Method & Implementation of Relocalisation and Management for Smart System in WSN

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Abstract— **Recovery from node faults and interference faults has been an important area of research in Wireless Sensor Networks (WSNs). Localization of sensor node is imperative in Wireless Sensor Networks (WSN) as data gathered at the user end become meaningless without location information of the node. Nodes might experience high interference, resulting in many retransmissions from that node and require higher energy consumption can cause the battery run out and sometimes the node aggregates sensor information and transmits it to the base station crashes, the complete WSN will be rendered useless. For this, the problems solved by maintain the configuration even when the context is unpredictable. It can completely running out of energy with only a small decrease in performance. If a component providing important functionality crashes, the functionality could be transferred to another node and WSN continue to run. Due to this, it presents the work of Dynamic Reconfiguration that solves the above problems. In this, nodes update their location with the help of controller. The main performance parameter is localization error which is to be reduced upto certain limits. All simulations are presented in MATLAB.**

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

I. INTRODUCTION

WSN is a special Ad-hoc network. It doesn't require a fixed network support. As the result, it can be widely used in military, industrial, transportation, environmental protection and other fields [1]. With the development of micro-sensors and low-power wireless communications, the technology of WSN is becoming increasingly mature step by step [2]. Because of the tremendous application potential, it is acknowledged that WSN will play an important role in the next generation networks in the future. In consequence, WSN has already aroused widespread concern. 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. A lot of routing protocols specially designed for WSN have been proposed.

Localization [1] of sensor node is imperative as nodes are randomly deployed in large numbers over any region of interest for a desired application. Data received at the user end without proper location information is meaningless, especially when the application is a highly sensitive one like locating enemy tanks in a battlefield. A possible solution could be equipping sensors with Global Positioning System (GPS) or manually recording location of the node. While manual recording is possible only when there are only a handful of sensors deployed in a known area. When the number of nodes are in thousands or even more then manual recording is not a practically feasible option. As node number increases, employing GPS is also not a cost effective approach. GPS receivers require line of sight to fix position and hence in dense forests, underwater or indoor environments GPS line of sight is hindered. GPS receivers drain a considerable amount of power from the low power nodes which limit the sensor nodes life.

This system utilized submerged acoustic sensors – hydrophones – conveyed in the Atlantic and Pacific seas. This detecting innovation is still in benefit today, but serving more tranquil elements of observing undersea natural life and volcanic movement. Reverberating the ventures made in the 1970s to build up the equipment for the present Internet, the United States Defence Advanced Research Projects Agency (DARPA) began the Distributed Sensor Network (DSN) program in 1980 to formally investigate the difficulties in executing disseminated/remote sensor systems.

Figure 1: WSN Deployed in Forests

Routing Steering in remote sensor systems varies from regular directing in settled systems in different ways. There is no framework, remote connections are temperamental, sensor hubs may fizzle, and steering conventions need to meet strict vitality sparing necessities. Many steering calculations were produced for remote systems all in all.

From the review, it can be acquired that a steering convention intended for WSN ought to have the capacity of adjusting to various applications and diverse system conditions. In the event that we can change the directing convention remotely as per the applications' prerequisite and the system conditions, can accomplish this objective. Right now, it is extremely troublesome, if not inconceivable, to change a steering administration in an expansive scale sensor arrange in light of the fact that the administration is statically pre-designed into every hub, which is frequently unattended. Thus, it proposes a portability based system reconfiguration framework in WSN which can be powerfully reconfigured.

The paper is requested as takes after. In segment II, it speaks about design factors of WSN. In Section III, It characterizes the advancement of Relocalisation calculation. Segment IV speak to the proposed framework. Area V depicts the results of proposed framework. At long last, conclusion is clarified in Section VI.

II. DESIGN FACTORS IN WSN

Network Dynamics

There are three primary segments in a sensor organize. These are the sensor hubs, sink and observed occasions. In numerous applications, the development of sensor hubs or the base station (sink) is fundamental. This implies sensor hubs are moving hubs.

