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RELIABLE AND EFFICIENT DATA ACQUISITION IN WIRELESS SENSOR NETWORK

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ABSTRACT

It has been observed that the sensor nodes are deactivated or damaged when exposed to specific radiations, change in temperature leading to the energy draining issues of the sensor nodes. This failure leads to the temporary isolation of the nodes from the wireless network which results in the formation of the holes. These holes are dynamic in form and can increase and decrease depending upon the factors affecting the failure to the sensor nodes. So a solution has been presented where the WSN functions in dual mode i.e. Radio frequency and the Acoustic mode so that the information can be transferred securely. With the help of the Dynamic Source Routing, Bridge protection algorithm and clustering techniques, more efficiently and reliably the data is transferred from the source to the destination node. Depending on this a survey has been taken where number of factors are studied so that the performance of the system can be increased. We use java based simulator as simulation platform to demonstrate proposed model implementation.

Keywords: Energy hole problem, Sensor Deployment, Wireless sensor network.

1. INTRODUCTION

WSN is the collection of several sensor nodes which transfers the data. The basic functionality of these nodes is to sense the surrounding, process the data and sending the data from source to the destination. There are several factors like the electromagnetic radiations, nuclear radiations, temperature etc. all such factors affects the energy of the sensor nodes, damage them and thus affecting the performance of the WSN. When there occurs some damage to the nodes then the communication range associated with each affected node becomes zero and isolates the node from the network. It is represented as below diagrammatically

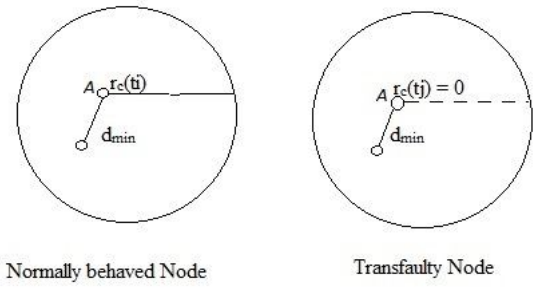

Fig. 1. Range of Sensor nodes.

As long as there is no damage to the sensor nodes, it continues to work in the radio frequency mode, when there occurs the node failure, the acoustic mode is activated. The data is then extracted and transferred further. The elimination of the faulty nodes from the system cannot be the solution since all the resources and the services associated with the sensor node can be used again; once when they are recovered. Thus the working of the model in dual mode proves to be better, since we switch to the other sleeping nodes and transfer the data through them. Also the range of the node plays the equal important role while the data is transferred from one node to the other. The motivating factors related to this are increasing the lifetime of the Wireless sensor network using the fault tolerance and the fault node detection, also active cooperative communication has to be there amongst the nodes so that the change in the topology can be reflected immediately and data can be sent with minimum delay also improving the lifetime of the WSN. The architecture diagram of the system shown below helps us to understand the system.

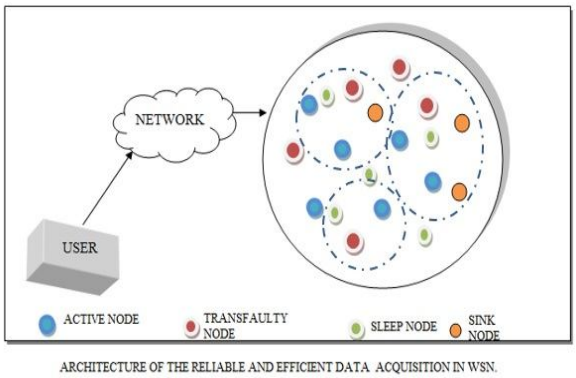

Fig. 2. Proposed Architecture.

2. REVIEW OF LITERATURE

The paper presented provides us with the details of how the dual mode i.e. radio frequency and the acoustic mode can be implemented for the effective and efficient data transfer. This emphasized on the data extraction process. Due to the proposed system the data can be sent more efficiently [1]. In the paper presented a solution for distributing symmetric keys and network access control in a WSN using IBC is proposed. The proposed scheme was evaluated against well-known attacks on a WSN and found to perform well. Several groups implement for Tate pairing in hardware but are targeting the latency metric and also Field Programmable Gate Arrays (FPGAs) rather than energy and an ASIC, therefore these contributions lack over the suggested theory which is several magnitudes higher than what is achieved by implementing the pairing in hardware, and too high for the limited energy available to a node. Work is needed in order to implement other components of the scheme such as the elliptic curve point multiplication and exponentiation in the field [2].

