodes in a wireless sensor network can be categorized into two categories: one is normal; in this state, it is said that the nodes function and accurately locate the data. And the second is defective; in this state, the sensor node is supposed to detect and transmit incorrect data to the data collection center or base station. The disadvantage, in turn, can be divided into permanent and static. The defective is called permanent state here means that failed nodes remain defective until they are replaced, and called static state means that new defects will not be generated during the error detection process.
In WSN node defects can be categories in two categories, soft and hard. "Soft bugs" means that failed sensor nodes can continue to function and communicate with other nodes (hardware communication of the software and modules is correct), but the transmitted data is not correct. The "hard bugs" is when the node sensor cannot communicate with other nodes due to the failure of a unit (pp., Communication failure due to communication unit failure, sensor node energy exhaustion, etc.).
In general, wireless sensor nodes can encounter two types of defects that will guide the deprivation performance. The default mode is one of the types, often resulting in atomic conflict nodes, loss of data packets, a routing distribution and network sharing. The other type of error is the absence of data, in which a node behaves normally in each aspect, expects the detection results to lead to significant biases or random errors.

METHODS TO DETECT FAULTY SENSOR NODES

Method 1: The method of nodes of defect recognition sensors discussed in question depends on the comparison between the adjacent nodes and the diffusion of the decision obtained at each sensor node. The algorithm is designed in this method cannot find malicious nodes that exist in sensor networks.
Method 2: The technical defect repair patch head shown recognize the nodes of defective sensors have a disadvantage of losing data due to the transmission cluster head.
Method 3: The method used by the redundancy path of the art for the identification of a defective sensor node shown in [12] and [13]. Redundancy is no increase in energy consumption and reduces the number of correct results over the life of the network. Due to excessive paths present in wireless sensor network speed of detection process gets slow down.
Methodos4. Using monitoring cycles (MC) and monitoring tracking paths (MP), the detection of connection failure is proposed in [14]. The disadvantages of this method are the connectivity of three edges for the wireless sensor array and each monitoring and positioning cycle using a distinct wavelength.
Methodos5. Using the RTD and the RTP The process for detecting faulty nodes using RTD and RTP can be considered as two parts. The first part includes the assumption that all sensor nodes are functioning correctly and there is no faulty node existing in the network and the threshold value is set by measuring the time RTD all RTP. In the second part of the actual detection of the defective node is performed by selecting discrete RTPs and comparing the RTD time to a predetermined threshold which is defined in the first part [15].
The below figure1 shows the example of circular network topology with 6 sensor nodes and figure2 shows the example of RTP formed by taking sensor nodes S2,S 3 and S5.

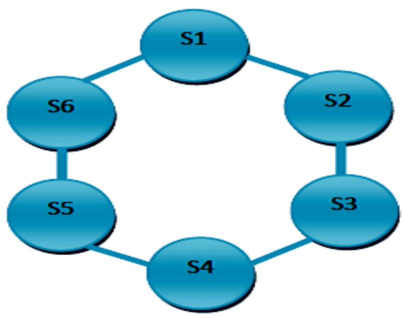

FIGURE 2: Circular topology involving 6 sensor nodes

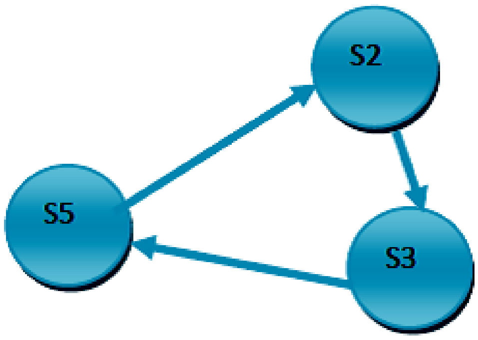

FIGURE 2: Example of discrete RTP

The round trip delay time the RTP will change due to the faulty sensor node. It will be either infinite or more than the predetermined threshold value. The node detector is defective can be detected by comparing the RTP time RTD with a predetermined threshold value. The detection node that is common to RTP accurate with RTD apnea time is detected as having failed. If the time is greater than the predetermined threshold value, then the sensor node detected as defective. The detection time of a faulty sensor node depends on the RTP number and the RTD time. Therefore, RTD measurement time and RTP evaluation should minimize detection time.