- **Node Deployment**

The topological organization of the hubs is application ward and influences the execution of the steering convention. The organization is either deterministic or self-sorting out. In deterministic circumstances, the sensors are physically put and information is steered through foreordained ways. However in self-sorting out framework the sensor hubs are scattered haphazardly makes a foundation in an advertisement - hoc way.

- **Self-Configuration**

It is fundamental for remote sensor system to act naturally compose; since the thickly conveyed sensor hubs in a sensor field may bomb because of many reasons (e.g., absence of vitality, physical demolition, condition obstruction, and so forth.) and new hubs may join the network. So they should act naturally arrangement to build up a topology that backings correspondences under extreme vitality imperatives.

- **Energy Consideration**

One of the parts of sensor hubs is the power source which is sufficiently constrained. A sensor hub is battery-worked. Thus; life time of a sensor hub depends unequivocally on the battery life time. Many inquires about are concentrating on planning power-mindful conventions and calculations for remote sensor systems with the objective of minimization of vitality consumption.

- **Fault Tolerance**

The disappointment of the sensor hub ought not influence the assignment of remote sensor systems. This is the dependability. Adaptation to internal failure is the capacity to maintain sensor organize functionalities with no intrusion because of sensor hub disappointments.

- **Scalability**

The quantity of sensor hubs conveyed in the detecting range might be in the request of hundreds, thousands or more and steering plans must be sufficiently versatile to react to occasions.

- **Operating Environment**

We can set up sensor arrange in the inside of expansive apparatus, at the base of a sea, in an organically or synthetically tainted field, in a combat zone past the adversary lines, in a home or a vast working, in a huge distribution center, joined to creatures, connected to quick moving vehicles, in woods territory for natural surroundings observing and so forth.

- **Data Aggregation/Fusion**

Since sensor hubs may create noteworthy excess information, comparative bundles from various hubs can be totalled so that the quantity of transmissions would be lessened.

- **Quality of Service (QoS)**

The nature of administration implies the quality administration required by the application, it could be the length of life time, the information dependable, vitality productivity, and area mindfulness, communitarian preparing.

III. DEVELOPMENT OF RELOCALISATION SYSTEM

To design a WSN application, knowledge of many elements of the context is essential as they influence the operation greatly. 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.

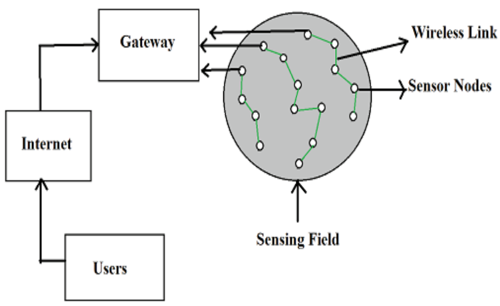

Figure 2: Wireless Sensor Network [2]

Reconfiguration means adapting components or their arrangement within a system. 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. 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. There are most commonly used techniques are given below.

- **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.

- **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.

- **Centralized Reconfiguration**

The 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. Because in some cases this still requires a restart of individual nodes, it is not considered run-time adaptation. However, the reconfiguration does occur after deployment and if the state of a node can be restored after reconfiguration, the WSN can continue its operation. This is not feasible for most actual deployments, because centralized algorithms scale poorly.

- **Distributed Reconfiguration**

It is 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. When an event in the network or the context decreases the functionality that a specific node offers, the subscribed nodes try to find other nodes with a better service level for the required functionality. Distributed reconfiguration promises a more scalable approach for WSNs, but the available solutions generally assume dense networks, place a heavy burden on system resources or are not generally applicable to multiple WSN applications.

- **Clustering Approach Clustering**

It 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.

IV. DESCRIPTION OF PROPOSED SYSTEM

Amid the advancement of a WSN, it is obscure which impacts the hubs may understanding, which hubs may crash and to what extent precisely the sensor hubs will last with accessible vitality. At first the WSN will perform well on the grounds that the setting matches the desires amid advancement. However, after some season of advancement, sensor changed position due to some outer occasion, making its sensor readings less exact. Likewise hubs may encounter high impedance, bringing about numerous retransmissions from that hub and require higher vitality utilization can cause the battery run out and once in a while the hub totals sensor data and transmits it to the base station crashes, the entire WSN will be rendered pointless. For this, the issues unraveled by keep up the arrangement notwithstanding when the setting is eccentric. Either modify its affectability or debilitate its sensor to counteract off base readings, or by expanding the length of its obligation cycle, It can totally coming up short on vitality with just a little decline in execution .

