International Journal of Engineering and Technical Research (IJETR)
ISSN: 2321-0869, Volume-3, Issue-4, April 2015

A Novel Study on Network Reconfiguration System to Enhance Security in Sensor Networks

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***Abstract*— Due to recent technological advances, the manufacturing of minor and low cost sensors became officially and economically feasible. The sensing electronics measure ambient circumstances related to the environment surrounding the sensor and convert them into an electric signal. In this paper, it proposes a scheme for designing mobility based reconfiguration system in WSN. WSN started to employ mobile nodes which increase the flexibility of maintenance and data collection. Sensor nodes are disposed to to failure due to energy reduction and their placement in an uncontrolled or even antagonistic environment. In this, it also proposes mobility based route recovery from multiple node failures. A vehicle will be used for monitoring all the status of nodes. The process is used to detect route to the sink. The projected mechanism will be implemented with MATLAB. It will also compute various performance parameters of proposed system.**

***Index Terms*— WSN Network recovery, wireless sensor networks, Network Reconfiguration System.**

I. INTRODUCTION

Wireless sensor networks have seen tremendous advances and utilization in the past two decades. Starting from petroleum exploration, mining, weather and even battle operations, all of these require sensor applications. All the user needs to do is to gather the data sent by the sensors, and with certain analysis extract meaningful information from them. Usually sensor applications involve many sensors deployed together. These sensors form a network and collaborate with each other to gather data and send it to the base station. The base station acts as the control centre where the data from the sensors are gathered for further analysis and processing. In a nutshell, a wireless sensor network (WSN) is a wireless network consisting of spatially distributed nodes which use sensors to monitor physical or environmental conditions. These nodes combine with routers and gateways to create a WSN system [2].

Manuscript received April 21, 2015.
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Wireless sensor network is a network that contains of a large amount of low-cost and low power-driven sensor strategies, called sensor nodes, which can be organized in strict environment; sensor nodes are disposed to have errors. It is thus needed to sense and locate defective sensor nodes to ensure the quality of service of sensor networks [3].

Today, wireless sensor networks are widely used in the commercial and industrial areas such as for e.g. environmental monitoring, habitat monitoring, healthcare, process monitoring and surveillance. For example, in a military area, we can use wireless sensor networks to monitor an activity. If an event is triggered, these sensor nodes sense it and send the information to the base station (called sink) by communicating with other nodes [11].

The use of wireless sensor networks is increasing day by day and at the same time it faces the problem of energy constraints in terms of limited battery lifetime. As each node depends on energy for its activities, this has become a major issue in wireless sensor networks. The failure of one node can interrupt the entire system or application. Every sensing node can be in active (for receiving and transmission activities), idle and sleep modes. In active mode nodes consume energy when receiving or transmitting data. In idle mode, the nodes consume almost the same amount of energy as in active mode, while in sleep mode, the nodes shutdown the radio to save the energy

The paper is ordered as follows. In section II, it represents related work with proposed system in wireless sensor networks. In Section III, It defines various WSN routing protocols. Section IV describes the proposed system. Finally, conclusion is explained in Section V.

II. LITERATURE REVIEW

This describes the literature survey related to network reconfiguration in Wireless sensor network. Literature survey is the important factor in carrying out any research work in various fields. The literature survey gives idea about the work to be done in chosen area

