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Method & Implementation on Node Relocalization in Dynamic Reconfiguration System in WSN

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Abstract: This is mobility based dynamic reconfiguration system in WSN. The concept of dynamic reconfiguration routing protocol is used that achieves the need of various applications and also various network conditions. An environmental data collection scenario is taken with the use of movement of nodes and controlled by controller. All nodes are in dynamic nature and moves randomly. All nodes are communicating with each other as well as from head nodes. There is a direct communication between head & nodes. It evaluate a multi-hop routing based on shortest path in wireless networks. A controller is designed which is used to control the movement 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. Results are presented and evaluated by use of MATLAB R2013a. The localization response and location error are the main performance parameters and its error value is less than 3%.

Keywords: WSN System, Dynamic Reconfiguration System, Localization, Mobility Management etc.

I. INTRODUCTION

Due to advances in wireless communications and electronic technologies over the last few years, the development of networks of low-cost, low-power, multifunctional sensors have received increasing attention. These sensors are tiny and able to sense, process data, and communicate with each other, typically over a radio frequency channel. A sensor network is composed of tens to thousands of sensor nodes which are distributed in a wide area. A wireless sensor network (WSN) is a self-organized system of small, independent, low cost, low powered and wirelessly communicating nodes dispersed over an area having sink nodes taking the data from sensor nodes and may handle a variety of sensing, actuating, communicating, signal processing, computation, and communication tasks, deployed in the absence of permanent network infrastructure and in environments with limited or no human accessibility. The sink serves as the gateway between the user application and the sensor network. The WSN nodes have no fixed topology, but they can configure themselves to work in such conditions.

Sensing units are usually composed of two subunits: sensors and Analog to Digital Converters (ADCs). The analog signals produced by the sensors based on the observed phenomenon are converted to digital signals by the ADC, and then fed into the processing unit. The processing unit, which is generally associated with a small storage unit, manages the procedures that make the sensor node collaborate with the other nodes to carry out the assigned sensing tasks. A transceiver unit connects the node to the network. One of the most important components of a sensor node is the power unit. Power unit may be supported by a power unit such as solar cells. There are also other subunits, which are application dependent [1]. Sensor networks may consists of many different types of sensors like acoustic, seismic, infrared, thermal, magnetic etc. which are able to monitor a wide range of ambient conditions like temperature, humidity, pressure, vehicular movements, lightening conditions, noise levels etc. WSNS supports variety of applications, ranging from habitat monitoring to battlefield management, from perimeter security to inventory management and from environmental sensing to vehicle tracking. Sensor nodes can also be used to detect and control forest fires, disaster prevention, structure health monitoring, area monitoring, landslide detection etc [4].

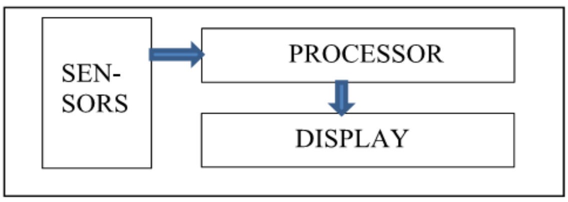

Fig 1: Representation of Sensing Device

Environmental observation and forecasting may include different studies and eruption warning system, flood detection, meteorological observation, earthquake studies and warning system, cyclone and tsunami warning system, water quality monitoring etc. A good warning system can help to avoid the damages caused by natural disasters. Sensor nodes can be used to monitor the conditions of plants and animals in wild habitat, as well as the

environmental parameters of the habitat. Sensor can be deployed under water or on the ground to monitor the quality of air and water. Air quality monitoring can be used for air pollution control and water quality monitoring can be used in biochemistry field. Sensors can also be deployed to detect natural or non-natural disasters. For example, sensor nodes deployed in a forest can also detect the exact origin of the fire before the fire is spread uncontrollable. Seismic sensors can be used to detect the direction and magnitude of earthquakes [2].
The rest of paper is ordered as follows. In section II, we discuss the development of WSN in modern era. In Section III, It defines general reconfiguration scheme. In Section IV, it describes proposed work of system. Section V describes the results of proposed system. Finally, conclusion is explained in Section V.

II. DYNAMIC RECONFIGURATION IN WSN

To design a WSN application, knowledge of many elements of the context is essential as they influence the operation greatly. However, because some aspects of the context are unpredictable and changing, many design choices are based on assumptions and approximations. During the development of such a WSN, it is unknown which influences the nodes might experience, which nodes might crash, and how long exactly the sensor nodes will last with the available energy. Because of these uncertainties, the quality of service of the WSN might develop over time.