In military applications remote sensor arrange is utilized which is a self-sorted out framework with little, autonomous, low controlled and portable hubs dispread over a range with no settled topology having a head taking the information from the detecting hubs and handle an assortment of detecting, inciting, conveying, flag preparing, calculation and correspondence errands, sent without lasting system foundation and condition with constrained or no human availability. To satisfy these prerequisites we propose versatility based dynamic reconfiguration framework in WSN. It utilizes the idea of dynamic reconfiguration steering conventions utilizing microcontroller for area changing of hubs. This work presents how to outline a steering convention, which can address the issue of various area at various conditions, is a to a great degree testing issue. With the assistance of dynamic reconfiguration, the steering convention can be changed by the remote manager as indicated by the need of various applications and diverse system conditions. In this work, all hubs are speaking with each other. A head is accommodated giving the directions to all hubs. The requirement for reconfiguration engineering for sensor organize applications is obvious from the aftereffects of even a basic natural observing calculation. The fundamental execution parameter will be confinement blunder. With the assistance of this, it might demonstrate the better soundness of framework. It takes the situation of security under remote system.

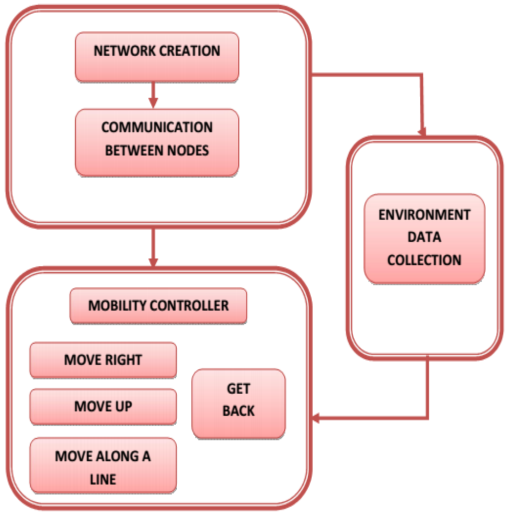

Figure 3: Proposed System Model

Sensors are arbitrarily spread over the range. Every sensor has a sensor ID appeared alongside it. It will be utilized to address any sensor all through the procedure. Here we take extensive number of sensors so that proposed plan will assess effortlessly. No two hubs cover each other. In run of the mill use situation, the hubs will be uniformly appropriated over an open air condition. This separation between adjoining hubs will be negligible yet the separation over the whole system will be noteworthy. At that point give arbitrary versatility in hubs to demonstrate that all hubs are dynamic in nature. All hubs are speaking with each other are put in least separation so that execution of hubs will be helpful. After the organization of the sensor hubs, there is a Head hub choice by surveying strategy. In a sensor arrange, the fundamental sensors are straightforward and play out the detecting assignment, while some different hubs, regularly called the heads, are all the more capable and concentrate on interchanges and calculations. At that point head check the status of every hub and gathers the ecological information from sensor hubs. .

Head gets some information about condition conditions, at that point answer back to head about status. With a specific end goal to get this capacity however our steering convention, they bolstered a few charges for the overseer to change the directing convention running on the sensor arrange stage. The hubs would change their directing convention when they got the charges. To give the summons a chance to become possibly the most important factor on the hubs, they gave an arrangement of components. With these orders and instruments, this directing convention was blessed with the immense capacity of adjusting to various applications and distinctive system conditions.

Another highlight of WSN application is security checking. In this work, organize is containing hubs which are put in open air condition and furthermore given at settled areas. They act as checking hubs that work ceaselessly. In security work, this hub just screen the information yet does not gather the information which is done is ecological information checking. Every hub consistently checks the status of sensors however it transmits a report of information when there is security issue in its region. In this way, it recommends a portability based system reconfiguration framework in WSN which can be progressively reconfigured. At that point it gives the component of dynamic reconfiguration. The dynamic reconfiguration at hub level looked to limit vitality utilization by powerfully altering equipment stages of sensor hubs. The usage of reconfiguration strategy need to consider dynamic elements, for example, changes in client prerequisites, varieties in correspondence channel quality, application changes and so forth.

