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Implementing Adaptation and Reconfiguration Method in WSN

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Abstract: This work provides a dynamic network reconfiguration in wireless sensor network using controller. A routing protocol designed for WSN should have the ability of adapting to different applications and different network conditions it uses the concept of dynamic reconfiguration routing protocol that achieves the need of various applications and also various network conditions. In this work all nodes are randomly deployed and communicated with each other as well as the head node. There is direct communication between head and sensor nodes. As the result, it can be widely used in a military application for battlefield surveillance wireless sensor network has been an area of active research with many civilian applications, fire detection. A microcontroller is designed which is used to control the movement of nodes (Move Right, Move Up) and location of nodes. Before disaster occurred, all nodes changed their location for security. As disaster under control, there may get back to their locations. But in this, some localization error is present but its value is less than 3% which is very efficient.

Keywords: WSN System, Routing protocol, Dynamic Reconfiguration System, Localization, Mobility etc.

I. INTRODUCTION

Sensor Networks were initially designed for military operations and surveillance. WSNs have been emerged as an excellent tool for military applications involving intrusion detection, various parameters monitoring, information gathering and, smart logistics support in an unknown deployed area. These networks can provide different services to military and air force like information collection, battlefield surveillance and attack detection etc. as shown in figure 1. Because of their capabilities of real time transmission, WSNs play an important role in military operations.

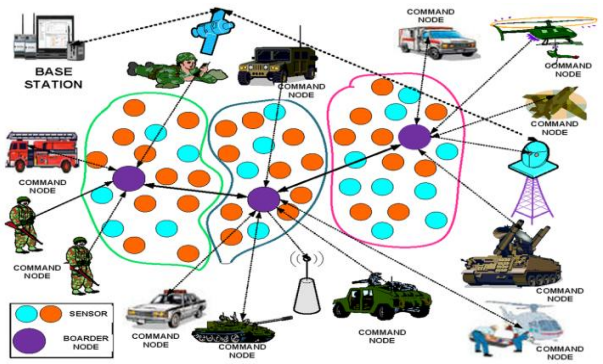

Figure 1: military application

The main function of WSN is to sense the physical world. In consequence, to collect, process, and forward data, which is sensed by WSN, is a very important task for WSN. Therefore, an efficient routing service is a must for all the applications running on the WSN platform. We need to guarantee the QoS requirements for all the applications through their life cycles.

A routing protocol designed for WSN should have the ability of adapting to different applications and different network conditions. This paper proposes a routing protocol for WSN, which can be dynamically reconfigured by the remote administrator. It can achieve the goal that adopt to different applications and different network conditions. This protocol will give the administrator of the WSN a powerful ability. With this great ability, the administrator can change the routing protocol remotely to adopt different applications and different network conditions.

Reconfiguration means adapting (sub) components or their arrangement within a system and able to reconfigure a wireless sensor network at run-time, allowing the sensor network to perform within its requirements under changing conditions. In this work we propose the node relocalization in sensor network using embedded controller. The main objective is to reduce the localization error in the system because Localization is one of the most important applications for wireless sensor networks since the locations of the sensor nodes are critical to both network operations and most application level tasks. So, when all nodes get back to their location after disaster control, there have some localization error but this value must be less than 3% for better response. The paper is ordered as follows. In section II, it represents mobility model. In Section III, It defines the localization algorithm. In section IV, It defines the general dynamic reconfiguration scheme. Section V represent the proposed system is defined in. Section VI describes the results of proposed system. Finally, conclusion is explained in Section VII.

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II. MOBILITY MODEL

Mobility based communication can prolong the lifetime of WSNs and increase the connectivity of sensor nodes and improves the coverage of wireless sensor networks. In this paper, we focus on scenarios where nodes move randomly by the field of sensing. We propose a general model for the mobility of sensor nodes.

Random Way Point Mobility Model

The Random Waypoint Mobility Model is a variation of Random Walk model with spatial dependence. It includes pause times between changes in direction or speed. A Mobile Node (MN) stays in one location for a certain period of time (a pause time), then MN chooses a random destination(x, y) in the simulation area with parameters such as speed between $[0,V_{max}]$,pause time between $[P_{min}, P_{max}]$ that are uniformly distributed. The MN then travels toward the newly chosen destination at the selected speed.

