

# Design and Simulation of a Fault Tolerant Routing Protocol for MWSN using MATLAB

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**Abstract**— As the sensors are mobile, the topology of a MWSN is constantly changing. Hence designing a routing path between the source and sink nodes in MWSN becomes very challenging. Most of the routing protocols of MWSN are just extension or variation of ones that exist for static wireless sensor network. Recent research works have led to the design of many efficient protocols for MWSN but still there are many unresolved problems like fault tolerance, retaining the network connectivity, reducing the energy cost, maintaining adequate sensing coverage, security etc. For all the above said applications of MWSN, the data transmitted or received has no scope for errors. This project aims at designing and simulation of fault tolerance routing protocol for MWSN using matlab.

## I. INTRODUCTION

### Overview

Mobile Wireless Sensor network (MWSN) is a wireless sensor network in which the sensor nodes are mobile. MWSN consists of several unattended and scattered sensor nodes that have the ability to move within the network. A sensor node is a tiny device that includes three basic components as shown in figure 1 below:

- A sensing subsystem for data acquisition from the physical surrounding environment,
- A processing subsystem for local data processing and
- Storage and a wireless communication subsystem for data transmission

**Fault detection-** To provide any countermeasures, the first step a system must perform is to detect that a specific functionality is or will be faulty.

**Fault Recovery-** After the system has detected a fault, the next step is to prevent or recover from it. The main technique to achieve this goal is to replicate the components of the system that are vital for its correct operation. i.e Fault tolerance.

**Routing Protocol:** Routing is the act of moving a data packet from source sensor node to destination base station (BS). The best routing protocol is the one that covers all states of a specified network and never consumes too much of network resources.

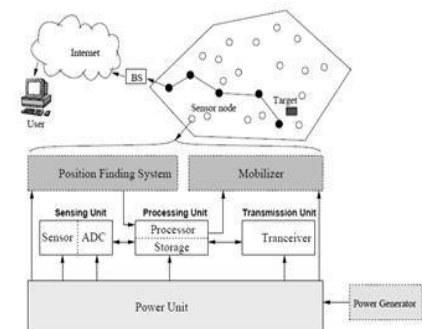


Fig 1: A Sensor node

## II. OBJECTIVES

The main aim of this project is to provide reliable communication with fault tolerance. Initially the fault is detected and it is rectified. Fault tolerance is the ability to sustain sensor network functionalities without any interruption due to sensor node failures.

## III. LITERATURE SURVEY

1. In year 2017, Kasilingam Rajeshwari, Subbu Neduncheliyan proposed a paper on „ Genetic algorithm based fault tolerant clustering in wireless sensor network“. In order to overcome issues like energy loss, message loss and link failure cluster based fault tolerance technique using genetic algorithm is proposed.

2. In year 2016, Beneyaz A Begum, Satayanarayana V Nandury explained a paper on Interference-fault free data aggregation in Tree based WSNs .Since WSN often suffer with issues related to interference during the transmission of 2 or more closely related sensor node interfere with each other ,IFFT(Interference Fault Free Transmission) technique has been proposed, which avoid interference.

3. In year 2016, Mandeep Kaur, Parul Garg explained a paper on Improved distributed fault tolerant clustering algorithm for tolerance in WSN. In

this paper they have proposed an algorithm to improve the life time of wsn by using Improved distributed fault tolerant clustering algorithm.

4. In year 2015, Gholamreza Kakamanshadi, Savita Gupta, Sukhwinder Singh proposed a paper on Survey on fault tolerance techniques in wireless sensor networks. In this paper they presents a critical analysis of various fault tolerance mechanism in wsn such as redundancy based, clustering based and deployment based to identify the strength and weakness of each one of these mechanism.

5. In year 2014, Jaideep Lakhota, Rajeev Kumar explained a paper on Fault Tolerant and Mobility Aware Routing Protocol for Mobile Wireless Network. this paper proposes a fault tolerance protocol that achieves fault tolerance of cluster head while routing and mobility management of mobile sensor nodes to reduce packet loss data transmission in MWSN.