Proposed Algorithm

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: Head collect data about environmental conditions like temperature
Step 7: If attacks occur then
Nodes move & change their locations immediately for security purposes
Else
Continue their work
Step 8: If locations get changed then controller checks for reconfigure the network.
Step 9: Compute localization error & other parameters.
Step 10: End

V. RESULTS & 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 2. After placement of nodes, each node requires has its ID with it so that we find out each node in network for communication. 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.

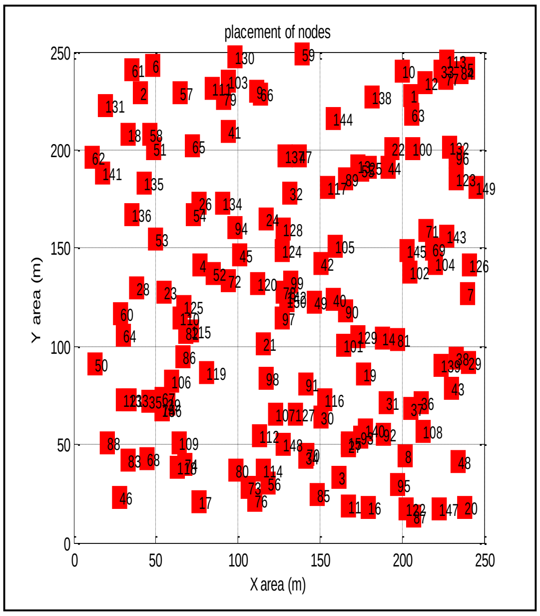

Figure 4: Nodes Placement in Network

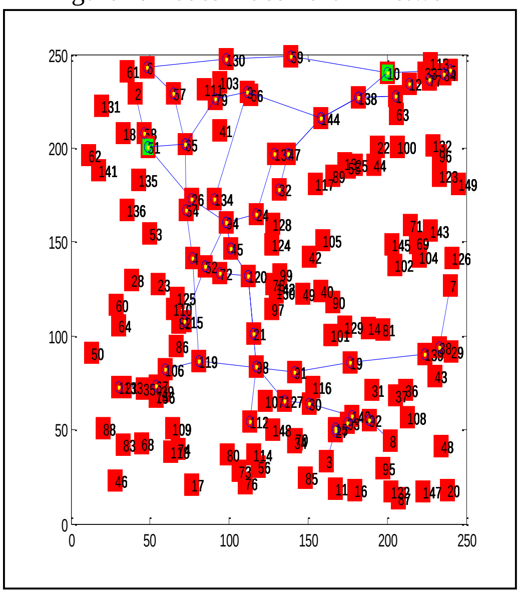

Figure 5: Data Communication by Nodes in Network

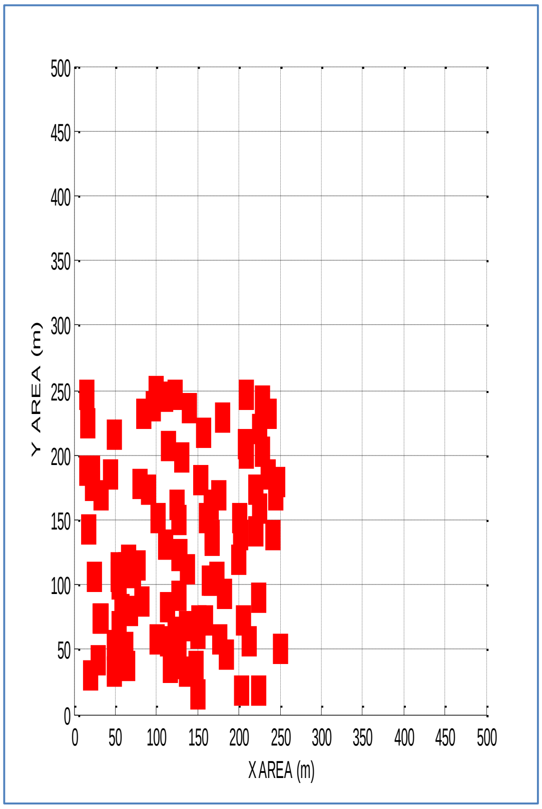

Figure 6: Movable Node in Predefined Area

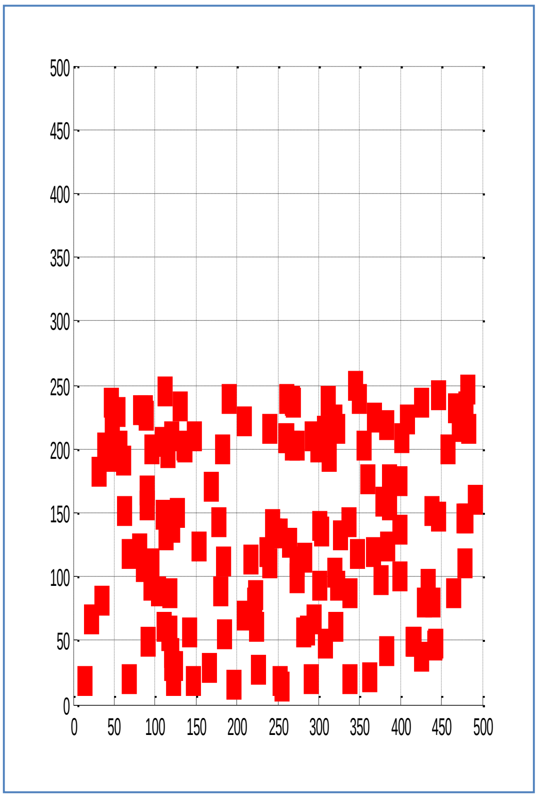

Figure 7: Movement of Some Particular Nodes

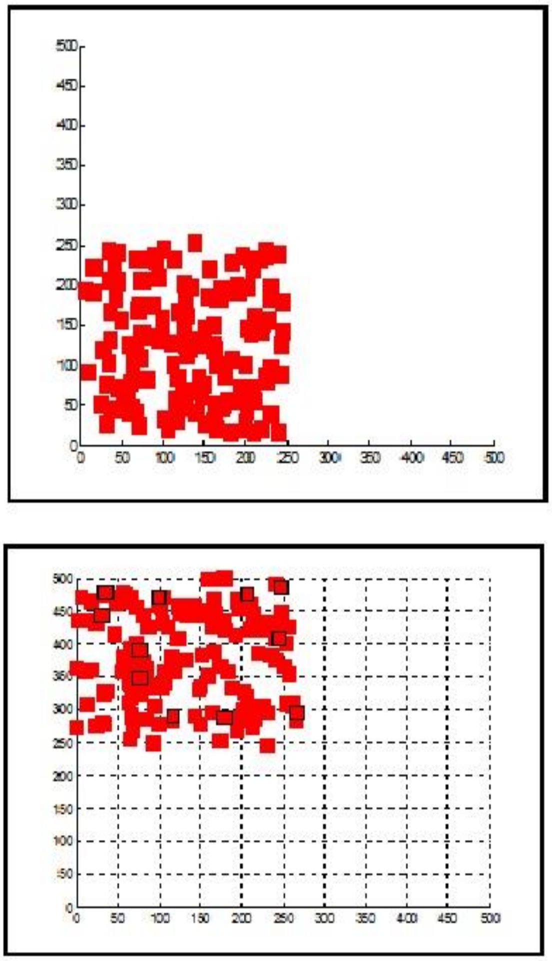

Figure 8: Movement of Nodes in Downwards Area