Recently, techniques of dynamic reconfiguration have attracted increasing attention from the research community. These techniques enable reconfiguration of the sensor network hardware at run time to adapt to external dynamics, providing an innovative approach to designing an energy-efficient WSN in a highly dynamic environment. Due to advances in hardware technology, several reconfiguration techniques have been developed on the sensor node level. These include Dynamic modulation scaling (DMS) (used to reconfigure modulation schemes in communication), dynamic voltage scaling (DVS) (used to reconfigure voltages and operating frequency of processors), adaptive sampling rate (used to change the sampling rate of sensors), and intelligent node activation (used to change sensor node status).

The energy efficiency achieved by these 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 [5].

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. A dynamic time allocation was developed, which considered DVS and DMS simultaneously to fully utilize the energy-aware capability of sensor nodes. In the following sub-sections, the two energy-aware techniques are first introduced, and then the dynamic time allocation is analyzed on a single-node scenario and is extended to multi-node scenario.

The utilization of DVS technique required consideration of time constraints because the changes in operating frequency interfered with the computation time given a fixed computation workload. Hence, a scheduling algorithm was usually accompanied with DVS technique to guarantee the time constraint, especially in real-time applications. Researchers have worked on scheduling algorithms for using DVS in different applications. The real-time scheduling of computation tasks for a sensor node was proposed to reduce energy consumption in computing stochastic computational tasks. The DVS was used to achieve an energy-efficient WSN for dynamic system monitoring of large-scale and capital intensive machines. Currently, DVS has already been used on digital signal processor and sensor node platform (Imote2) to achieve energy efficiency of the system. DMS was another emerging reconfiguration hardware technique that has been utilized to reduce energy consumption in wireless communication, where the communication energy was reduced by changing the modulation level of the communication at the cost of increased transmission time.

Dynamic Time Allocation
Since both DVS and DMS techniques traded energy savings against the computation and communication time, respectively. 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.

III. PROPOSED RECONFIGURATION SCHEME

From the survey, it can be obtained that a routing protocol designed for WSN should have the ability of adapting to different applications and different network conditions. If we can change the routing protocol remotely according to the applications' requirement and the network conditions, we can achieve this goal. Currently, it is very difficult, if not impossible, to change a routing service in a large scale sensor network because the service is statically pre-configured into each node, which is often unattended. So, it proposes a mobility based network reconfiguration

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system in WSN which can be dynamically reconfigured. Then we present 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.

An environmental collection of data means a scientist is willing to gather various readings of sensors from a collection of points in surroundings along a span of time. This is used to find trends of data in environment. In this work, scientist or user wants collection of data from various spread points from area provided and then data analyzed is done offline. The main requirement in this work is to collect large data at regular interval of time and detecting the nodes location at each period of time.

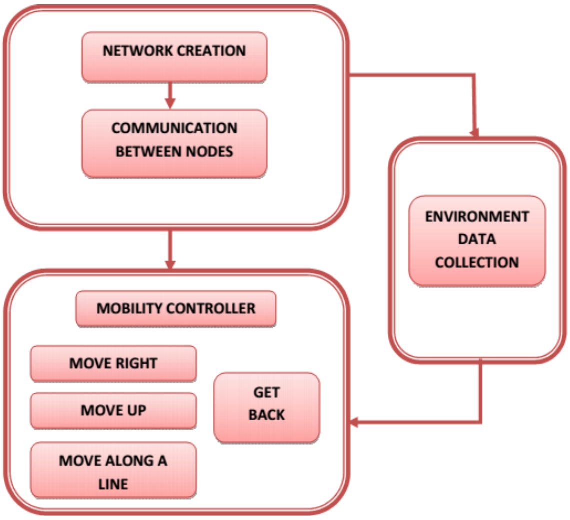

Fig 2: Proposed System Model

The main objective of this work is to design mobility based self-network reconfiguration system in WSN. The next objective is to use dynamically reconfigurable routing protocol with shortest path for routing in network. Environmental observation and forecasting may include eruption warning system, flood detection, study of earthquake cyclone and tsunami warning system, water quality monitoring etc.

In actual, the actual system presented a routing protocol for WSN, which can be dynamically reconfigured by the remote administrator. It could achieve the goal that adopt to different applications and different network conditions. This protocol would give the administrator of the WSN a powerful ability. With this great ability, the administrator could change the routing protocol remotely to adopt different applications and different network conditions. 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.