RESULTS

```
-----------------------------------------
|Node              |     DELAY          |
-----------------------------------------
|        Node(0)   |       1            |
|        Node(1)   |       2            |
|        Node(2)   |       4            |
|        Node(3)   |       2            |
|        Node(4)   |       3            |
|        Node(5)   |       7            |
|        Node(6)   |       2            |
|        Node(7)   |       2            |
|---------------------------------------|
FAULTY NODE IS 5
LINEAR PATH
RTP PATH1 ---> 0 1 2 0
RTP PATH2 ---> 1 2 3 1
RTP PATH3 ---> 2 3 4 2
RTP PATH4 ---> 3 4 5 3
RTP PATH5 ---> 4 5 6 4
RTP PATH6 ---> 5 6 7 5
RTP PATH7 ---> 6 7 0 6
RTP PATH8 ---> 7 0 1 7
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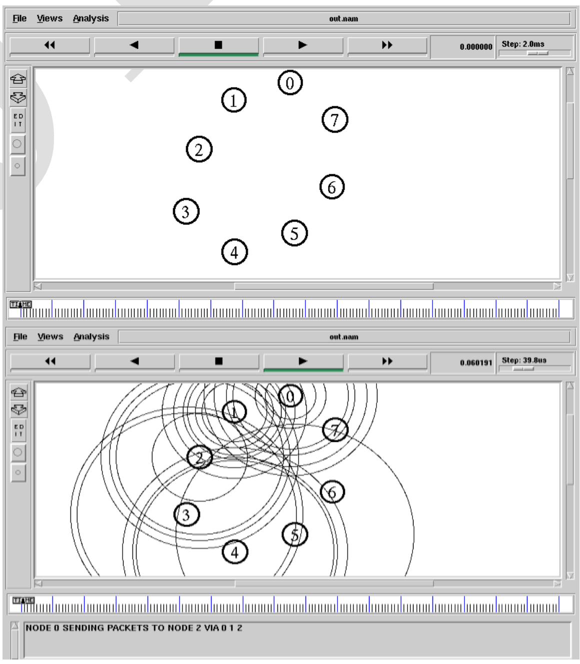
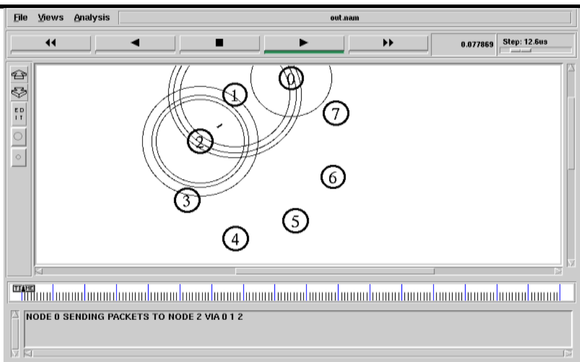
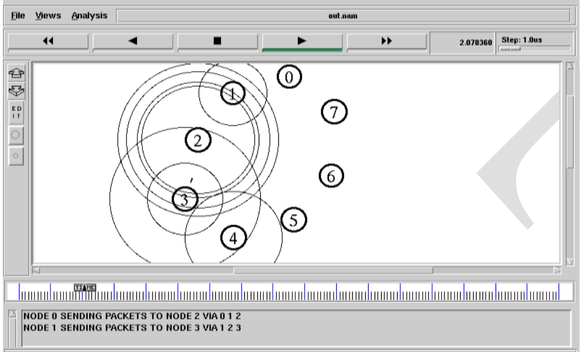
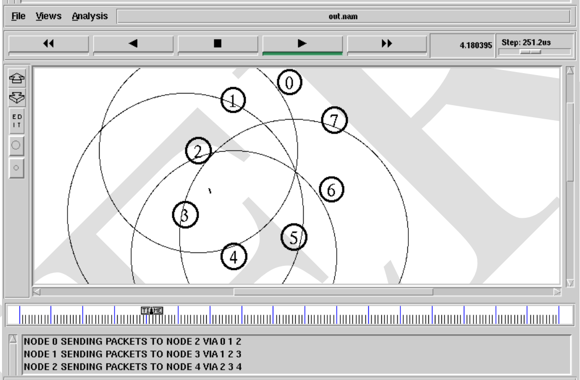