In this paper authors proposed an adaptive sampling algorithm that estimates online the optimal sampling frequencies for sensors. This approach, which requires the design of adaptive measurement systems, minimizes the energy consumption of the sensors and, incidentally, that of the radio while maintaining a very high accuracy of collected data. It can perform similar to a fixed-rate scheme where the sampling frequency is known in advance. This approach results in a corresponding energy saving of both the sensor and the radio. Conclusion strongly depends on the specific sensor, whose power consumption is significantly larger than that of the radio [3].

In a pollution attack, the adversary maliciously alters some of the stored encoded packets, which results in the incorrect decoding of a large part of the original data upon retrieval. Authors proposed algorithms to detect and recover from such attacks. This paper can be applied in any coding-based distributed storage in application, be it in the domain of peer to peer file distribution or in wireless sensor networks. In particular, this approach does not require the storage nodes to perform additional coding on or to add additional information to the encoded packets. Proposed algorithm is effective and extremely efficient both in terms of communication and computational overhead. It does not scale up to very large systems in terms of computational complexity [4].

Authors developed adaptive fault-tolerant quality of service (QoS) control in algorithms depends on hop-by-hop data transmission utilizing “source” and “path” redundancy, with the goal to satisfy application QoS requirements while prolonging the lifetime of the sensor system. Algorithm which incorporates path and source redundancy mechanisms to satisfy query QoS requirements while maximizing the lifetime of query-based sensor networks. Future work: provide a more detailed analysis of the effect of network dynamics on MTTF, such as more energy may be consumed by some SNs over others or some SNs may fail earlier than others [5].

The paper proposes a distributed management function, called virtualized network management function(vNMF), to detect sensor failure to virtualized services. vNMF detects the failures by monitoring physical-layer statistics that are processed with a self-organizing map algorithm. Memory leaks and network traffic failures can be successfully detected and that and the accuracy of failure detection can be significantly improved compared to common k-means clustering. The proposed vNMF is expected to facilitate scalable network management toward more complex network virtualization environments in the future work [6].

A mechanism for dielectric charge trapping and its effect on the electrostatic force is proposed. Of notable significance is the susceptibility of GaAS MEMS devices to radiation effects, as found in this work. Such effects, if present, may be eliminated with proper design techniques, as demonstrated in the alternate RSC switch configuration. It is strongly

recommended that devices of this type be thoroughly characterized for radiation effects prior to use in systems with a space or nuclear radiation environments[7].

The problem of decentralized detection in wireless sensor networks in the presence of one or more classes of malicious nodes. Binary hypothesis testing is considered where the honest nodes transmit their binary decisions to the fusion centre (FC), while the misbehaving nodes transmit fictitious messages the problem of decentralized detection in wireless sensor networks in the presence of many more classes of malicious nodes. Binary hypothesis testing is implemented where the reliable nodes sends their binary decisions to the fusion centre (FC), while the misbehaving nodes transmit fictitious messages [8].

Authors present a data-sensitive analysis of the algorithm's running time, which describes that the algorithm work faster as the independently between clusters increases. Second, a number of empirical studies both on synthetically generated data and on real data sets from applications in colour quantization, data compression, and image segmentation. A simple and efficient implementation of Lloyd's k-means clustering algorithm, which we call the filtering algorithm. The advantage of this algorithm is it requires a kd-tree as the only major data structure. This algorithm is quite complex and does not provide significantly faster running time in practice [9].

Proposes a new routing algorithm (Master/Slave) for discovery and recovery of the routing path efficiently. The primary path, secondary path and the segmentation process helps to navigate the data from the non-faulty nodes [10]. Also multipath routing helps transfer data simultaneously thus by reducing delay and congestion in the network [12].The paper proposes a theory where the bridge nodes are protected by giving some of the responsibilities of the sink nodes to the other nodes. It prevents the apparition of the additional bridge nodes. The paper discusses the advantages of multipath routing and proposed an effective solution for finding multiple paths depending upon the demand of quality of service from the network [15][16][17].

The disadvantage is that the algorithm sacrifices the length of some routes in order to distribute the routes away from the critical area [11].In this work analysis of the energy consumption of a WSN node is analysed with proposed node. With the help of this the estimated lifetime of the battery can be increased significantly [14]. It is observed that sensors are used for forwarding data to sink directly so as to reduce energy consumption, packet loss and delay [13].