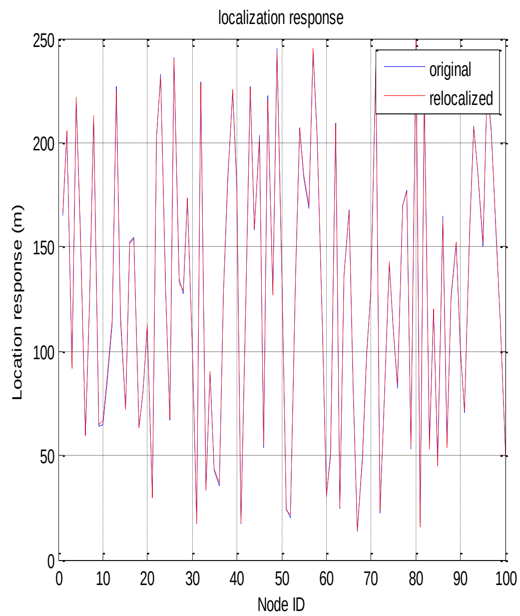

Figure 9: Localization Response of System

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 .

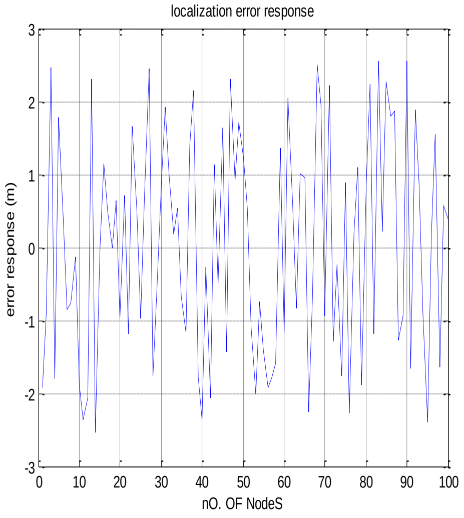

Figure 10: Localization Error of Proposed System

This shows the performance comparison of proposed and actual system. In this work, the average RMSE value is calculated and compared with actual results [25]. The results showed the proposed value show better improvement in RMSE value as compared to actual results. Figure 11 shows the performance comparison of system of proposed and actual results.

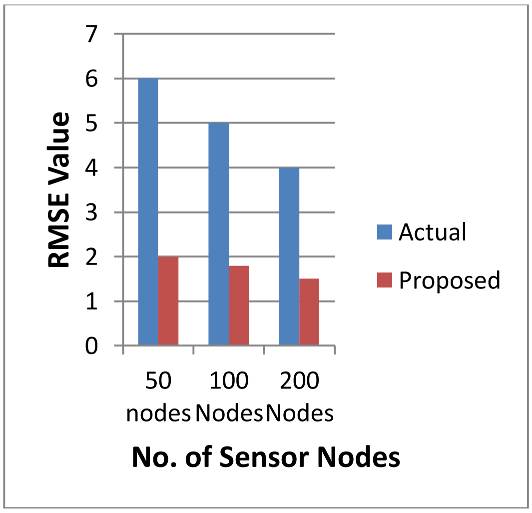

Figure 11: Performance Comparison of Proposed System

VI. 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. In this work, all nodes are communicating with each other. A head is provided for giving the instructions to all nodes. In this, it takes the scenario of disaster in forests. Before disaster occurred, all nodes changed their location for security. 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% for better response. The controller controls the movement of nodes and provides new area under suitable conditions. The time required for a particular network to reconfigure its components is around 15 to 20 seconds, which is very less when compared to the cost of restarting the application with the correct components.

REFFERENCES

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

[2] T. S. Rappaport, Wireless Communications: Principles and Practice, 2nd ed. Singapore: Pearson Education, Inc., 2002.

[3] Fabian Nack, "An Overview on Wireless Sensor Networks", Institute of Computer Science (ICS), Freie University Berlin, pp. 1-8, 2009.

[4] 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.

[5] Kun Wang, Lei Wang, Can Ma, Lei Shuy, Joel Rodriguesz, "Geographic Routing in Random Duty-cycled Wireless Multimedia Sensor Networks," IEEE Globecom Workshop on Advanced Sensor Integration Technology, pp.230-234, 2010.

[6] Chunsheng Zhu, Laurence T. Yang_, Lei Shu, Joel J. P. C. Rodrigues, Takahiro Hara, "Sleep Scheduling Towards Geographic Routing in Duty-Cycled Sensor Networks," IEEE Transactions On Industrial Electronics, pp.1-3, 2011.

