# A Self Dependable Protocol for Faulty sensor Networks in WSN

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**Abstract -** In recent days, WSNs must be able to sustain network problems that occur during packet transmission. This will be accomplished by the incorporation of network monitoring and error evaluation procedures into the network deployment process. As the sensor's nodes Networks have limited an energy resource, which makes them challenging to implement in demanding environments such as medical, military, and aerospace. Additionally, they require assistance with energy resource optimization, routing, and node failure. As a result, the standard methods for energy optimization, node failure, and packet transmission cannot be used. A sensor network can be used for a wide number of applications with varying requirements and efficiency factors; however they frequently encounter issues such as erroneous data transmission, network failure, and node failure. To maintain the network's required efficiency, they must rely on themselves. This will be emphasized by the proposed Self-Dependable Protocol (SDP) for the WSN, which will be used to repair them. The protocol concentrated on identifying network failures, resolving them, and restoring the network to an error-free state. The SDP protocol's performance is compared to that of other previously defined research work utilising the MATLAB simulator.

**Keywords** : Self-realization, WSN, Faulty data transmission, Adhoc based.

## 1. INTRODUCTION

Sensor networks have several uses, including monitoring the environment and predicting weather, as well as medical diagnosis. Among the most spectacular uses,notable are animal ecosystems, emergency management and its services, big data, asset monitoring, health care, and industrial operations flow. Due to the growing need for cable installations, certain of these applications require a large number of devices.

Recent days WSN needs to have the ability to sustain the network problem occurred in the data packets transfer. This will be achieved by implementing network monitoring and error evaluation methods in the network deployment processes. As the nodes in a sensor Networks have a limited energy resources which makes difficult to implement in the challengeable environment like medical, Army purposes, Aerospace etc. Also they need assistance in optimization of their energy resources, routing and node failure. This results in not able to implement the traditional methodology in energy optimization, node failure, packets transmission [1].

Generally nodes in the network structure are higher in terms of their price used to transmit environment parameters in their deployed application. The duty of a sensor node is to collect the data, passed the data's to nearest node to reach destination. The nodes may linked in a specific coverage are in Ad-hoc manner. The data packets transmission may be either centralized or dynamic. For this, nodes may have a capacity to relocate its geographical location in their Coverage area for the success full packets transmission.

For deployment of nodes in an application, they have to be self-dependent manner for sustaining the network failures. The capability as

- Cooperative functions may carried over the nodes for handling large size of data packets
- Able to handle the packet transmission on the basis of traffic, resources avail in the network
- Self-dependent on solving the network failure occurred

Although they have the self-dependent manner to handle the situation, they have to simplify in their deployment process for an application [2].

Even if the nodes are deployed by satisfying the environment requirements by giving the uniform predefined geographical location. The nodes may failure on the energy resources exhaustion. Non uniform distribution of network traffic may also influence the nodes to be inactive. The stated before network Problem makes the network lifetime to be decreased.

This article is structured as related surveys in section 2, description of adaptable sensor networks with its modules in section 3and section 4 defines its protocols, simulated results followed by conclusion in the remaining sections.

## 2. RELATED WORKS

The methodized view described in [3] stated a changeable, adoptable self-realization repairing capacity for the network on the basis of the distance between the nodes to be in active. This is used to reduce the density of the nodes. In [4] the nodes in active stage are monitored periodically if there is any failure in a particular node. It will be separated from all other nodes. The procedure given in the [5-7] breaks the link between the paths with a failure node. Initially they use identify the location of the failure node and separate it from the network.

The failure node identification and separation from the network will be handled by a static node as given in SHR [6]. In [8-10] an Adhoc based schema was given by neglecting the faulty node and redesign the entire network link. But [11-14]CLB allows creating a temporary network path for the packet transmission up to the time of packet forwarding. This results in a specific methodology to be in the network for handling the network failure problem which is proposed by Self Dependable Protocol (SDP). The protocol will study the problem carefully and states the optimization for the successful network structure and life time.WSN nodes are frequently placed in remote areas. So they run on renewable energy, and a DC-DC power converter connects them to a battery bank and the WSN node's electric load [15-18].

## 3. ADAPTABLE SENSOR NETWORK

Generally adaptable nodes means that they can handle the network issue like packets failure, traffic density, and inactive node. The network have to initially identify the Type of the problem occurred and they have to make implementing a problem solving methods described by the type of the protocol defined. In those instances, the corresponding node should identify the node to be diagnosed and separate them from all other active node. This is because that the packet transmission should not be affected due to the problem occurred.