6. In year 2014, XiongQi Zheng, Yong Feng, Jie Yang, ZhiQiang Lu proposed a paper on Energy Efficient And Fault Tolerant Routing Protocol For Mobile Wireless Sensor Networks. The proposed EFTCP has high fault tolerance through providing an alternate for each cluster head node. An EFTCP can reach efficient message text by the method that cluster head adoptively allocate time slot to their member nodes according to amount of data need to send.

7. In year 2014, Rama Ranjan Panda, Bhabane Sankar Gouda, Trilochan Panigrahi explained a paper on Efficient fault node detection algorithm for wireless sensor networks. centralized robust fault detection algorithm to identify faulty node present in the network.

8. In year 2013, Sourour Trab, Ahmed Zouinkhi, Boumedyen Boussaid, Mohamed Naceur Abdelkrim proposed a paper on Application of distributed fault detection in WSN to dangerous chemical products based on Bayesian approach. Accidents are becoming frequent in the field of the storage and handling of chemical product. Bayesian approach has been included which ensures a pre study of WSN's deployment in dangerous chemical product stores and guarantes a best performing fault detection.

9. In year 2010, Salvatore F Pileggi, Carlos E Palau, Manuel Esteve proposed a paper on Multimode WSN : Improving robustness, fault tolerance and performance of randomly deployed wireless sensor network. This paper proposes an advanced flexible solution that applies the concept of ABC(Always Best Connected). During hostile and unpredictable environment it effects the communication range and increase the number of unconnected nodes. Multimode WSN is provided with an adaptive mechanism for environment condition evaluation and with ability of self configuration.

10. In year 2009, Hind Alwan, Anjali Agarwal explained a paper on A Survey on fault tolerance routing techniques in WSN. this paper presents an overview of fault tolerance in WSN routing protocol. They have surveyed existing approaches and summerized recent

research results on fault tolerant data routing into two main schemes retransmission based and replication based.

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

#### IV. METHODOLOGY

The methodology consist of four parts

1. Formation of cluster
2. Cluster head formation
3. Isolation of faulty node
4. Re-election of cluster head
5. Transmission of data through cluster head from source to destination

##### *Formation of cluster head*

A cluster consist of number of nodes so that in many aspects they can be viewed as single system. The nodes in the

cluster are set to perform same task, which are controlled and scheduled by software.

Cluster formation is based on geographical area of the earth size of the cluster is based on the density of the nodes present in the geographical area which is been considered size of the cluster is inversely proportional to density of nodes i.e. higher the node density smaller the cluster size.

##### *The cluster head formation*

Cluster head is a node in the cluster that is responsible for collecting data from all other sensors in its cluster and rely these data to the base station its role usually rotates between the nodes in the cluster.

Cluster head is selected depending on following parameters

- Less delay
- Low power consumption
- Position of the node
- Greater life time
- No data loss

Cluster head formation method is used provide reliable data transmission which enhances the quality of services.

##### *Isolation of faulty node*

Faulty node is one which sends irrelevant data. The nodes which are faulty are automatically isolated and only the proper nodes are considered for transmission. The isolation of nodes depends on following parameter

- More delay
- More power consumption
- Lesser life time
- Data loss

##### *Re-election of cluster head*

The movement of nodes within the safe limit is considered as movement of node within the cluster. Whenever the node crosses this safe limit there are two possible events that can happen. The node may return back to the same cluster Whenever the node moves into the

neighboring cluster and if this node is a cluster head then re-election of cluster head takes place in both the cluster. Re-election of cluster head is nothing but selection of the cluster head among the remaining cluster nodes. Whenever the node returns back to the same cluster the connection is re-established