S.N.	Author's Name	Title	Conclusions
1.	Na Wang, Haihui He	Time Synchronization for Failure Tolerance in Wireless Sensor Network	• Proposed that Node in WSN has its own local clock, and it's difficult to achieve long-term time synchronization between nodes due to some internal and external factors. • An improved HRTS algorithm which based on Hierarchy Referencing Time Synchronization resolving the general problem will be introduced [10].
2.	Hong-Chi Shih, Jiun-Huei Ho, Bin-Yih Liao	Fault Node Recovery Algorithm for a Wireless Sensor Network	• Proposed a fault node recovery algorithm to enhance the lifetime of a wireless sensor network when some of the sensor nodes shut down [9]. • reduces the rate of data loss by approximately 98%
3.	M. Younisa, I. F. Senturk, S. Lee	Topology management techniques for tolerating node failures in wireless sensor networks: A survey	• Focused on network topology management techniques for tolerating/handling node failures in WSNs. • Two broad categories based on reactive and proactive methods have been identified for classifying the existing techniques [8].
4.	Abbasi, M. F. Younis	Recovering From a Node Failure in Wireless Sensor-Actor Networks With Minimal Topology Changes	• Presented a Least-Disruptive topology Repair (LeDiR) algorithm. • LeDiR relies on the local view of a node about the network to devise a recovery plan that relocates the least number of nodes and ensures that no path between any pair of nodes is extended [7].
5.	J. Kullaa	Detection, identification, and quantification of sensor fault in a sensor network	• Sensor network was modeled as a Gaussian process and each sensor in the network is estimated in turn using the minimum mean square error (MMSE) estimation. • Proposed approach was experimentally verified with an array of accelerometers assembled on a wooden bridge [6].
6.	N. Jabeur, N. Sahli, Ijaz M. Khan	Survey on Sensor Holes: A Cause-Effect-Solution Perspective	• Proposed a new taxonomy (PLMS) which classifies holes into type groups according to the cause of anomaly. • They discussed the effects of holes on the sensor network. • Finally, they survey the different curative approaches (prevention, detection, repairing, and avoidance) [5].
7.	N. Gaur, A. Chakraborty, and B. S. Manoj	Load-aware Routing for Non-Persistent Small-World Wireless Mesh Networks	• Proposed a Load-aware Non-Persistent small-world long link Routing (LNPR) algorithm for small-world wireless mesh networks to achieve lower average transmission path length for data transfer sessions among a set of source-node and destination node pairs in the network [1].

A. *Inferences from Survey*

The main idea of these efforts is to identify and relocate some of the nodes when a single node fails causing the network to partition .controlled node mobility has been used to restore connectivity in several wireless networks. Some used a robot called packbot to serve as a mobile relay. The use of packbot enables reaching isolated nodes or blocks and links them to the rest of network. An algorithm has been proposed for determining trajectory of packbot to serve multiple nodes. Some presented that mobile relay stay within atmost two hops of sink thus they don't need to travel around the network.

III. WSN ROUTING PROTOCOLS

Generally, operation of WSN involves communication between sensor node and base station. The sensor node senses environment, perform some computation (if required) and report gathered information to the base station. Routing protocols are divided into many categories like structure-based routing protocols and operation-based routing protocols. [4].

A. *LEACH (Low Energy Adaptive Clustering Hierarchical)*

In WSN, LEACH is the most aspiring and widely used protocol [9]. LEACH can be described as a combination of a cluster based architecture and multi-hop routing. The term cluster-based can be explained by the fact that sensors using the LEACH protocol functions are based on cluster heads and cluster members. Multi-hop routing is used for inter-cluster communication with cluster heads and base stations. Multi-hop routing consumes less energy when compared to direct transmission [11].

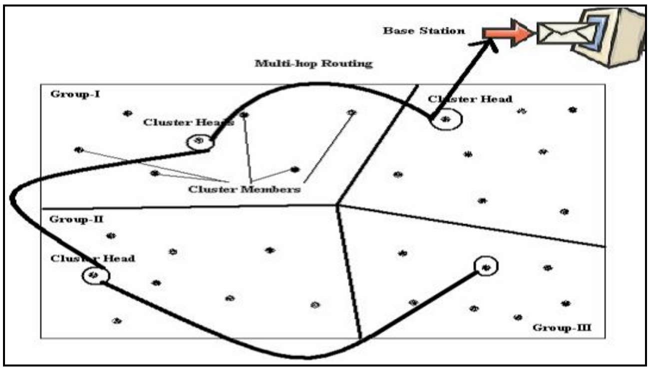

Figure 1: Operation of LEACH Protocol [11]

LEACH is well-suited to reduce the data aggregation issues using a local data fusion which performs a compression of the amount of data that is collected by the cluster head before it sends it to the base station. All sensors form a self-organized network by sharing the role of a cluster head at least once. Cluster head is majorly responsible for sending the data that is collected by the sensors to the base station.