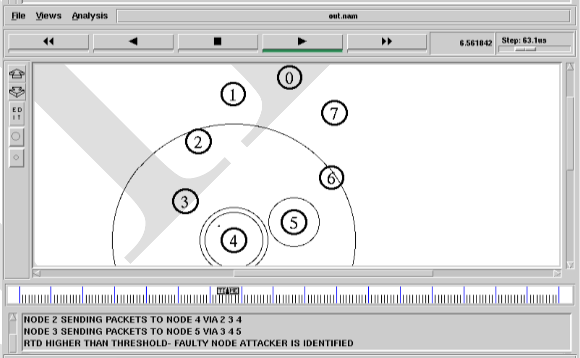
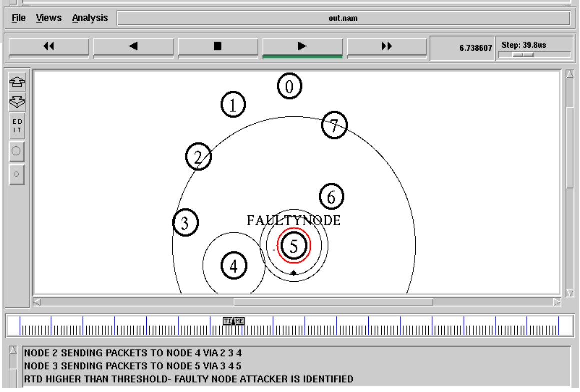



File Views Analysis
out.nam
0.077869
Step: 12.6us
0
1
7
2
6
3
5
4
NODE 0 SENDING PACKETS TO NODE 2 VIA 0 1 2


File Views Analysis
out.nam
2.078360
Step: 1.0us
0
1
7
2
6
3
5
4
NODE 0 SENDING PACKETS TO NODE 2 VIA 0 1 2
NODE 1 SENDING PACKETS TO NODE 3 VIA 1 2 3


File Views Analysis
out.nam
4.180395
Step: 251.2us
0
1
7
2
6
3
5
4
NODE 0 SENDING PACKETS TO NODE 2 VIA 0 1 2
NODE 1 SENDING PACKETS TO NODE 3 VIA 1 2 3
NODE 2 SENDING PACKETS TO NODE 4 VIA 2 3 4


File Views Analysis
out.nam
6.561842
Step: 63.1us
0
1
7
2
6
3
5
4
NODE 2 SENDING PACKETS TO NODE 4 VIA 2 3 4
NODE 3 SENDING PACKETS TO NODE 5 VIA 3 4 5
RTD HIGHER THAN THRESHOLD- FAULTY NODE ATTACKER IS IDENTIFIED


File Views Analysis
out.nam
6.738607
Step: 39.8us
0
1
7
2
6
3
FAULTYNODE
5
4
NODE 2 SENDING PACKETS TO NODE 4 VIA 2 3 4
NODE 3 SENDING PACKETS TO NODE 5 VIA 3 4 5
RTD HIGHER THAN THRESHOLD- FAULTY NODE ATTACKER IS IDENTIFIED