Upon arrival, the MN pauses for a specified time period before starting the process again. The value of pauses and speeds is relevant. Fast nodes and long pauses produce a more stable network than slow nodes and short pauses. Even though the Random Waypoint model is commonly used in simulation studies, a fundamental understanding of its theoretical characteristics is still lacking.

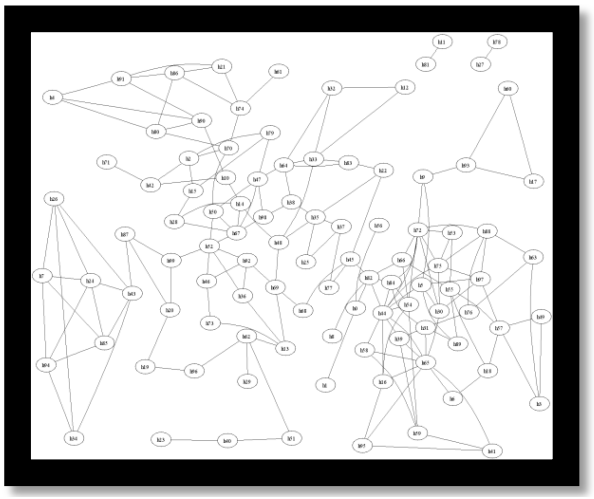

Figure 2:Node movement in the Random Waypoint Model

III. LOCALIZATION

The important function of a sensor network is to collect and forward data to destination. It is very important to know about the location of collected data. This kind of information can be obtained using localization technique in wireless sensor networks (WSNs). Localization is a way to determine the location of sensor nodes.

One of the major challenges for WSN deployment is the localization of the sensor nodes. Another problem is design and development of localization systems for mobile sensor networks. Here we define the widely used algorithm.

Improved DV-hop Algorithm

DV - Hop algorithm is one of the series algorithms which is put forward according to a distance vector routing algorithm DV – Hop algorithm is obtained the distance between unknown nodes to anchor node by calculation of the network topology information as shown in figure 3.

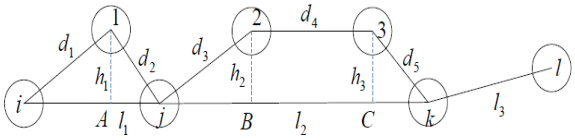

Figure 3:Improved DV-Hop Topology

According to the formula of distance between two points in mathematical, it can be easily get two actual distances of anchor nodes calling D_{ij}, the main calculation process is shown in the following equation:

$$D_{ij} = \sqrt{(xi - xj)^2 + (yi - yj)^2} \qquad (1)$$

After getting the actual distance, we should calculate estimated distance calling ij d between two anchor nodes; the main calculation process is shown in the following equation:

$$d_{ij} = H1_{ij} * h_{ij} \qquad (2)$$

Whare, $H1_{ij}$is estimated distance of average hop, h_{ij} is the hop between two anchor nodes. It is able to get the general error of distance calling E_{ij} between the anchor nodes i and the anchor node j, we get the equation (3) which is shown in the following equation from the above formula (1) and (2).

$$E_{ij} = \sum_{i \neq j}(D_{ij} - d_{ij}) \qquad (3)$$

Thus we get an error between the actual distance and the estimated distance, so we can use the value of this error to calculate the error of average jump distance. We can hypothesis that there are n anchor nodes, the sumhop of n anchor nodes is C_{n2}, so we can get the error value ofaverage jump distance which is shown in the followingequation:

$$e_{ij} = \frac{E_{ij}}{C_n^2} = \frac{\sum_{i \neq j}(D_{ij} - d_{ij})}{C_n^2} \qquad (4)$$

In this way, we can get the final correction of every jump distance, as shown in the following equation:

$$H_{ij} = H1_{ij} - e_{ij} \qquad (5)$$

The average jump distance is improved from the aspect of calculating the average jump distance between anchor nodes. So we put this average jump distance as a new correction which is more close to the value in the actual network, What's more it can results more accurate positioning.

