Efficient Approach for Disaster Management in Wireless Sensor Networks

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***Abstract*—There are large numbers of sensor nodes are distributed over a large geographical area in a Wireless Sensor Network (WSN). Wireless data transmission is a very important in WSN, because of energy efficient structure and size of each sensor nodes. They can be easily deployed into the error prone environment, where sensor nodes can transmit the error and disaster related data sensed from source to sink node. The project is provide a design of model that is useful to incorporated with an any disaster management system(Landslide prediction), like military surveillance and emergency response .In order to provide the availability of sensed data of sensor nodes in a critical application like landslide prediction, fault tolerant approach have to be followed. The aim of the project is to provide efficient Fault Tolerant and energy efficient clustering based on the ARS approach which organizes the whole network into smaller cluster to diminish the Communication and processing overhead. It provides the awareness improvement in the CH failures. Existing zone based clustering architecture has been implemented through this ARS scheme to improve the fault tolerance of the sensor network. Here it provides a proper cluster architecture and uses ARS (Autonomous reconfiguration system) Algorithm that is useful for the fault tolerant scheme to improve the energy efficiency in a WSN. Results show that ARS bests existing failure-recovery schemes in improving channel-efficiency by more than 90% and in the ability of meeting the applications' bandwidth demands by an average of 200%.**

***Keywords* – ARS, Clustering, Disaster management, Fault tolerant, WSN.**

I. INTRODUCTION

Wireless sensor Networks used to monitor the physical and environmental conditions like temperature, pressure from remote locations. WSN have applications in a variety of fields such as, military surveillance, climate control, environmental monitoring, structural health monitoring, emergency response, medical diagnostics, disaster management, air pollution monitoring and gathering sensing information in error prone environments. Sensor nodes have many energy and computational constraints because of the deployment of Sensor Node in intimidating environments. Substantial research has been focused on overcoming these deficiencies through more energy efficient mechanism. Wireless Sensor Networks formed by a large number of Sensor nodes distributed over a certain region. In many situations, the Wireless nodes must operate for a long time without any replacement. so it is very important to minimizing the Energy consumption in a design consideration, and Energy efficient transmission schemes must be used for the data transfer in Sensor Networks[11][12].

Land slide prediction is one of the environmental disaster and it is caused due to masses of earth, rocks slow down or sudden slant because of severe rain fall The earth's population has greater than before very shrilly which causes human need more land to be alive As an outcome, settlements occupy steep areas, which previously resulted in movement of land every year in all corners of the world. Losses caused from movement of landslides for one year is more than that of damage caused by the disasters like earthquake. The landslide is one of the critical environmental process. Such process always happens every year and makes losses of lives and properties. So study is needed to propose a system that can help to prevent the calamitous environmental process.

II. EXISTING SYSTEM

WSN is a network; the connection of wireless access points that are installed at each node will create a wireless communication. It includes clients, routers and gateways. Today WSNs are used extensively and are speedily undergoing progress. Though WSNs are extensively used they will obviously face a common problem due to f link failures that are frequently occur. To overcome these failures many solutions have been proposed such as, greedy channel assignment algorithm [13], resource allocation algorithm [14] and fault tolerant routing protocols [15]. Resource allocation algorithm: here resources are allocated initially. The main drawback is even though they provide a most advantageous solution they require the global configuration changes, which is not suitable where in case of frequent link failures occur. Greedy Channel- Assignment: when it finds faulty links it will only changes the settings there [7].Fault-tolerant routing protocol: to avoid the faulty links it is used.

The examples are local rerouting and multipath routing [15]. This routing protocol depends on redundant transmission; network resources are used more than to that of reconfiguration in link-level network.

Drawbacks:

A. Localized reconfiguration:

Planning algorithm needed by any Network reconfiguration to recover from link failures as local as possible, by reducing changes in the entire network settings. However, these algorithms do not consider the changes in the degree of configuration from previous network settings, and so they often require global network changes in order to meet all the constraints. These algorithms are suitable for static or periodic network planning; they may cause disruption of network service and thus are not suitable for active i.e. dynamic network reconfiguration which deals with frequent local link failures. Next, the greedy channel-assignment algorithm [13], which considers only local areas in channel assignments, might do better in reducing the range of network changes than the above-mentioned assignment algorithms. However, this approach will also still suffers from the ripple effect; ripple effect means one local change triggers the change of additional network settings at neighbouring nodes, due to association dependency among neighbouring radios. This effect might be avoided by transforming a mesh topology into a tree topology, network connectivity will reduced by these transformation, as well as path diversity among mesh nodes.