The formation of the network is shown in the figure1 (a). The formation is done by grouping the nodes according to their coverage area. Also it is assumed that the all the nodes are stationary on the data transmission cycle occasion. If there is any change of geographic location of the nodes it is noted down by the corresponding cluster head. Finally the cluster head also decided as the node having highest power backup and high data rate. The high data rate is to ensure the speed data transmission to be occurred in the cluster group levels.

This type of structure may like a closed routed feedback system with following steps

- Nodes monitoring
- Analysis the type of issue
- Having a strategy to solve the problem
- Execution of the protocol defined

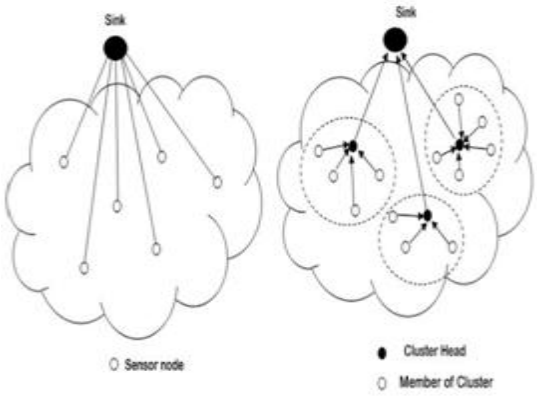


**Figure 1 (a) Network formation**

Initially the basic network parameters will be collected for getting the status of network. Sometimes the basic parameters may also State type of the issues happened in the network. After that the system will plan they are necessary steps to solve the network problem occur in particularnode. At the last stage the procedure to solve the problem is executed without affecting the all other nodes in the network structure.

In the deployment of the nodes in applications nodes are categorized into three parts lower, intermediate and upper layers. The lower part will collect the metrics of the deployed environment with some conditions.

The intermediate layer processes the senses data's given by the nodes in deployed environment. This stage has two sub categories as information defined and decision defined Stages. In the information stage the collected data were processed and the environment will take a decision intimal basis. But in the decision defined stage the system will make a global decision by comparing the intimal decision with previously collected data's.

The top layer of the Structure has a managerial module in fig. 1 (b) which gets global decision from the Intermediate layer to other nodes in the network. It also assigns some tasks to the nodes in the network. Hence it acts as a task deciding authority of a node.

Fault occurred in the network should be identified and analyzed before it reaches the managerial module of the node structure. But the self-dependent methods make the network to analyze and repair them to heal the network issues.

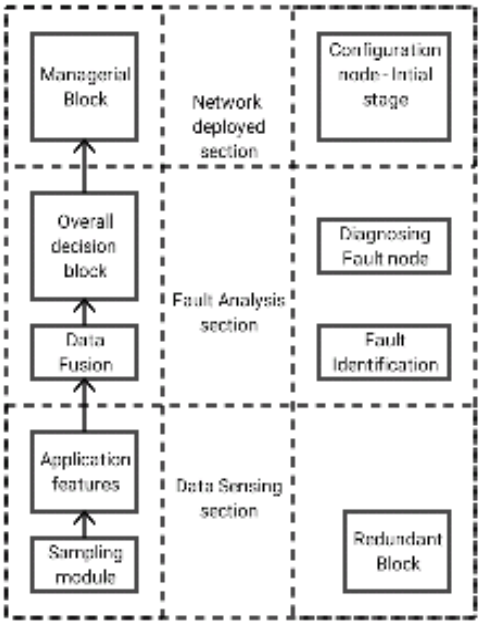


**Figure 1(b). Modules in Self Dependable Protocol**

In the lower layer of dependent block sense data for making the necessary steps to withstand the fault. After that analysis layer make fault identification and diagnosis the error occurred with the environment basic parameters. Finally the network based layer in the module makes the fault node separation and assign the remaining tasks with the available Network resources.

## 4. SELF-DEPENDENT PROTOCOL

The feature of WSN for military based, medical domain application with sensing of environment parameters in challengeable environment structure. Also the power backup of all deployed nodes in a application is limited many methodology have been stated on optimization of power usage, power management of remaining power after data hopping [6]. Also for diagnosing the issues the

data sensing and forward has to done in faster manner with consumption of low energy. The balancing between data forwarding and minimum power usage is difficult.