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Location error analysis

Each node positioning error is that use the location of the actual estimate and the real value of the node position to calculate as the follow equation:

$$\text{error} = \frac{\sum_{i=1}^{n} \sqrt{(\text{xcal} - \text{xreal})^2 + (\text{ycal} - \text{yreal})^2}}{n} \quad (4)$$

The positioning error of the unknown node divided the ratio of the nodes in the wireless range is the positioning accuracy.

IV.DYNAMIC RECONFIGURABLE SYSTEM

Wireless sensor nodes are used to sense and transmit information from target region such as nature and industrial environment. In those nodes, dynamic reconfiguration is required to update codes, change functions, change location and maintain programs, because each node is deployed in a remote region. Currently, many dynamic reconfiguration schemes have been researched in wireless sensor networks. The energy efficiency achieved by the dynamic reconfiguration techniques can be categorized into two different types. At node-level reconfiguration, the DVS, DMS, and adaptive sampling rate are used to minimize the energy consumption of sensor nodes. At network-level reconfiguration, intelligent node activation determines node activity to minimize redundant energy usage within the network. The utilization of all reconfiguration techniques have to consider dynamic factors, such as changes in user requirements, variations in communication channel quality, application changes, addition of new nodes, and node failure. This increases the complexity of using dynamic reconfiguration in WSNs.

1. Node Level Reconfiguration: The dynamic reconfiguration at node level sought to minimize energy consumption by dynamically adjusting hardware platforms of sensor nodes. We addressed two promising reconfiguration hardware techniques, DVS and DMS, since they have already been separately used on computation and communication systems to reduce the energy consumption.

2. Dynamic Time Allocation: When only limited time was available for the sensor node, it became critical to allocate the time resource for minimizing the total energy consumption. Such an allocation mechanism was called Dynamic Time Allocation (DTA), which determined the optimal share of computation time and transmission time subject to the time constraint.

3. Centralized Reconfiguration: Need for reconfiguration of a WSN by creating a global model based on information coming from sensor nodes at run-time. Next, a design space search is performed in order to come up with a suitable new configuration, which is subsequently transferred on to the sensor nodes. Some provides a method for creating virtual machines for sensor nodes that execute small script-like programs. These scripts can be sent to a node and loaded and unloaded at run-time. This way, nodes can be reconfigured by uploading new individual software components to the nodes and deleting unused parts.

4. Distributed Reconfiguration: A solution, in which nodes reconfigure themselves without a centralized algorithm. Each node contains an application adapter and update component. These respond to certain events in the network and periodically check system and application parameters. Software components are modelled by a finite state machine. If specific preconditions are satisfied, the application is transferred to a different state. Here, nodes publish their functionality as a service to which other nodes can subscribe. Distributed reconfiguration promises a more scalable approach for WSNs.

5. Clustering Approach Clustering: has become an emerging technology for building scalable and energy balanced applications for WSNs. Some derive an efficient failure detection solution using a cluster-based communication hierarchy to achieve scalability, completeness, and accuracy simultaneously. They split the entire network into different clusters and subsequently distribute fault management into each individual region. Intra-cluster heartbeat diffusion is adopted to identify failed nodes in each cluster.

V. PROPOSED SYSTEM

In military applications wireless sensor network is used which is a self-organized system with small, independent, low powered and movable nodes dispread over an area with no fixed topology having a head taking the data from the sensing nodes and handle a variety of sensing, actuating, communicating, signal processing, computation and communication tasks, deployed in the absence of permanent network infrastructure and environment with limited or no human accessibility. To fulfil these requirements we propose mobility based dynamic reconfiguration system in WSN. It uses the concept of dynamic reconfiguration routing protocols using microcontroller for location changing of nodes. This work presents how to design a routing protocol, which can meet the need of different location at different conditions, is an extremely challenging problem. With the help of dynamic reconfiguration, the routing protocol can be changed by the remote administrator according to the need of different applications and different network conditions. In this work, all nodes are communicating with each other. A head is provided for giving the instructions to all nodes. The need for reconfiguration architecture for sensor network applications is apparent from the results of even a simple environmental monitoring algorithm. The main performance parameter will be localization error. With the help of this, it may prove the better stability of system. It takes the scenario of safety under wireless network. Due to this, it will provide safety and also minimum location error. Initialy consider a large network area having large number of nodes which are transmitting data and also sensing the location and collect the data. Consider all nodes are dynamic in nature and move randomly. All nodes are

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communicating with each other as well as from head node. There is direct communication between head and all sensing nodes as shown in the proposed model in figure 4.