B. QoS-awareness:

Network Reconfiguration has to satisfy QoS constraints like bandwidth etc on each link as much as possible. Scheduling algorithms [5] can provide approximately best possible network configurations. However, as we said before, these algorithms may requires a global network configuration changes from changing local QoS demands, thus may obviously causes network disruptions. We need instead a reconfiguration algorithm that makes only local changes while maximizing the chance of meeting the QoS demands. Next, the particular links' QoS demands are satisfied by greedy algorithm by replacing a faulty channel with a new channel. However, neighbouring links, whose channel has been changed due to ripple effects may fail to meet QoS demands if the links in the new channel experience interference from other co-existing networks that operate in the same channel.

C. *Cross-layer interaction:*

For multiple layers Network reconfiguration has to jointly consider network settings. Fault-tolerant routing protocols [15], such as local re-routing or multi-path routing [15] are used in the network layer; allow the flow of reconfiguration to meet the QoS constraints path diversity. They obviously consume more network resources than link reconfiguration, because of their dependence on deviation paths or redundant transmissions. On the other hand, channel and link assignments across the network and link layers can avoid the overhead of detouring, but they have to take intrusion into explanation to avoid additional QoS failures of neighbouring. The other distributed clustering and routing algorithm such as CAMP [17] uses distributed clustering, in which the decision of vigorously electing the cluster head (CH) is taken solely by the group of individual nodes based on their local information. Clustering a group of sensor nodes and dynamically electing a head responsible to transmit the summary of aggregated data of individual nodes is an energy efficient approach, as compared to the sending of individual data to the Base Station (BS).

III. PROPOSED SYSTEM

Disaster management protocols is an important research area, various researches have been going on this research area. There are various and different types of protocols are there for disaster recovery situation. In the application like landslide prediction, the land slide prediction monitoring protocols were developed to use in the Energy efficient Sensor Network. The Sensor nodes are distributed in different locations which are categorized into hierarchical zone based clustering [18]. In the hierarchical architecture, the geological data like pore water pressure, ground vibration, soil moisture, tilts or acceleration that are measured for the particular application and strain on the particular Sensor column into which these analog sensors are placed and buried under the ground. The periodical sampling of sensor nodes about the environmental data are transmitted at constant time intervals to the aggregating node.

In traditional WSN depends on the Retransmission mechanism and indirect route paths which leave a resource scarcity in the network so, further WSN requires the architecture with energy efficient and Fault tolerant mechanism[7]. To overcome these restrictions, energy efficient clustering algorithm combined with ARS is developed and deployed in the WSN. This will allow the network to reconfigure autonomously for Fault detection with energy efficient Cluster based routing. ARS are set of rules with a reconfiguration planning algorithm that identifies local configuration changes and route failures of network settings. For a while, ARS first searches for sensible local configuration changes available around a motionless area, based on radio links and current channel. It considers a network setting as constraints and identifies reconfiguration plans that require only a minimum changes in the network setting.

Further it also adds up the monitoring algorithm where the WSN are enabled to perform real-time failure recovery in conjunction with the clustering algorithm. The monitoring protocol gather the information about the node link-quality is used to make out network changes with Quality of service demands to evade failures to neighboring links. It uses side by side hybrid link-quality measurement techniques for the Wireless link environment. To Support on the information measured, ARS sense the link failures and generates quality of service aware network reconfiguration plans to detect a link failure.

A. System Architecture:

The design of our system architecture is as shown in figure1 it consists of base station (BS), clusters, cluster head (CH), sensor nodes (SN).Here we are proposed a ARS based fault tolerant and energy efficient clustering approach. Here whole network is organized as clusters to reduce communication overhead. The sub cluster formation technique is used here is to overcome CH failures because it provides and take the responsiveness to improve the CH failures.ARS is implemented to improve the fault tolerant of the sensor nodes in the zone based clustering architecture.