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. The environmental data collection is considered by large network area having large no. of nodes which are transmitting data and also sensing the locations and other data collection. Then they transmit data back to base station so that collected data will be stored. In this, these nodes do not require high data rates for transmission. Then provide random mobility in nodes to show that all nodes are dynamic in nature. All nodes are communicating with each other on the basis of shortest path calculated. The proposed algorithm is defined below:

Step 1: Generate no. of sensor nodes (N)
Step 2: Create a random topology
Step 3: Provide random movement in nodes
Step 4: Compute the shortest distance between nodes & all nodes are communicating with each other.
Step 5: Provide head in network for giving commands & monitoring the nodes.
Step 6: Design a controller for controlling the movement of nodes in all directions
Step 7: Controller collect data about environmental conditions like temperature
Step 8: If temperature > tolerable Temperature then
Controller change the position of Nodes immediately for security purposes
Else
Continue their work
Step 9: If locations get changed then check the reconfigure the network.
Step 10: Compute localization error & other parameters.
End

After the deployment of the sensor nodes, there is a Head node selection by polling method. Then head check the status of each node and collects the environmental data from sensor nodes. For this, there is a direct communication between head & nodes. Head asks the nodes about environment conditions, then reply back to head about status. Now if temperature goes above threshold due to any disaster effect, the nodes sense data and tells to the head and starts moving from their locations. Then they collect to any other location and when the disaster under control then head orders the nodes to repositioning or reconfigure their locations within minimum time.

IV. RESULTS & DISCUSSION

Achieving automatic reconfiguration requires some intelligent component to reason about when to change which components. Initial configuration of network is setup and then each node senses the data from sensors and transmits data back to base station so that collected data will be stored.

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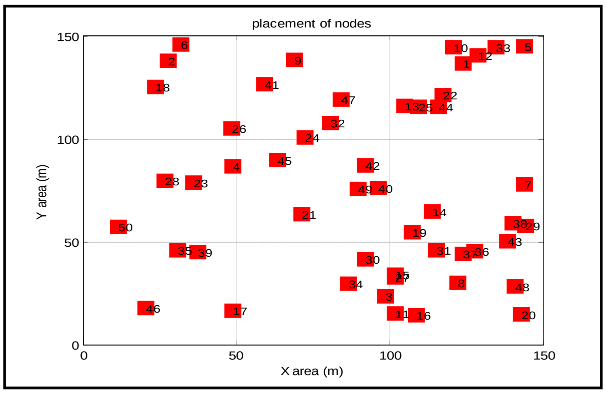

Fig 3: Network Creation in WSN

In this, these nodes do not require high data rates for transmission. In this work, we are taking the scenario of 50 nodes which are placed randomly in network. After placement of nodes, it requires to determine the topology of network i.e. tree or star based etc. each sensor node has its ID with it so that they can find out other node in network.

Then provide optimum routing technique based on shortest path so that delay will be minimized. In this routing, data is routed through various nodes so that data may reach to destination. 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.

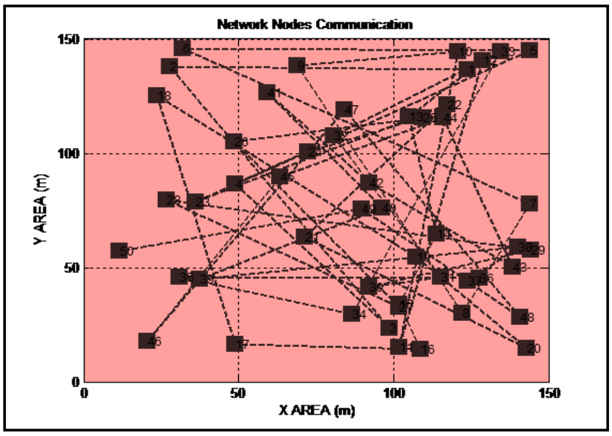

Fig 4: Nodes Communication in Network

Here we take large number of sensors so that proposed scheme will evaluate easily. No two nodes overlap each other. They provide a topology initially which is random in nature. Reconfiguration means the process of transition of network nodes from one point to another transition in space. In this work, it requires two operations. First is to find the new location with new configuration and secondly it requires the operation so that network will be reconfigured. Both tasks are performed by a controller designed. 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. Basically, the head organizes the basic sensors around it into a cluster, where sensors only send their data to the head and the head carries out the long-range inter-cluster communications. In this, all the nodes wait for the commands from the administrator. If the administrator doesn't send any command, these nodes will begin to work. At that time, the route protocol runs on the WSN platform.