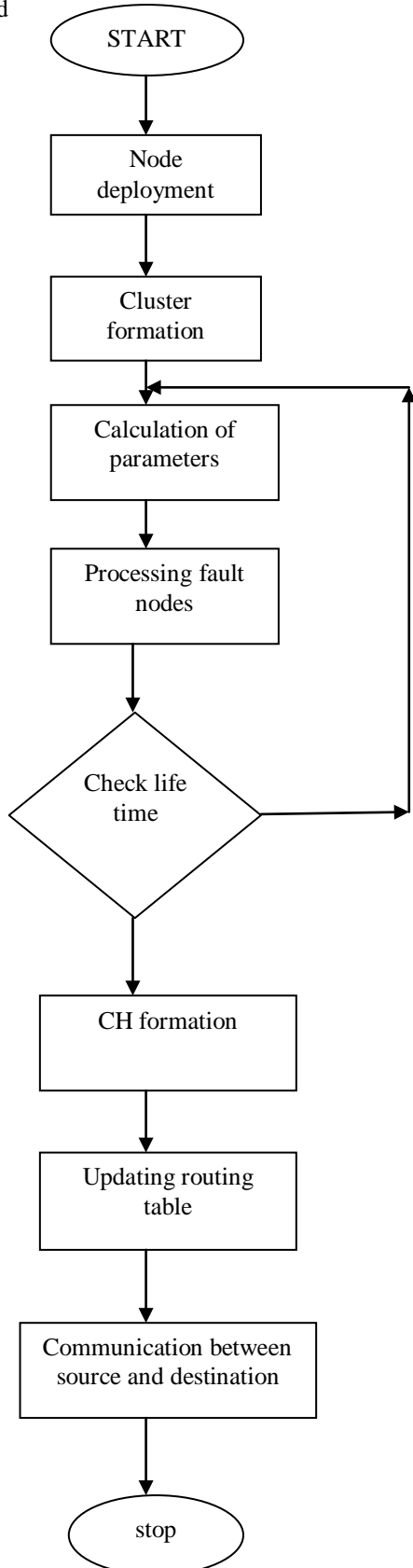


Fig 4.2: Flow chart

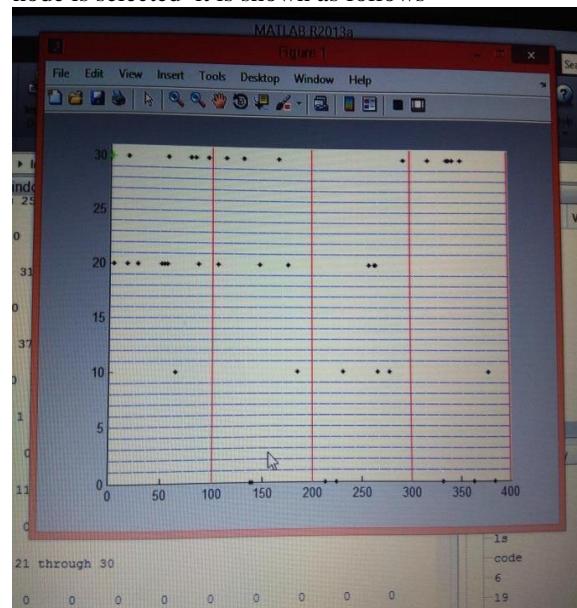
V. SOFTWARE SPECIFICATION

Software required: MATLAB R2013a

MATLAB combines a desktop environment tuned for iterative analysis and design processes with a programming language that expresses matrix and array mathematics directly. MATLAB (matrix laboratory) is a multi-paradigm numerical computing environment. A proprietary programming language developed by MathWorks, MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C, C++, C#, Java, Fortran and Python. Operating system: WINDOWS 8.1 Coding language : MATLAB

V1. RESULT AND DISCUSSION

Initially the cluster is formed and later cluster head is selected once the cluster head is selected once the first three steps of methodology is followed source and destination node is selected it is shown as follows