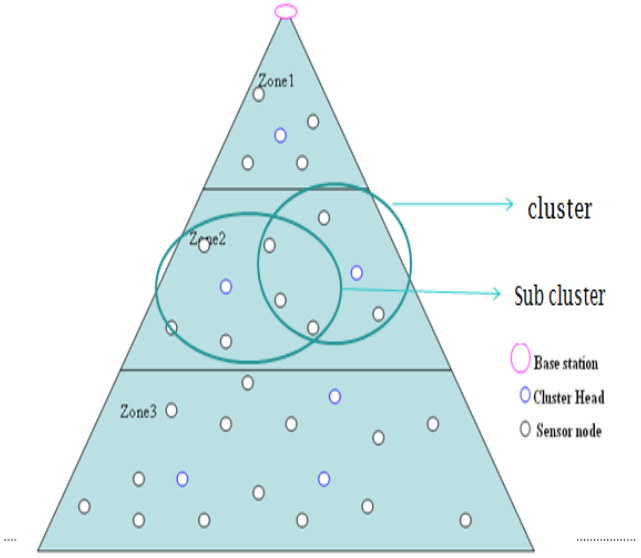

Fig1: System Architecture

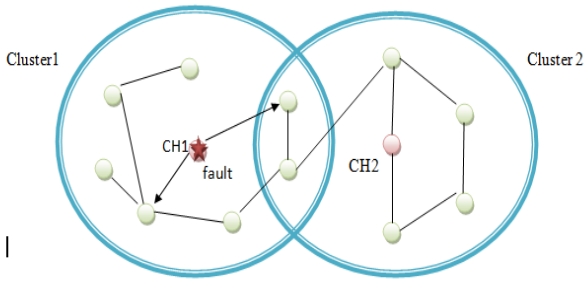

Fig2: CH Failure

The working of the implemented architecture is as follows:

- The Base station initiates the CH by sending a broadcast packet at its maximum transmission range in order to CH select their group members.
- Sensor nodes within the Cluster that eavesdrop to the broadcast message sensed by the base station (BS) then it generates a node database. Node database is more important and includes, Node ID, Energy Level of the node and list of neighbour Node, Strength of the Received Signal indication and Number of sensor nodes which are shared with the number of other CH.
- Once the All sensor nodes with in audible range of the broadcast from the CH will send an acknowledgement message tagged with the corresponding Node database then CH decide the members of its group on receipt of the acknowledgement messages along with the node database.
- After groups of clusters are formed, through its respective CH the time synchronization signals will be broadcasted from the BN (Broadcast Node) to the Cluster members. The Cluster members start sampling data at the same time.
- Frame and time slot size concurrence to the number of nodes connected to it are decided by the individual CH. This process helps to adapt the dynamic change of frame and slot size, which is used to reduce a redundant delay.
- TDMA scheme is used here; the CH will receive the corresponding node details from all sensor nodes from which the Cluster head can find out the SN in the overlapping zone between the Cluster head.
- The figure2 shows the CH failure occurs, If any failures CH failures or any link failures occurs which triggers the ARS implemented in each node which is going to reconfiguration locally not with globally.

B. ARS Algorithm:

- For each link Measure the quality of link through passive monitoring After send the result of link quality to the gateway. lures
- Any link failure occur i.e. any of link fails to meet the link requirement it sends group formation request on channel.
- Any of nodes is elected as a node leader and this will be planning request to the gateway. Then it will synchronize the planning request. Send reconfiguration plan to leader.
- Through this node leader all nodes will get a plan and apply changes.

The algorithm work flow as described below:

First it will going to check the link quality of all out going link by using passive monitoring. Passive monitoring means which access the network traffic without interfering the communication system. The gate way check for any link failure in the network if there is a failure node leads is selected with group formation. The reconfiguration plan is formed it may include more than one plan for single link failure, gateway will do the required plan. Whatever changes are required is done with reconfiguration plan and made reached to every sensor node through node leader.

IV. IMPLEMENTATION

The network simulator NS-2 used for simulation of WSN.Here the model is implementing with the Autonomous Reconfiguration System with energy efficient clustering protocol.ARS timely detects the link failure and make a decision of reconfiguration settings locally without affecting global network settings.

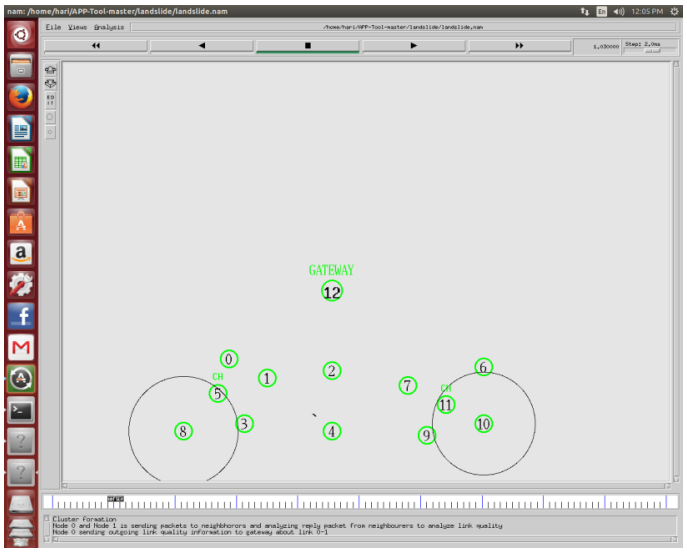

Fig3: Formation of Cluster

The fig 3 shows the cluster formation within the network. Base station initiates CH by broadcasting the signal with maximum range. The nodes within the range will receive the signal and sends the acknowledgement to the corresponding CH.Thus by receiving ACK; CH will identify their group members.