The routing consists of two basic mechanisms: Route Discovery and Route Maintenance. Route Discovery is the mechanism by which a node wishing to send a packet to a destination obtains a source route. To reduce the cost of Route Discovery, each node maintains a Route Cache of source routes it has learned or overheard. Here a controller is used to control the movement of nodes and its location. It provides the new location or area where network is to be configured. In figure 5, initially network is placed in area of 150*150 m^2randomly.

Each node is mobile in nature and controlled by a controller used. After some time, controller changes its topology and updates its location to a new location. While updating the nodes location, some nodes lost its energy and become faulty nodes. During reconfigure time, each faulty node is replaced by a new one so that network may work better.

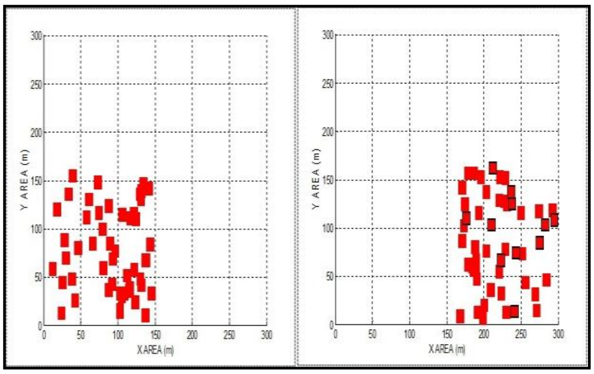

Fig 5: Movement of Nodes Controlled by Controller

It is hard to find out or checking the operating conditions of sensor network. During hardware reconfigure system, it requires the proper hardware requirement with suitable environment so that it works better. Due to this, there is a need of software reconfigure system for sensing network.

The proposed protocol is proved steady by our truthful experimentation. Moreover, the experiment results validate that proposed protocol is with the ability of dynamic reconfiguration when it is running on the WSN platform. The main parameter is the localization error of nodes. As nodes are moving and they changed their location when disaster occurred. So, when all nodes get back to their location after disaster control, there have some localization error but this value must be minimum for better response.

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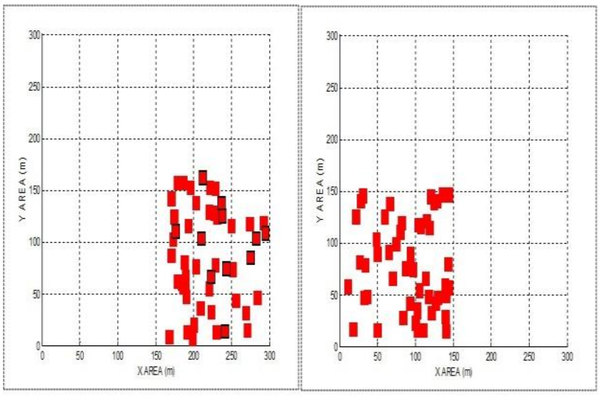

Fig 6: Network Reconfiguration by Controller

Reconfiguration is intended to adapt the software's components such that it can operate in a changing context. The quicker the middleware responds to a change, the lesser the application is interrupted and the more time the application spends in an optimal configuration.