B. PEGASIS (Power Efficient Gathering in Sensor Information Systems)

PEGASIS is an extension to LEACH; it has better ways of conserving energy which last even more than using cluster mechanism in LEACH. The key idea in using PEGASIS is that it uses all the nodes to transmit or receive with its closest neighbour nodes. This is achieved by the formation of a chain. All the nodes which collect the data fuse it with the data received by the neighbour node and transmit it to the next-nearest neighbour. In this way all the nodes receive and fuse their data, and pass it to the next neighbor in a chain format till they all reach the base station. Every node in the network takes turns as a leader of the chain and the one responsible to transmit the whole fused data collected by the chain of nodes to the base station.

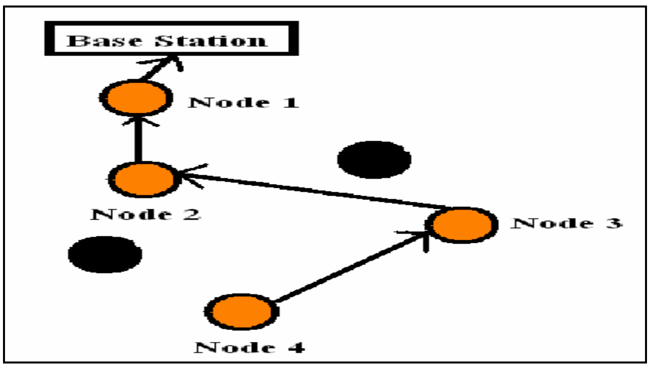

Figure 2: Data Flow in PREGASIS [12]

C. SPIN (Sensor Protocol for Information via. Negotiation)

SPIN is the first data-centric protocol that was designed for wireless sensor networks and has many similarities to direct diffusion. It is efficient in reducing the redundant data and save energy. The motivation behind developing SPIN is due to the dissemination of data. Dissemination is the process of collecting the observations of the whole set of individual sensors which are deployed in the network, where all sensors are treated as sink nodes. The work assigned to these sensors is to collect the complete view of the environment in the form of data, and enhance a fault-tolerant network structure.

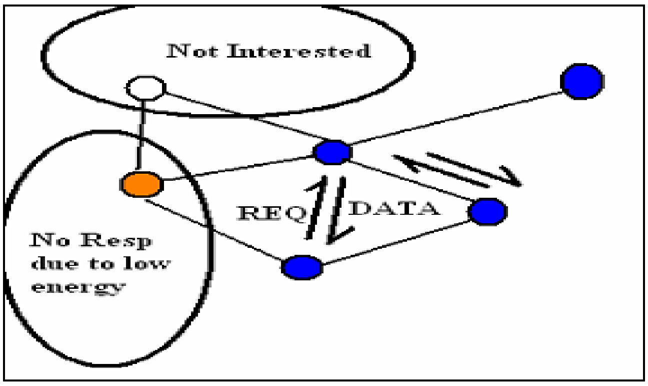

Figure 3: Process of SPIN Protocol [13]

D. GEAR (Geographic and Energy Aware Routing)

GEAR a protocol that disseminates queries directly to the sensor nodes of a network and extract the required data from a specific region called target region. The Geographic and Energy Aware Routing (GEAR) scheme uses an energy-aware and geographically-informed neighbour selection heuristic to route a data packet to a target region. It proceeds internally by applying a recursive geographic forwarding technique to disseminate a data packet directly to the sensor node inside the target region.

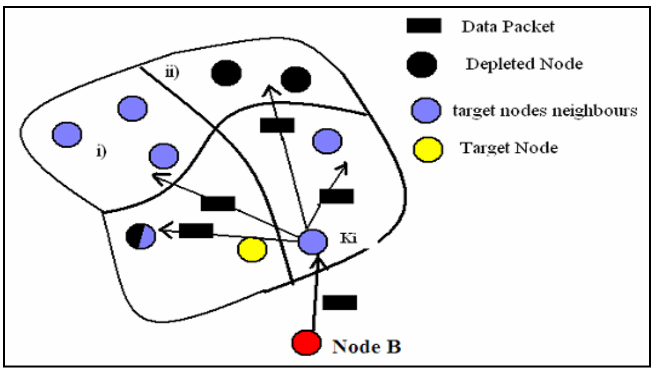

Figure 4: Geographical Forwarding in WSN [14]

E. GAF (Geographic Adaptive Fidelity)

Geographic Adaptive Fidelity states that it locates nodes in the network and makes the best use of them to have a better fidelity. All the nodes use a location-identification technique to locate itself within the network along with its nearest neighbours by using location-information systems like GPS. In GAF, all the nodes arrange themselves according to grids also called virtual grids. All the nodes in the network divide themselves in virtual grids and all those nodes which are under a same grid coordinate among themselves to see who will go into sleep state and for how long. Load balancing is performed and a single node will not get drained with extraneous work.