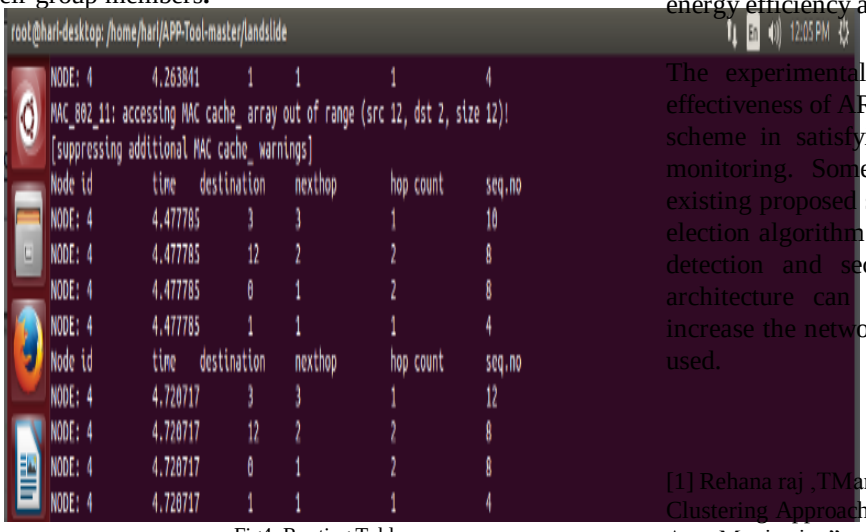

Fig4: Routing Table

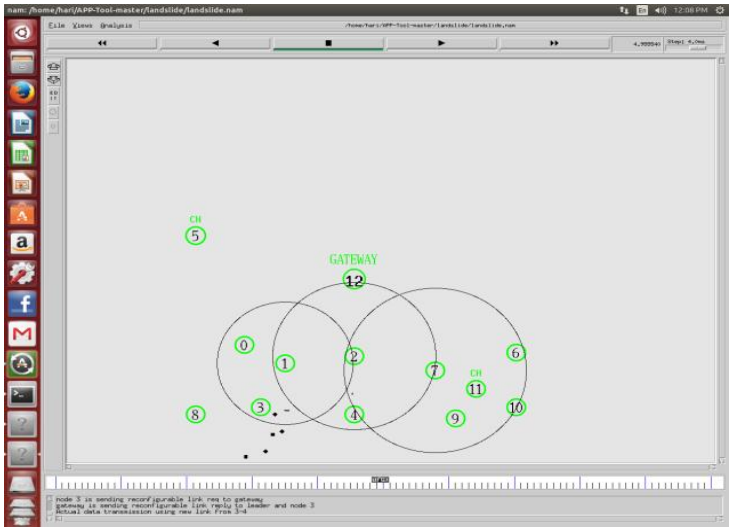

Fig5: ARS Reconfiguration Plan

The fig 5 shows the ARS reconfiguration plan of faulty network

V. CONCLUSION AND FUTURE WORK

Fault tolerant approaches are very important in WSN. An energy saving clustering technique is going to represented here with a Fault tolerance scheme i.e. ARS in order to compute the gathered data from Sensor nodes (SN) in the zone based Cluster groups. The ARS proposed here with zone based clustering architecture enables a WSN to autonomously recover from Wireless link failures. Effective reconfiguration plan is generated by ARS that changes only local network configuration setting changes by effectively identifying reconfiguration plans that effectively improves energy efficiency and lifetime of WSN.

The experimental evaluation and simulation shows the effectiveness of ARS compared to an existing Fault Tolerant scheme in satisfying application such as land slide area monitoring. Some future work have followed with the existing proposed system which are listed are ,Efficient CH election algorithm is used and each CH is to provide some detection and security mechanism. Different clustering architecture can be implemented with ARS.Inorder to increase the network life time efficient transmission can be used.

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