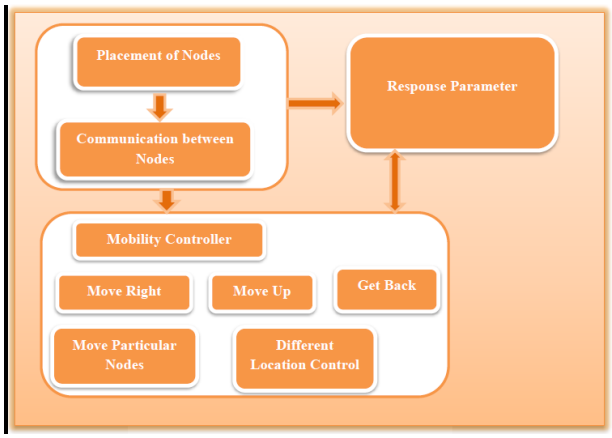

Figure 4: Proposed Model of System

In above figure, the first step describes the sensors are being deployed in a disaster area. Sensors are randomly spread over the area. Each sensor has a sensor ID shown along with it. It will be used to address any sensor throughout the process. Here we take large number of sensors so that proposed scheme will evaluate easily. No two nodes overlap each other. In typical usage scenario, the nodes will be evenly distributed over an outdoor environment. This distance between adjacent nodes will be minimal yet the distance across the entire network will be significant.

Then provide random mobility in nodes to show that all nodes are dynamic in nature. All nodes are communicating with each other are placed in minimum distance so that performance of nodes will be useful. After the deployment of the sensor nodes, there is a Head node selection by polling method. In a sensor network, the basic sensors are simple and perform the sensing task, while some other nodes, often called the heads, are more powerful and focus on communications and computations. Then head check the status of each node and collects the environmental data from sensor nodes. . Head asks the nodes about environment conditions, then reply back to head about status. In order to get this ability though our routing protocol, they supported some commands for the administrator to change the routing protocol running on the sensor network platform.

The nodes would change their routing protocol when they received the commands. To let the commands come into play on the nodes, they provided a set of mechanisms. With these commands and mechanisms, this routing protocol was endowed with the great ability of adapting to different applications and different network conditions. Another feature of WSN application is security monitoring. In this work, network is containing nodes which are placed in outdoor environment and also provided at fixed locations. They work as monitoring nodes that work continuously. In security work, this node only monitor the data but does not collect the data which is done is environmental data monitoring. Each node continuously checks the status of sensors but it transmits a report of data when there is security problem in its area. So, it suggests a mobility based network reconfiguration system in WSN which can be dynamically reconfigured. Then it provides the mechanism of dynamic reconfiguration.

The dynamic reconfiguration at node level sought to minimize energy consumption by dynamically adjusting hardware platforms of sensor nodes. The utilization of reconfiguration technique have to consider dynamic factors, such as changes in user requirements, variations in communication channel quality, application changes etc.

VI. RESULT&DISCUSSION

In this case, initially configuration of wireless sensor network is setup and then each node senses the data from sensors and transmits back to head node (base station) so that collected data will be stored. In this work, we are taking the area of 250*250 m^2 where 100 no. of sensor are placed and each node is movable in nature randomly in given area as shown in figure 5. After placement of nodes, each node requires has its ID with it so that we find out each node in network for communication.

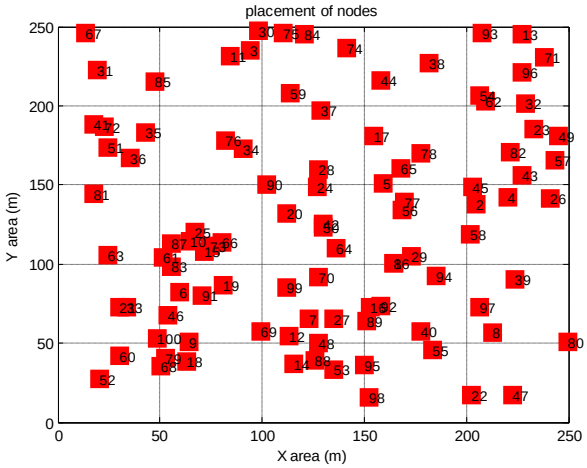

Figure 5: Placement of Sensor Nodes

Each node is communicated with each other as well as head node.