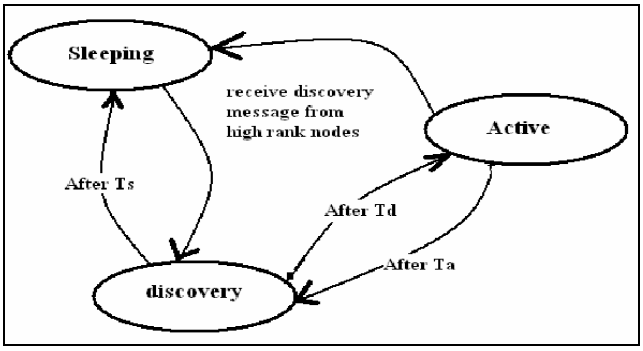

Figure 5: Geographic Adaptive Fidelity [15]

IV. NETWORK RECOFIGURATION SYSTEM

A WSN involves two types of nodes: 1) sensors and 2) actors. Sensors are inexpensive and highly constrained in energy and processing capacity. On the other hand, actors are more capable nodes with relatively more on board energy supply and richer computation and communication resources. However, the transmission range of actors is finite and significantly less than the dimensions of the deployment area. Although actors can theoretically reach each other via a satellite channel, the frequent inter-actor interaction required by WSAN applications would make the often intermittent satellite links unsuitable. It is thus necessary for actors to rely mostly on contemporary terrestrial radio links for coordination among themselves. Upon deployment, actors are assumed to discover each other and form a one-connected network using some of the existing techniques.

In an environmental monitoring application, we assume that a set of battery-operated sensors, including the sink node itself, are randomly deployed in an area of interest with a single sink node which collects data from those nodes regularly. Sensors are assumed to determine their locations by localization techniques. Since we will be exploiting the mobility of the nodes, sensors are assumed to be repositioned whenever needed. This can be done in two ways: First, the sensors can be mobile which are available in the market with different capabilities. Second, we may assume the availability of some other nodes such as mobile robots which can either carry the stationary sensors or replace them temporarily. Since the number of such robots will be limited compared to sensors, each sensor will be assumed to know the location of at least a robot in case they need to be carried or replaced. Any movement of the sensor/robot should be using the energy from the battery.

We assume that the damage will occur after the data collections starts. When the damage occurs, a set of sensors in a particular region will be out of function. The number of such nodes will depend on the density of the deployment and the number of partitions created out of this damage will be topology dependent. We also assume that the failures happen at the same time and thus the nodes affected from these failures will detect the failures around the same times. Data sensed during the recovery are assumed to be buffered until the routes are re-established. Each sensor is assumed to have a path (which can be multi-hop) to the sink node.

First, we need to decide on node which will lead the recovery process. Second, we need to decide which nodes should move to fill the gap so that connectivity is restored. The proposed approach consists of two major steps; (1) Self Partition Detection; and (2) Route Recovery via movement. Second step also consists of three sub-steps: (1) Autonomous Vehicle Selection; (2) Vehicle Movement; and (3) Maintaining Connectivity with the Vehicle. After detecting a partition, the nodes initiate the recovery process. We discuss two sub-problems related to route recovery: Which of the sensor nodes should move (i.e., leaders) and where should they move. In the proposed distributed approach, a leader is picked to initiate the recovery process by relocating to the location of failed upstream node. The leader node travels step by step. Firstly, it moves gradually towards the location of failed node. This Process is repeated for network reconfiguration system.