3.SYSTEM ARCHITECTURE

Proposed clustering aims to associate every node with one cluster. Every node does not violate the admissible degree constraint, and every cluster does not compromise the size limit, while forming the cluster. The number of cluster in the network is restricted to a minimum of N/S, N is less than C, C is less than N/S, (N< C < N/S).
Where,
N is the number of nodes in the sensing area.
Proposed system uses two types of nodes in the network
(a) normal-behaved node.
(b) Trans-faulty node.

4.SYSTEM OVERVIEW

Proposed system network uses sensor nodes with double mode of data acquisition i.e. RF and acoustic. It was observed that the communication range for the radio frequency mode was 90m and that in acoustics mode was 70m, also instead of wasting the time in activating the sleeping nodes and working in acoustics mode, it was logical to try to do the maximum data transfer in the radio frequency mode only. To get huge coverage within a radiation affected area, the sensor nodes in the area which are affected or damaged deactivates and sleeping nodes become activated. Then the nodes function into the acoustic communication mode after detecting themselves to be affected by radiations. For the better performance of the system, the Dynamic source Routing protocol has been used. This forms a route on demand when transmitting node requires one. This uses source routing instead of relying on the routing table at each intermediate device.
Due to several energy issues and considering the lifetime of the network as one of the key factor for the proper functioning of the WSN, a bridge protection algorithm has also been implemented which reduces the chances of the network fragmentation.

5.SOFTWARE REQUIREMENT SPECIFICATION

In order to implement this project we shall be undergoing the following steps.

1. Create wireless sensor network for data collection.
2. Design cluster based wireless sensor network for data acquisition.
3. Determining the energy of nodes and considering the trans-faulty nodes in WSN.
4. Determine radio frequency mode for sensor network.
5. Choose of source and destination nodes.
6. Moving sensor across cluster for data collection in WSN.
7. Perform routing by using the shortest path for route discovery.
8. Fault detection and recovery for the wireless sensor nodes.
9. Assign trust value to sensor node from routing table.
10. Energy efficient data collection in the presence of WSN.

To implement above system we used the below mentioned operating system, front end and the tool for the programming.

Platform:
Operating System : Windows7
Front End : Java Swing (Simulation)
Tool : Eclipse Luna

Mathematical Model

Let WSN= (node, links) denote the topology of the network. Consider that node j is neighbor node i. It is shown by T(i, n) which is the trust value for node j assigned by node i.
Tj (i, n) is topology computed by,
T(i, n) = Fij(n) / Nij(n) (1)
Where,
Nij(n) = the number of packets that have been received by at time .
Fij(n) = the frequency of packets that have been received by at time . We shall calculate the trust value of sensor using the average model i.e. using (n+1)th topology
(i, n+1) = aa.Tj(i,n) + (1-a).Tj(i,n+1) (2)
Where,
Tj(i,n+1) is node js trust value measured by node during the (n+1)th topology updating cycle. Weighting factor used to trade-off between current measurement and previous estimation is considered and represented as below a and its value lie between 0-1.

6.RESULT

The project currently shows how the network can be generated and it also gives us the choice to decide the number of nodes to deploy and the source and the destination node. The system considers the time factor for each node involved in the transmission process. The GUI of the system is as shown below.

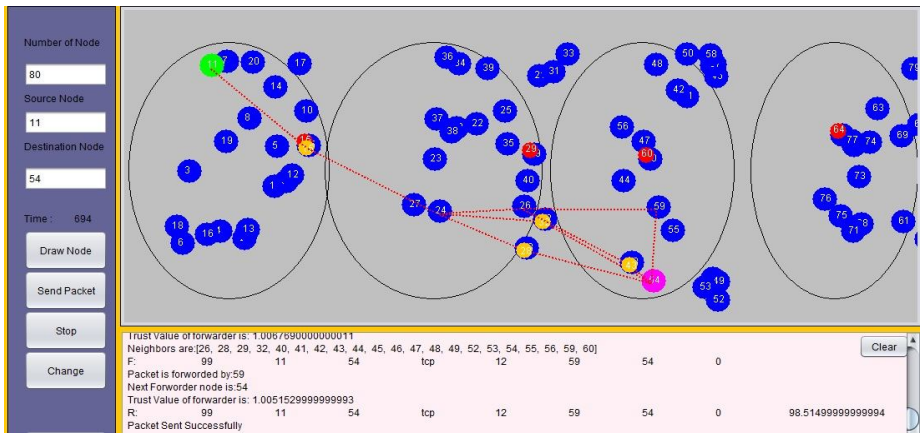

Fig. 3: Proposed System.