As the energy metrics is important parameters in calculation of Network efficiency. In large size network, un-operated task should be focused carefully on the energy management. The network efficiency depends on Ratio between the power on transmission is a data packet to the power consumption on executing a network based instruction [11]. It may also design on changing the power usage on the basis of network load [12]. The methods given here is an Adhoc based Methodology on designing self-dependent network.

Consider a network having "n" nodes from $n_1$ to $n_n$ by transmission of data packet between the nodes with time interval (0, t). By definition of rate $r_i$ between the nodes the time interval defined as

$$T_i = n_i / b_i + r_i \quad (1)$$

The energy consumption of data hopping between the nodes stated as

$$e_i = (P_i + X_i * r_i) * T_i = (Y_i (2^{bi} - 1) + d_i) \quad (2)$$

In the above equation, $P_i$ represent the power for data hopping cycle, $Y_i$ tells about the quality of data transmission, $d_i$ network dependent metrics, $b_i$ gives the number of bits per symbol.

On substitute of bit values in (2) it shows the energy parameter is a non-negativevalue.

Consider a WSN network having 1000 of nodes which are distributed in non-uniform manner. Each node has a capable of processing the environment data's. The data's are processed to their corresponding supervisor node in different geographical location.

Modulation based energy management was used for the energy optimization in the data cycles. This results in minimum power usage in data forwarding and the remaining power after data manipulation time.

Apart from the protocol defined for the self-healing process, some of the task has been allotted to the nodes and cluster head which were described below. The task should carry out in a stable way for the error free data transmission cycle on the network structure designed.

Task assigned to each node in the network has been discussed below.

### 4.1 Power monitoring manager

This module is to check the power back up of the sensor node which takes place in the data transmission cycle. It has been checked periodically by sending ACK to all nodes. If the energy of the node goes below the threshold level. The corresponding node is kept in an ALERT LIST and it is instructed to send only higher priority messages only.

### 4.2 Packet continuity inspecting module

The primary task of this module is to track the packets transmission in the Communications l link between the sensor nodes in the architecture. It will keep tracking of data packets from

source node up to the destination node for the successful packet forwarding. If there is any packet loss in the intermediate links it will take care of the data transmission in the future by assigning an alternative path. Also it will retransmit the losses data packets to the corresponding destination node

### 4.3 Error diagnosing

Here the infrastructure failure is avoided by monitoring the basic network metrics entry in each node in its network entry table. If there is any failure of node in the data transmission, with the details in the network table of each node alternative path will recommended for the next data forwarding process

### 4.4 Execution Manager

The manager supervised the error free data transmission between the nodes. If there is any data loss happens in intermediate of the data transmission cycle, manager will make note of the amount of data loss and ID of the nodes in which the loss happens. It will halt the entire node for a mean time for reconstruction of the data link between the nodes for starting the transmission again.

### 4.5 Power monitoring manager

This block will monitor the power backup of all cluster head in the network. This is because, the inter data transmission between the various nodes belonging to different cluster group is takes place through the corresponding cluster head only. Hence it is important to monitor the Clustered head in a sensor network.

### 4.6 Packet continuity checking

The manager is to check the data transmission to appropriate cluster group only. This is done by collecting the details of cluster head including ID, Energy backup, collision value etc. Hence the integrity of the intra clusters data transmission cycle.

### 4.7 Error diagnosing

This module used to keep track of the amount of Pac passing between vary cluster group. This done by making a note of source and destination cluster head ID with their geographic position in the network structure

### 4.8 Execution Manager

The manager focused on the node which is act as source from a cluster group and destiny node ID with the corresponding cluster group for the error data hopping between the clusters in the network architecture.

As the separation of task between the Nodes and cluster head is allotted. The failure of the network is identified from the root cause either in node part or in any cluster group. By separation of the failure will helps in sorting out way of the issue for making uninterrupted data packets transmission in the network structure

## 5. RESULTS AND DISCUSSION

The simulation results are discussed below with the primary network parameters as shown in the given below table1..

**Table1. Parameters taken for Simulation**

| S.no | Parameters | Values |
|---|---|---|
| 1 | Total no.of nodes | 148 |
| 2 | Clustering Size | As required |
| 3 | Simulation time | 100 sec |
| 4 | Sensing Area | 130 x 130m |
| 5 | Initial Power of nodes | 10 joules |
| 6 | Network type | Heterogeneous |
| 7 | MAC type | IEEE 802.11 |
| 10 | Routing Algorithm | None |
| 11 | Propagation Model | Shadow |
| 12 | Node distribution | Uniform |
| 13 | Energy spend in sensing | 5 mW |
| 14 | Node mobility | Stationary |

### 5.1 MAC packet transmission

The self-dependent Methodology stated improves network life time, minimum network delay and a higher Number of MAC packet sends to the corresponding receiver node.From the figure2, total number of packets send by the proposed system is high when comparing to previously defined methodology. This will increase the data transmission to be in faster manner with stable network data transmission rate. Hence the transmission of the data packets will be carried out in a Error free environmental sensor networks.