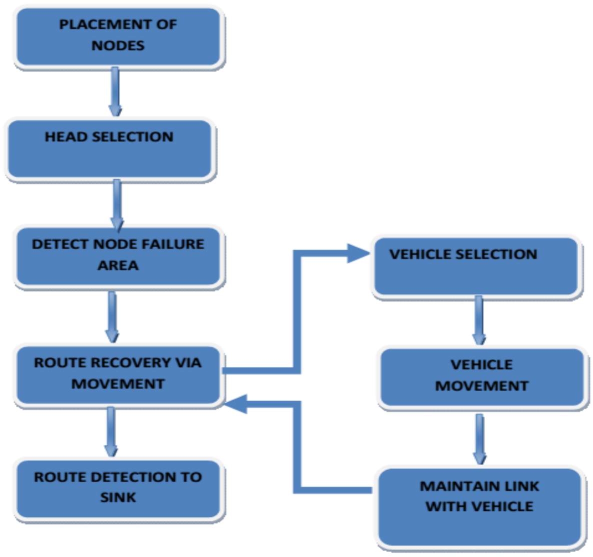

Figure 6: Flow Chart of System

A. Tool Used: MATLAB

MATLAB is one of a number of commercially available, sophisticated mathematical computation tools, which also include Maple, Mathematica, and MathCAD. Despite what proponents may claims, No singles one of these tools is “the best”. Each has strengths and weaknesses. Each allows you to perform basic mathematical computations. They differ in the way they handle symbolic calculations and more complicated mathematical processes, such as matrix manipulations. For example, MATLAB (short for Matrix Laboratory) excels at computations involving matrices, whereas Maple excels at symbolic calculations.

V. CONCLUSION

WSNs started to employ mobile nodes which increased the flexibility of maintenance and data collection. In this, it presents a review on network reconfiguration system in wireless sensor networks.

In this, it exploits the mobility capability of sensors. The objective is to detect, isolate, identify, quantify and correct a sensor fault in sensor network. In this, we introduced partition detection and route recovery scheme for node failures happened as a result of large scale damage. When partition will be detected, a local leader will be selected to initiate the recovery process. All simulations will be done in MATLAB.

REFFERENCES

[1] N. Gaur, A. Chakraborty, and B. S. Manoj, "Load-aware Routing for Non-Persistent Small-World Wireless Mesh Networks", 2014 IEEE.

[2] A. Bijwe, Dr. C.G. Dethe, "RSS based Vertical Handoff algorithms for Heterogeneous wireless networks - A Review", IJACSA 2014.

[3] Richa, S. Khera, "QOS Parameters based Vertical handoff Decision in Heterogeneous Network: A Practical Approach", IJARCCE 2014.

[4] K. Akkaya, I. F. Senturk, S. Vemulapalli, "Handling large-scale node failures in mobile sensor/robot networks", Elsevier 2013.

[5] N. Jabeur, N. Sahli, Ijaz M. Khan, "Survey on Sensor Holes: A Cause-Effect-Solution Perspective", Elsevier 2013.

[6] J. Kullaa, "Detection, identification, and quantification of sensor faultin a sensor network", Elsevier 2013.

[7] A. Abbasi, M. F. Younis, "Recovering From a Node Failure in Wireless Sensor-Actor Networks With Minimal Topology Changes", IEEE 2013.

[8] M. Younisa, I. F. Senturk, S. Lee, "Topology management techniques for tolerating node failures in wireless sensor networks: A survey", Elsevier 2013.

[9] H. Shih, J. Ho, B. Liao, "Fault Node Recovery Algorithm for a Wireless Sensor Network" IEEE Sensors Journal, Vol. 13, No. 7, 2013.

[10] Na Wang, Haihui He, "Time Synchronization for Failure Tolerance in Wireless Sensor Network", IEEE 2012.

[11] S. Ozdemira, Y. Xiao, "Secure data aggregation in wireless sensor networks: A comprehensive overview", 2009.

[12] L.T Nguyen, X.Defago, R.Beuran, Y.Shinoda, "An Energy Efficient Routing Scheme for Mobile Wireless Sensor Networks", 2008.

[13] W.H Liao, H-H Wang, "An asynchronous MAC protocol for wireless sensor networks", 28 July 2008.

[14] J. Zhua, K.L Hunga, B. Bensaoua, F.N Abdesselam, "Rate-lifetime tradeoff for reliable communication in wireless sensor networks", 29 September 2007.

[15] Y. Cheng, D.P. Agrawal, "An improved key distribution mechanism for large-scale hierarchical wireless sensor networks", 27 June 2007