Detection of Sensor Node Failure in WSNs Using Round Trip Delay and Round Trip Path

Abdul Kalandar\textsuperscript{1}, Mrs. Akhila Thejaswi\textsuperscript{2}
\textsuperscript{1}IV Semester, M.Tech, Computer Science and Engineering, Sahyadri College of Engineering and Management
\textsuperscript{2}Asst. Prof., Department of Information Science and Engineering, Sahyadri College of Engineering and Management

Abstract- Wireless sensor networks (WSNs) it is a collection of sensor nodes organized into a cooperative network. According to the specific requirement field of application the WSNs are distributed. For observation, locating vehicle position, weather monitoring, military and hospital operation sensor node are extensively used. Construction of WSN consisting of large number of portable sensor increases quality of service (QoS) by the rapid growth in electronics fabrication technology where more number of sensor node are produced at low price with better perfection and reactivity. The failure and duration of sensors the probability of sensor node failure increases. Spotting and uncoupling such faults essential in order to maintain the better QoS under failure condition. Calculating round trip delay (RTD) from round trip path (RTP) and compared with threshold and faulty sensor node is detected. WSNs with dynamic topology are simulated to determine the round trip delay time of round trip paths. Matlab is used for verify the scalability by simulating the WSNs with large sensor nodes.

I. INTRODUCTION

WSNs are the distribution of sensors node that performs a many number of measurements process. It is also defined as wireless network of thousand of low price small device capable of computing, communicating and sensing. According to the field of specific requirement application the portable sensor node are distributed in WSNS. It has vast potential to connect the physical world and virtual world. Sensor node are extensively used for monitoring area, monitoring environment, application in medical, structural monitoring structure, monitoring traffic, monitoring habitat, observation, locating vehicle position\textsuperscript{[1]-[4]}. WSNs are made of sensor nodes from one to several hundred, where each sensor node is connected to one or several via Bluetooth or ZigBee connections. The basic components of sensor node are sensor and actuator which is an interface to the real world designed to capture the parameter like pressure, temperature and other physical parameter from the environment, microcontroller it is a processor where sensed data is processed and it converts the physical data in to digital data, memory is to store the generated results from microcontroller, communication where it is used to send the data from one sensor node to other and to base station through antenna via wireless channel, Battery is used to supply the power to the sensor node for smooth operation.

The topology of WSNs can be star topology, ring topology, mesh topology, circular topology, dynamic topology and other different topology. Routing and flooding are the propagation technique used among the sensor nodes of the networks. WSN have the capability to dynamically adapt to changing environments due to drastically decreasing the installation costs. Network topology gets changed because of adaptation mechanisms or can cause network to shift different modes of operations.

The hot area of research is to develop an efficient and accurate design to increase the QoS in WSNs. WSNs to be implemented in efficient and accurate design but the field requires deployment of large
numbers of portable sensor nodes. The factor such as lifetime and failure of sensor node affects the QoS of WSNs. In decision-making process the data from faulty sensor node has to be ignored or discarded in order to improve the QoS of WSNs [5]. Hence the primary importance is detection of faulty sensor node. By using RTPs and their compared on the basis of RTD. To determine the RTD time of RTPs WSNs with circular topology are simulated. Scalability of various sensor nodes in WSNs is verified by simulation tool that is Matlab.

II. RELATED WORK

Many different approaches are used to detect fault sensor nodes in WSN. Some of the approaches are as follows.

L.B. Ruiz, I.G. Siqueira, L.B. Oliveira, H.C. Wong, J.M.S. Noqueira, and A.A.F. Loureiro proposed failure detection scheme called MANNA using management architecture for WSNs. Faulty sensor nodes are able to detect from the above architecture. This approach is too expensive for WSNs it requires an external manager to perform the centralized diagnosis and the communication between nodes [6].

M. Lee and Y. Choi proposed the method to detect the failure in sensor nodes in WSNs. In this method faulty sensor nodes identified on the idea by comparisons between the surrounding nodes that is neighboring nodes and at each node level dissemination of the decision made. The algorithm is simple while maintaining low false alarm rate it detects faulty sensor nodes with high accuracy for fault probabilities of wide range. In this method the algorithm fails to detect the malicious nodes. There is a need to distinguish events from extending faults and fault detection algorithm modification and requires an algorithm to differentiate event [7].