(1) Fig 6.1 : movement of the nodes

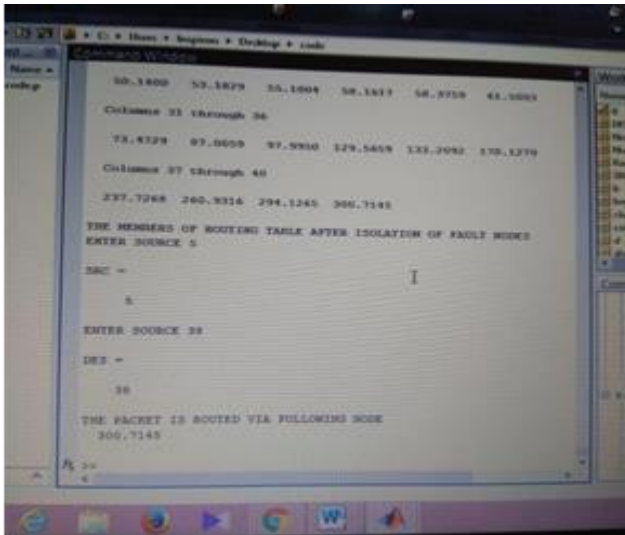


Fig 6.2: selection of source and destination nodes

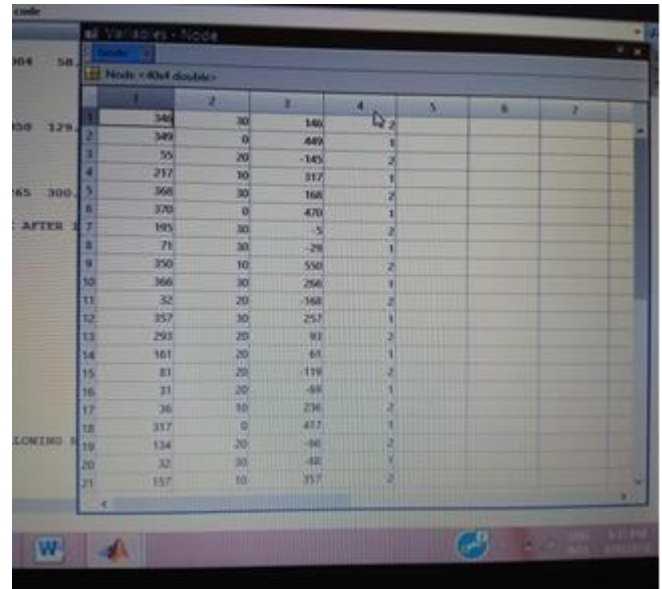


Fig 6.4: detection of faulty nodes, position of nodes and life time.

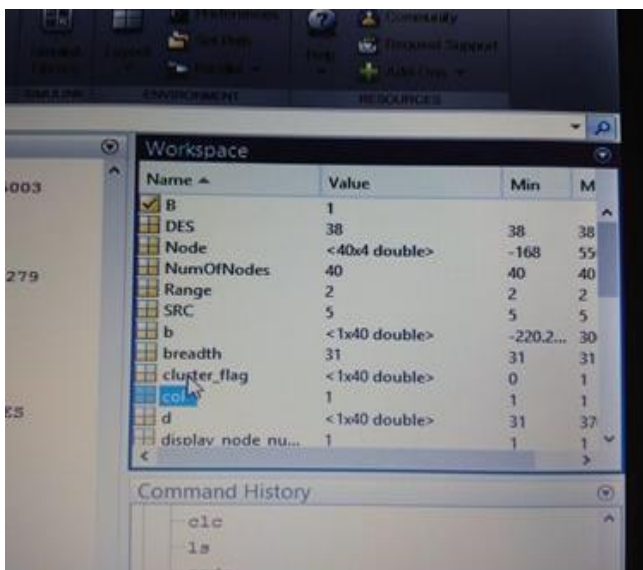


Fig 6.3: parameters considered during the communication

**APPLICATIONS**

- Healthcare monitoring,
- Environmental surveillance,
- Defense tracking,
- Wildlife mapping,
- Traffic monitoring etc.
- The monitoring of vital signs in temporary hospitals and the use of un- manned aerial vehicles (UAVs) in the aiding of search and rescue (SAR) operations.

**ADVANTAGES**

The main advantage of this project is that faults and other errors are rectified and corrected in initial level itself and it is not done in communication level because of which time consumption has been reduced

**CONCLUSION**

The main aim of the project is to provide reliable communication for MWSN by considering challenging parameters such as life time, power dissipation, fault tolerance. Providing a fault tolerance network for MWSN is a most difficult task. In this project that has been achieved by using cluster formation and creating cluster head fault tolerance has been achieved.

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