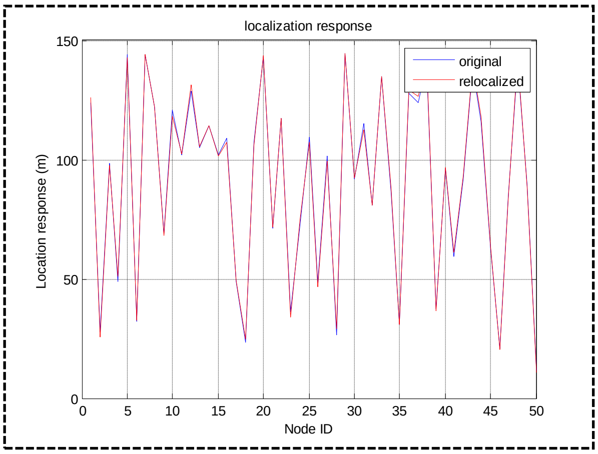

Fig 7: Localization Response of Nodes in Network

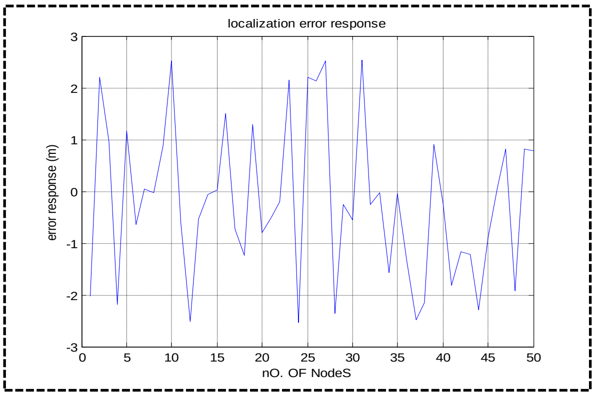

Fig 8: Localization Error in Network

Table 1: Performance Comparison of System

Parameter	Existing Technique (DRRP)	Proposed (50 Nodes)	Proposed (70 Nodes)
Localization Error (m)	4-5	2.5	3

V. CONCLUSION

This work provides a technique for reconfiguration of network nodes in WSN with the help of controller system. All scenarios of the dynamic reconfiguration infrastructure have been evaluated. All nodes are communicating with each other. A head is provided for giving the instructions to all nodes. It takes the scenario of disaster in forests. Before disaster occurred, all nodes changed their location for security. As disaster under control, there may get back to their locations. Each node is mobile in nature and controlled by a controller used. After some time, controller changes its topology and updates its location to a new location. While updating the nodes location, some nodes lost its energy and become faulty nodes. During reconfigure time, each faulty node is replaced by a new one so that network may work better. But in this, some localization error is present but its value is less than 3% which is very efficient.

REFFERENCES

[1] Rappaport, Wireless Communications, 2nd edition. Singapore: Pearson Education, Inc., 2002.

[2] Davis. Basics of Design: Battery Power Management. Supplement to Electronic Design.2004

[3] S. Gao,Y. Piao, "DRRP: A Dynamically Reconfigurable Routing Protocol for WSN", IEEE 2014.

[4] M. Mwila, K. Djouani, "An Well-organized Approach to Node Localisation and Tracking in Wireless Sensor Networks", IEEE Ad Hoc and Sensor Networking Symposium, 2014.

[5] F. Nazir, R. Boreli, Stephen Herborn, "A Case Study for Mobility Management Protocol Co-existence", IEEE 2008.

[6] T. Condeixa, Susana Sargento, "Decoupling and Distribution of Mobility Management", IEEE International Workshop on Mobility Management in the Networks, 2011.

[7] A. Majumder, Sudipta Roy, Kishore Kumar Dhar, "Design and Analysis of an Adaptive Mobility Management Scheme for Handling Internet Traffic in Wireless Mesh Network", IEEE International Conference on Microelectronics, Communication and Renewable Energy, 2014.

[8] Jong-Hyouk Lee, Jean-Marie Bonnin, "Comparative Handover Performance Analysis of IPv6 Mobility Management Protocols", IEEE Transactions On Industrial Electronics, Vol. 60, No. 3, March2012.

[9] Y. E. Krasteva, J. Portilla, J. M. Carnicer, "Remote HW-SW Reconfigurable Wireless Sensor Nodes", IEEE 2008.

[10] A. Abbagnale, Emanuele Cipollone, "A case study for evaluating IEEE 802.15.4 wireless sensor network formation with mobile sinks", IEEE 2008.

[11] Reed Tompkins, Thomas B. Jones, "Reconfiguration and Management in Wireless Sensor Networks", IEEE 2013.

[12] Szczodrak, Omprakash Gnawali, "Dynamic Reconfiguration of Wireless Sensor Networks to Support Heterogeneous Applications", IEEE International Conference on Distributed Computing in Sensor Systems, 2013.

[13] Marco, F. Gallo, "Implementing Adaptation and Reconfiguration Strategies in Heterogeneous WSN", IEEE 27th International Conference on Advanced Information Networking and Applications, 2013.

[14] Fei Ding, Kenneth A. Loparo, "Hierarchical Decentralized Network Reconfiguration for Smart Distribution Systems—Part II: Applications to Test Systems", IEEE Transactions on Power Systems, Vol. 30, No. 2, March 2015.

[15] Shilpa Gambhir, "Comparative Study of Various Routing Protocols for Wireless Sensor Networks", IJRASET, Vol. 3, Issue 12, December 2015.

[16] Jean A. Guevara, Enrique A. Vargas, "Dynamically Reconfigurable WSN Node Based on ISO/IEC/IEEE 21451 TEDS", IEEE Sensors Journal, Vol. 15, No. 5, May 2015.