A. Akbarl, A. Dana, A. Khademzadeh and N. Bemlkahdavl proposed the method named cluster based recovery algorithm. Sensor node failures changes due to which energy-efficient and responsive to network topology. It is used to detect battery failure node and recovery the battery failure node. The disadvantage of the cluster based recovery algorithm that is while transferring the cluster head that results in heavy data loss [8].

C.-C.Song, C.-F. Feng, C.-H. Wang, D.-C. Liaw, A.Mojoodi, M.Mehrani, F.Forootan, and R. Farshidi proposed method to find the fault sensor node using redundancy path. Redundancy path results in consuming more energy and the number of correct response in network lifetime will reduced [9][10].

S.S. Ahuja, R. Srinivasan, and M. Krunz presented monitoring cycles(MCs) and monitoring path(MPs) for the detection of link failure in sensor node in WSNs. The limitation of the method three-edge connectivity in the network, for each monitoring cycles and monitoring locations maintained a separate wavelength [11].

R.N. Duche and N.P. Sarwade proposed the method to detect the faulty sensor node using discrete round trip delay and round trip path. In this method sensor nodes are arranged in circular topology that is in static and using this topology the packet is forwarded from source to destination by routing and Maximum round trip delay is calculated and considered as threshold value. To find the faulty sensor node the round trip delay of the round trip path should be greater than threshold value. Before detecting faults in the sensor node the sensor node should be made faulty otherwise it does not show the faulty node. Before implementing the method in which sensor is failed is know and implementing the method is to confirm that same node is failed [12].

III. PROPOSED SYSTEM

In proposed approach the research named detection of sensor node failure using round trip delay and round trip path where it is used in the field of networks of sensor node that it used in smart city, traffic controlling etc. Sensor nodes in wireless sensor networks are used for capturing, analysing and sensing the environment or sensed body data. More number of sensor node is deployed more is the use and efficient and accuracy and increase the quality of service. The probability of failure of
sensor node also increase if one sensor node is failed than it effects the whole wireless sensor network. In order to maintain the quality of service the sensor which is faulty is needed to replaced. In this method the failure sensor node is detected and send the information to sink node of wireless sensor network.

A. **System Architecture**

A System Architecture is a composition of the components that define the structure, behavior of the method. Where in wireless sensor network which contains sensor nodes that are network of sensor node that can be arrange in any topologies for this method dynamic topology is selected for detection of sensor node failures. A packet of any size is selected and packet forwarded from source to destination through routing. During routing the round trip delay is calculated for each round trip path pairs. Initially the all sensor node are under working condition that is considering all sensor nodes are not failure nodes packet is forwarded for each round trip path and round trip is calculated and maximum round trip delay is considered to be the threshold value. The packet is again sent from source to destination through routing in round trip paths and round trip delay is calculated if the round trip delay of the round trip path is greater than threshold value than the sensor node is declared as faulty sensor node. The results are displayed in simulator.

![System Architecture](image)

**IV. IMPLEMENTATION**

**Modules:**

In the first phase, the sensor node is deployed dynamically for each time interval the number of sensor node is 15 is considered in this topology.
The sensor node will change according to time that is 1 to 12 and position of the sensor node will change dynamically.

The packets is forwarded from source to destination through routing and while packet is forwarded from source to destination it calculate the round trip delay of round trip path. Maximum round trip value is considered as threshold value.
After finding the maximum threshold value the packets are forwarded for many iterations to find the malicious and dead node. The malicious node is found by comparing threshold value with the round drip delay value of the round trip path. If it is greater than threshold value than it is a malicious node.

If the round trip delay is greater than and its energy value is infinity or zero than that node is considered to be dead. Any sensor node can be malicious or dead sensor node. In this method the failure node are found not created. It finds the failure of node at each iterations and displays the which sensor node dead or malfunctioning. It prints the threshold value for each iteration and also its
prints the malicious and dead node. It displays each simulation time as evaluation time and total simulation time has elapsed time.

The sensor movements and positions are tracked in the graph below.

![Graph showing sensor movements and positions](image-url)
This graph displays the transmission failure rate where initially high because of dynamical topology and it decreases due to transmission perfections.

The graph displays the results of routing accuracy in wireless sensor network.

The graph shows the round trip delay and round trip path and its comparison is made by using this graph.
V. CONCLUSION

This paper mainly focuses on detecting sensor node failure detection where in it uses round trip delay and path and identify which sensor node is dead or malfunctioning in dynamic topology. Scalability of the method is excellent has been verified by implementing it to various WSN.

REFERENCES