[7] Tiago Condeixa, Susana Sargento, Andr´ea Nascimento, Rute Sofia, "Decoupling and Distribution of Mobility Management", IEEE International Workshop on Mobility Management in the Networks of the Future World, pp. 1073-1078, 2012.

[8] Rajeev Wankar, Rajendra Akerkar, "Reconfigurable Architectures and Algorithms: A Research survey", International Journal of Computer Science and Applications, Techno-mathematics Research Foundation, pp. 108-123, Vol. 6, No. 1, 2012.

[9] Samira Afzal, "A Review of Localization Techniques for Wireless Sensor Networks", Journal of Basic and Applied Scientific Research, pp. 7795-7801, 2012.

[10] Swati Sharma and Dr. Pradeep Mittal, "Wireless Sensor Networks: Architecture, Protocols", International Journal of Advanced Research in Computer Science and Software Engineering, pp. 304-308, Volume 3, Issue 1, January 2013.

[11] Marcin Szczodrak, Omprakash Gnawali, Luca P. Carloni, "Dynamic Reconfiguration of Wireless Sensor Networks to Support Heterogeneous Applications", IEEE, pp. 52-61, 2013.

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

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

[14] A. Di Marco, F. Gallo, O. Gemikonakli, L. Mostarda, F. Raimondi, "Implementing Adaptation and Reconfiguration Strategies in Heterogeneous WSN", IEEE International Conference on Advanced Information Networking and Applications, pp. 477-483, 2013.

[15] Shan Gaoy,Yong Piaoz, " DRRP: A Dynamically Reconfigurable Routing Protocol for WSN", IEEE, pp. 460-465, 2014.

[16] Martin K. Mwila, Karim Djouani, "An Efficient Approach to Node Localisation and Tracking in Wireless Sensor Networks", IEEE Ad Hoc andSensor Networking Symposium, pp. 492-497, 2014.

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

[18] Rajeev Patel, Rajendra Akerkar, "Reconfigurable Architectures and Algorithms: A Research survey", International Journal of Computer Science and Applications, Techno-mathematics Research Foundation, pp. 108-123, Vol. 6, No. 1, 2014.

[19] Jean A. Guevara, Enrique A. Vargas, "Dynamically Reconfigurable WSN Node Based on ISO/IEC/IEEE 21451 TEDS: A Genetic Algorithm Approach", IEEE Sensors Journal, pp. 2567-2576, Vol. 15, No. 5, May 2015.

[20] G.V Rama Lakshmi and V. Srikanth, "Location-Based Routing Protocol in Wireless Sensor Network- A Survey", International Journal of Advanced Research in Computer

Science and Software Engineering, pp. 663-667Volume 5, Issue 4, 2015.

[21] Shelei Li, Xueyong Ding, Tingting Yang, “Analysis of Five Typical Localization Algorithms for Wireless Sensor Networks”, Scientific Research Publishing Inc.,pp. 27-33, April 2015.

[22] Ming Jiang, Yunfei Li, Yuan Ge, Wengen Gao and Ke Lou “An Advanced DV-hop Localization Algorithm in Wireless Sensor Network”, International Journal of Control and Automation, pp.405-422, Vol.8, No.3, 2015,

[23] Ishfaq Ahmad, Khalil Shah, Saif Ullah, “Military Applications using Wireless Sensor Networks: A survey”, International Journal of Engineering Science and Computing(IJESC), pp.7039-7043,Volume 6 Issue No. 6, June 2016.

[24] Isha Sharma, Shilpa Gambhir, “To Propose Mobility Based Reconfigurable System under Disaster Management in WSN”, IOSR Journal of Electronics and Communication Engineering (IOSR-JECE), pp.90-97, Special Issue AETM’16, 2016.

[25] Megha. S. Kumar and R. Ramanatha, " Impact of Anchor Position Errors on WSN Localization Using Mobile Anchor Positioning Algorithm", IEEE WiSPNET 2017, pp.1924-1928.

[26] Muhammad Asad and Muhammad Aslam, " Heuristic Path-Reconfiguration Algorithm using Multi-Hop Opportunistic Routing in WSNs", IEEE International Conference on Frontiers of Information Technology, 2018, pp. 47-52.

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