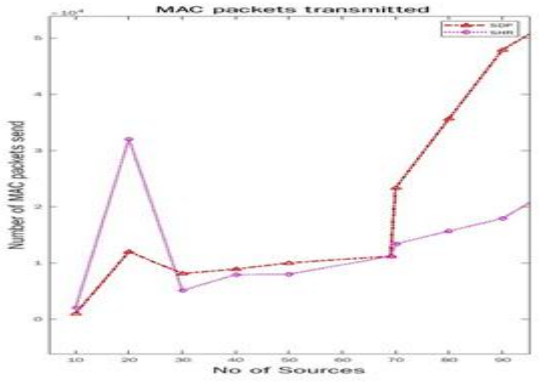


**Figure 2. MAC packets transmission**

### 5.2 Network Energy Consumption

The power backup of all the nodes will place a vital network metrics for the packet transmission between the nodes. In the deployment of sensor nodes it was assumed that all the nodes will have same power bacy. After the data transmission takes place, energy may vary depends on the load handled by the nodes. The comparison of energy for the various scenarios is compared in the given below simulation result.

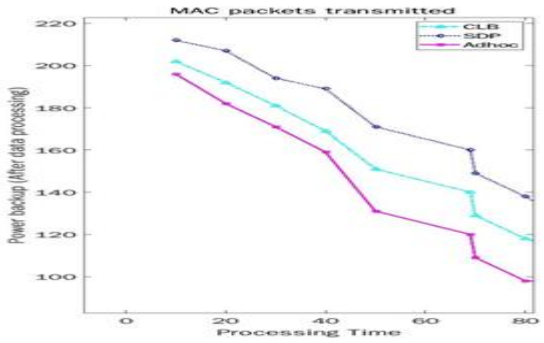


**Figure 3. Network Energy Consumption**

From the graphs of fig.3, it can be seen that the proposed system performance is high Energy metrics among the various compared methods. As the power backup is high using the proposed system network lifetime will be extended and nodes in the network structure will have more life span for the futuristic data transmission cycle.

The proposed has minimum number of failure when compared to traditional healing methodology defined before. This will increase the network life time. As the failure rate is low which implies that the network will having a stable data hopping processing time for the error less data transmission. This will result to have a se data rate among the nodes in network module. This is shown in figure 4.

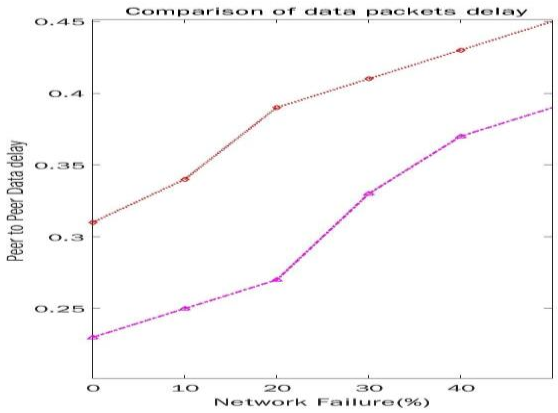


**Figure 4. Comparison of packets transmission delay**

The transmission delay plays a vital role in packet hopping cycle which gives the successful transmission of packets without failure. The proposed system gives an improvised form of delay in minimum range in comparison of previously defined methodology.

## 6. Conclusion

In wireless sensor networks, automatically recovering from failures and reporting inappropriate activities boosts service availability and network resilience. All data analysis demonstrated that the proposed solution was effective at resolving communication issues and extending the life of the network.The research provides an adaptable technique for the network domain using the MATLAB simulator, in which the network is capable of identifying when problems exist. Following discovery, the network problem was subjected to an analysis cycle. Finally, the difficulties preventing packet transmission were identified. Additionally, the methodology increases network longevity, MAC packet transmission, and network failure rate. In comparison to previously defined approaches, the Fault Analysis module in the architecture effectively handles system difficulties. This will assist the network in resolving difficulties with the least amount of energy consumed by the node.

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