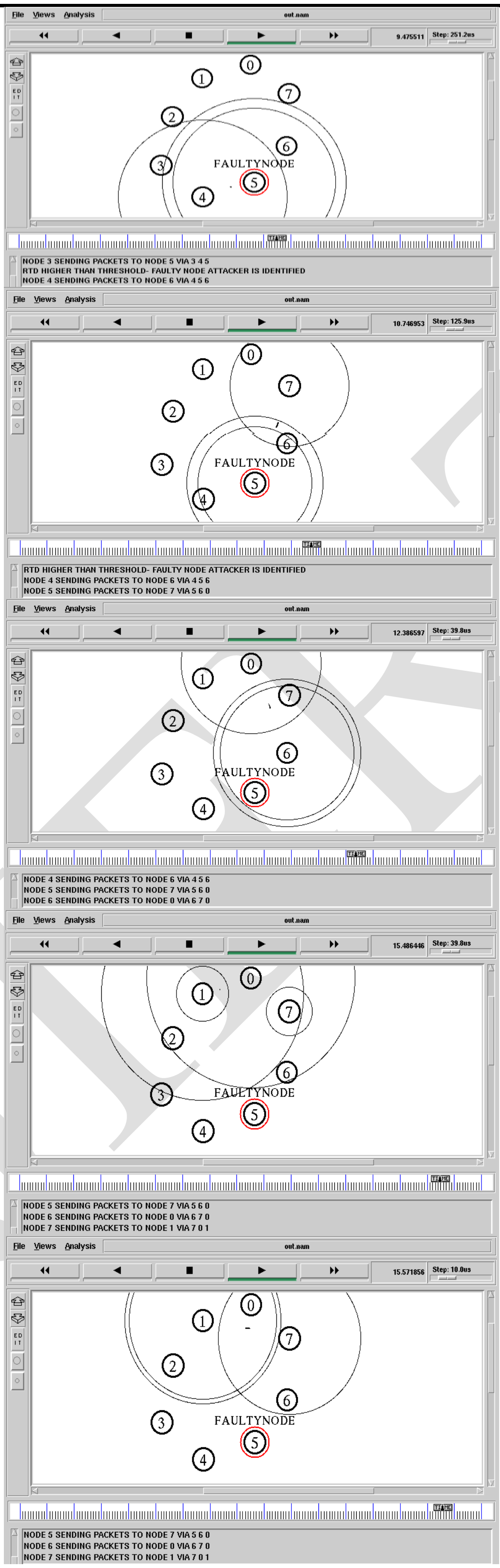


FIGURE 3: Data sent by different nodes through different paths

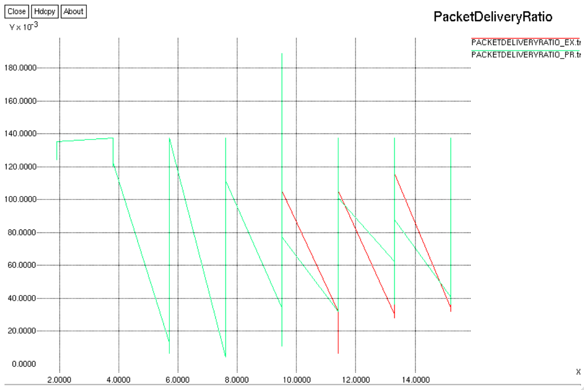


FIGURE 4: Pocket Delivery Ratio

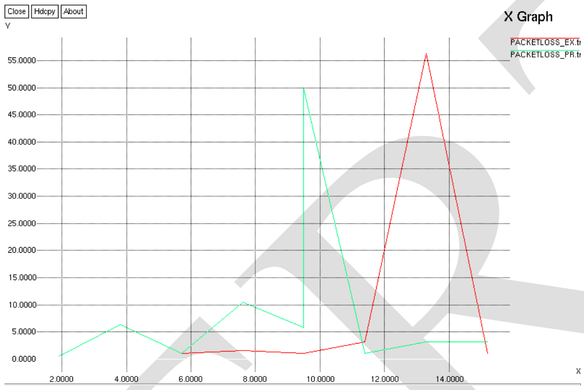


FIGURE 4: Pocket Loss

CONCLUSION

In this article we have an overview of the different causes of node errors and the techniques used to detect faulty nodes in the wireless sensor network. Method1 analyzes neighboring nodes to detect faulty nodes. Method 2 is very simple, but it has problem of data loss due to the transfer of head group. Way redundancy technique has a disadvantage of energy and low bandwidth consumption. The use of a distinct wavelength for each monitoring cycle is the disadvantage of methodou4. According to the work carried out, the RTD node detection technique defective using RTP and found accurate and energy-saving.

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