Network configuration

In this work, initially we take 100 no. of sensors, which is randomly moved in predefined areas as shown in figure 6. In this work, reconfiguration means the process of transition of network nodes from one point to another transition in space, in order to get location changing commands from the head. Here location is changed by designed the micro controller. Controller is used to control the movement of nodes and it provides the new location or area where nodes are configured. In proposed network microcontroller move the nodes in two directions.

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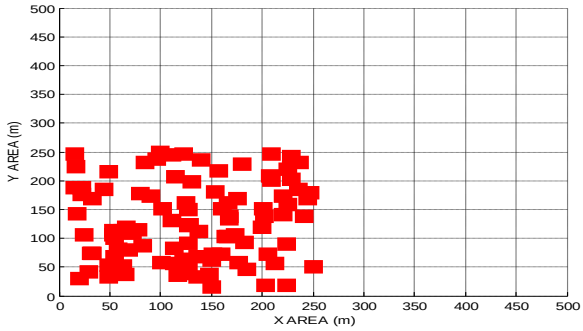

Figure 6: Movable Node in Predefined Area

Movement in Right Direction

When controller command to all node move in right direction then after same time all nodes move in right direction as shown in figure7. Some nodes are faulty due to environment interference, lack of energy etc. is found out using algorithm. During the reconfiguration time of nodes then faulty nodes are replaced by new nodes as shown below for better performance.

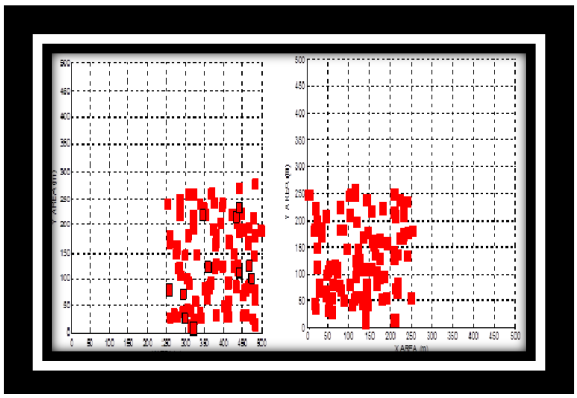

Figure 7: Reconfigure Sceneries of Network in Right Direction

Movement in Upward Direction

When controller command to all node move in up-word direction then after same time all nodes move in upward direction as shown in figure 8.those nodes in bordered by black nodes in figure 8 is faulty nodes. During the reconfiguration time of nodes then faulty nodes are replaced by new nodes as shown below for better performance.

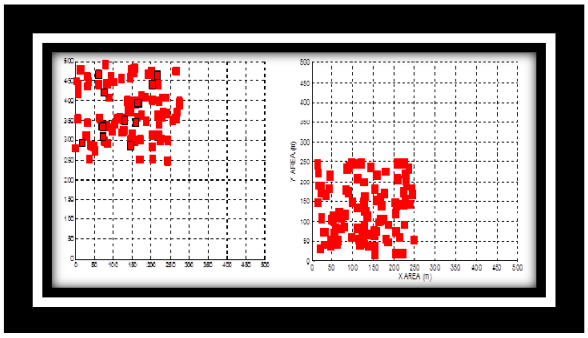

Figure 8: Reconfigure Sceneries of Network in Upward Direction

Movement of Particular Nodes

When controller command to some node move in a given direction then after same time some nodes move and remaining nodes are on their position as shown in figure 9.

