**A HYBRID FAULT-TOLERANT ROUTING BASED ON GAUSSIAN NETWORK FOR WIRELESS SENSOR NETWORK**

**ABSTRACT:**

In this paper, we have proposed a hybrid fault tolerant routing to solve fault-tolerant issue in wireless sensor networks (WSNs) based on hierarchical topology. The hierarchical topology is a combination of clustering and the labelling of sensor nodes as Gaussian integers. Accordingly, the network area is divided into small square grids, the cluster head of each grid is represented by a Gaussian integer. These cluster heads are connected together to create a Gaussian network. Through node symmetry, and the shortest distance in the Gaussian network, as well as the advantages of multi-path routing, this paper proposes a hybrid fault-tolerant clustering routing protocol based on Gaussian network for wireless sensor network (FCGW). The purpose of FCGW is to improve fault tolerance, increase data reliability and reduce energy consumption for wireless sensor networks. The experimental results of the proposed scheme show that FCGW protocol has high data reliability.

Keywords—Clustering, fault-tolerance, Gaussian network, multi-path routing, wireless sensor network.

**EXISTING SYSTEM:**

* Low Energy Adaptive Clustering Hierarchy (LEACH) Protocol is a founding or one of the earliest techniques for clustering of sensor nodes. LEACH protocol uses the energy values of the nodes and their random numbers which is a value between 0 and 1. Later, a threshold value will be calculated based on the probabilities of a node becoming a CH and their random numbers, then, those nodes which have energies higher than the threshold will be selected as CHs and each CH display it through a message of becoming a CH. Remaining nodes will join the nearest CH and forms clusters. Every time the nodes sends its data to the CH in their time slots, CH will transmits it as a packets to the BS. After, the CH reaching below the threshold value it will become a node again and the node which has next highest energy than the threshold value will becomes CH.

**DISADVANTAGES:**

* If any CH will be dead then, the packets from that particular cluster will never reaches the BS resulting in loss of data of that cluster.
* There exists an unbalanced energy consumption when the rounds goes on.
* There is no optimal limit for the number of nodes in a cluster.

**PROPOSED METHOD:**

There exists a number of techniques for clustering of nodes in a WSN, but none of them considers faults while clustering. Even though clustering is better in some of the approaches, none of the clustering algorithms doesn’t considers Faults in a Wireless Sensor Network. For that, we are implementing, the Hybrid Approach for Fault Tolerant Routing Algorithm. The approach constructs a Gaussian Network, for an efficient way to detect the faults in a WSN. Gaussian Network is a network of nodes that have become Cluster Heads (CHs), for that particular round. All the CHs of all clusters are connected through forming a Gaussian Network. The Gaussian Network reveals the behavior of the clusters, so, whenever a cluster undergoes a fault it can be detected easily and the data transmission of that particular cluster won’t be stopped, in fact, it will be shared by the remaining nodes of the Gaussian Network to be sent to the BS.

**ADVANTAGES:**

1. All the CHs are connected through Gaussian Network making chance of faults occurring less.

2. CHs nodes are connected through GN, making the chances of fault tolerance high.

3. Fault tolerance is higher compared to remaining algorithms..

**APPLICATIONS:**

1. Industrial control

2. Environmental monitoring,

3. Military surveillance,

4. Intelligent transportation systems and medical field.

5. Furthermore, it can function independently in harsh or high-risk places where human presence is not possible

6. Disaster relief operations.

7. Biodiversity mapping

8. Monitoring of temperature, pressure, and humidity

**Software & Hardware Requirements:**

**Software:** Matlab R2018a.

**Hardware:**

**Operating Systems:**

• Windows 10

• Windows 7 Service Pack 1

• Windows Server 2019

• Windows Server 2016

**Processors:**

Minimum: Any Intel or AMD x86-64 processor

Recommended: Any Intel or AMD x86-64 processor with four logical cores and AVX2 instruction set support

**Disk:**

Minimum: 2.9 GB of HDD space for MATLAB only, 5-8 GB for a typical installation

Recommended: An SSD is recommended a full installation of all Math Works products may take up to 29 GB of disk space

**RAM:**

Minimum: 4 GB

Recommended: 8