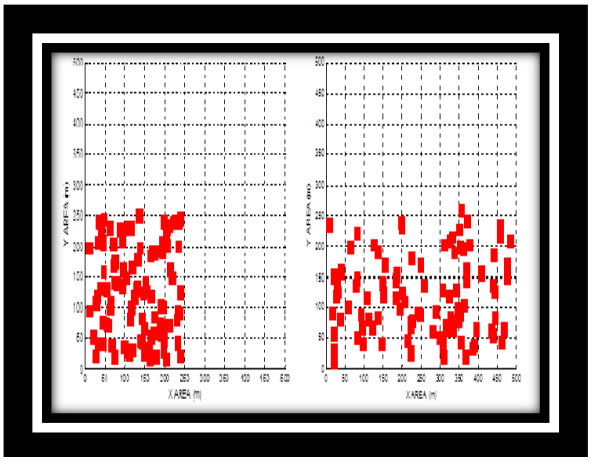

Figure 9:Movement of Some Particular Nodes

Movement of Nodes from Different Location

When controller command to nodes which are placed at different location move in a given direction then after same time all nodes move at that locationas shown in figure 10.

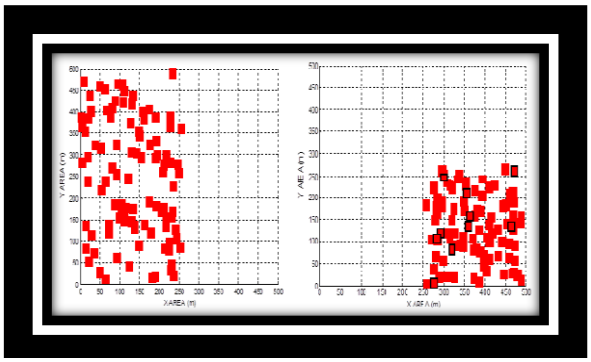

Figure 10:Movement of Some Particular Nodes

Localization Response

The localization response of dynamic reconfiguration system of wsn is shown in figure 11.

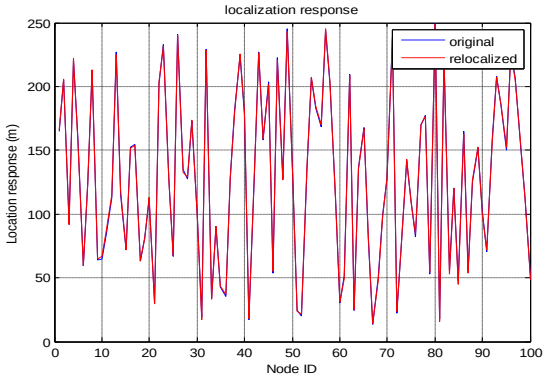

Figure 11: Localization Response

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Localization Error Response

The main parameter of this work is localization error of nodes. As nodes are moving and they changed their location under disaster and when condition are under control then all nodes get back to their location but during this time some localization error occur as shown in figure .

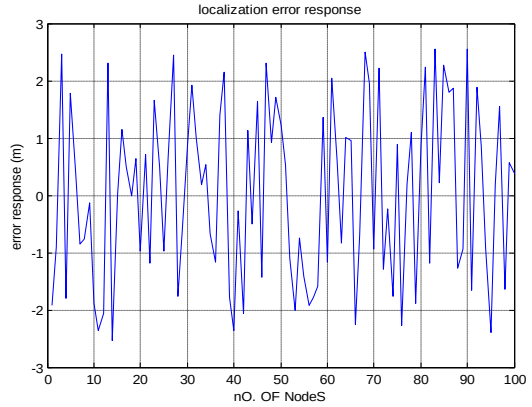

Figure 5.11: Localization Error of Proposed System

Energy Available with Nodes

Due to the fact that WSNs generally have battery operated sensor nodes, there is a lot of focus on availability energy of each sensor nodes for better functionality of wireless sensor network. The availability of each sensor node after reconfiguration is shown in figure 12.

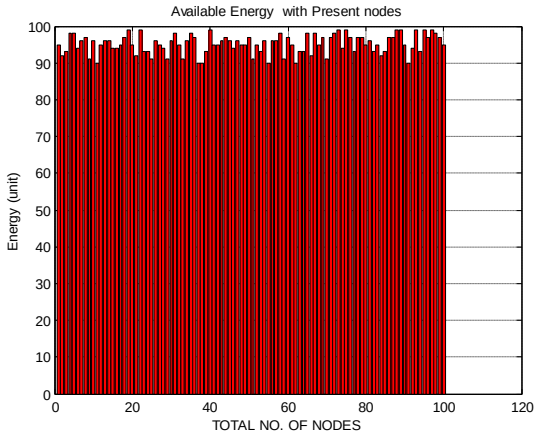

Figure 5.10: Available Energy with Present Nodes

VII. CONCLUSION

In this paper, we proposed the WSN nodes have no fixed topology, but they can configure themselves to work in conditions such asthe absence of permanent network infrastructure and in environments with limited or no human accessibility. Routing protocol designed for WSN should have the ability of adapting to different applications and different network conditions. To change a routing service in large scale sensor network propose a mobility based network reconfiguration system in WSN which can be dynamically reconfigured. Localization is one of the most important applications for wireless sensor networks since the locations of the sensor nodes are critical to both network operations and most application level tasks. The main parameter is the localization error of nodes. So, when all nodes get back to their location after disaster control, there have some localization error but this value must be less than 2.5% for better response.

REFFERENCES

[1] Rajni Kamboj, Er. Veena Rani, " Design & Implementation of Node Relocalization in Dynamic Reconfiguration System in WSN", July 2016 IARJSET

[2] Isha Sharma, ShilpaGambhir, "To Propose a Mobility Based Reconfigurable System under Disaster Management in WSN", Feb 2016 IEEE

[3] Isha Sharma, ShilpaGambhir, " Mobility Based Reconfigurable System under Disaster Management in WSN Using Shortest Path Algorithm ", january 2016 IARJSET

[4] Jean A. Guevara, Enrique A. Vargas, "Dynamically Reconfigurable WSN Node Basedon ISO/IEC/IEEE 21451 TEDS", May,2015IEEE

[5] Shan Gaoy,YongPiaoz, "DRRP: A Dynamically Reconfigurable Routing Protocol for WSN", 2014 IEEE

[6] Martin K. Mwila, Karim Djouani, "An Efficient Approach to Node Localisation and Tracking in Wireless Sensor Networks", 2014 IEEE Ad Hoc and Sensor Networking Symposium.

[7] Marcin Szczodrak,OmprakashGnawali,Luca P. Carloni, "Dynamic Reconfiguration of Wireless Sensor Networks to Support Heterogeneous Applications", 2013IEEE International Conference on Distributed Computing in Sensor Systems.

[8] Abhishek Majumder, Sudipta Roy, Kishore Kumar Dhar, "Design and Analysis of an Adaptive Mobility Management Scheme for Handling Internet Traffic in Wireless Mesh Network", 2013International Conference on Microelectronics, Communication and Renewable Energy.

[9] Tiago Condeixa, Susana Sargento, Andr´eaNascimento, Rute Sofia, "Decoupling and Distribution of Mobility Management", 2012 The 4th IEEE International Workshop on Mobility Management in the Networks of the Future World

[10] Rajeev Wankar, RajendraAkerkar, "Reconfigurable Architectures and Algorithms: A Research survey", 2009 International Journal of Computer Science and Applications, Techno-mathematics Research Foundation.

[11] Haibo Zhang and Hong Shen, "Energy-Efficient Beaconless Geographic Routing in Wireless Sensor Networks, IEEE Transactions On Parallel And Distributed Systems, Vol 21, Issue 6, pp.881-897,2010.

[12] YunanGu, Miao Pan and Wei Li, " Maximizing the Lifetime of Delay-Sensitive SensorNetworks via Joint Routing and Sleep Scheduling," International Conference on Computing, Networking and Communications, pp.540-544, 2014.

[13] AmulyaRatna Swain, R. C. Hansdah and Vinod Kumar Chouhan, "An Energy Aware Routing Protocol with Sleep Scheduling forWireless Sensor Networks:, 2010 24th IEEE International Conference on Advanced Information Networking and Applications, pp.933-940, 2010.

[14] Rama SundariBattula, and O. S. Khanna, "Geographic Routing Protocols for Wireless Sensor Networks: A Review," International Journal of Engineering and Innovative Technology, Vol 2, Issue 12, pp.39-42, 2013.