The user has added 80 nodes and choose 11thnode as a source node and the 54th node as a destination node. All these nodes get distributed randomly in the 4 specified clusters or regions. The clustering of nodes improves the performance and routing of the system. The figure also shows the multiple paths so that the packet reaches till the destination node. The results for the above mentioned system is as below.

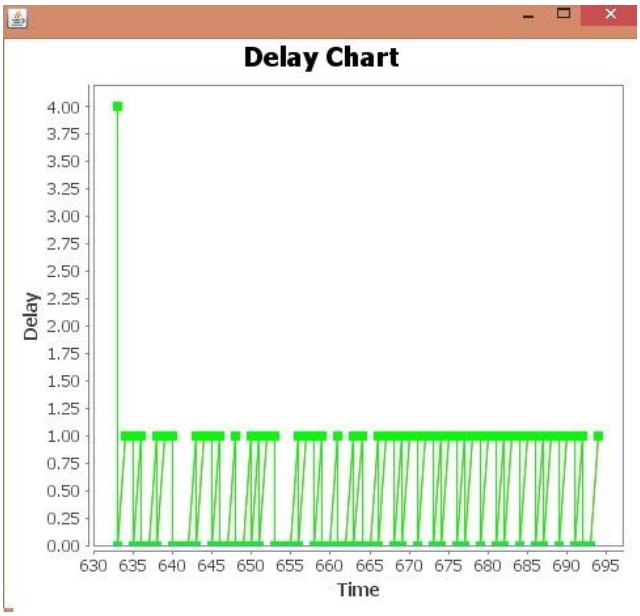

Fig. 4. Delay Chart.

The graph shows that the delay is less and it is maintained even when the time value goes on changing.
The consistent and low delay values helps us to understand that the system sucessfully managed to transfer the data with less delay value.

The next graph is of the packet delivery ratio Vs. time which shows that the packet has been delivered at a greater ratio while the time value goes on increasing.

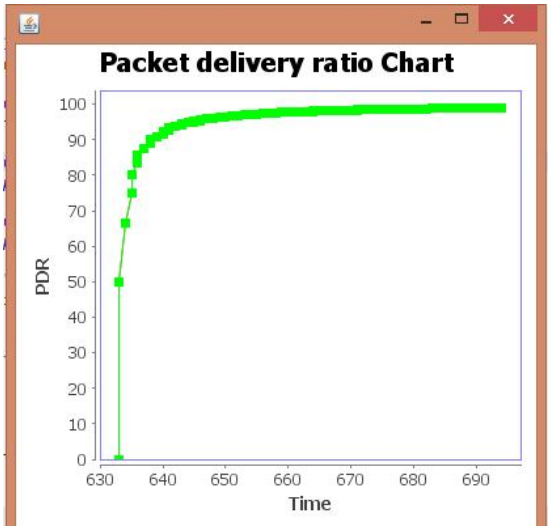

Fig. 5. Packet Delivery Ratio.

The next graph shows the Packet Loss ratio. In this again it has been observed that the packets los issues almost becomes zero as the times changes. Which means that there is very less packet loss ratio. This also helps us to understand that the packets are not affected by the energy of the sensor nodes.

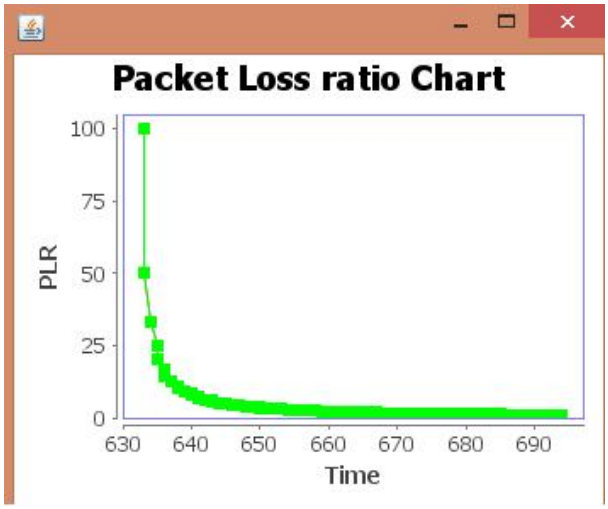

Fig. 6. Packet Loss Ratio.

7. CONCLUSION

Reliable and efficient WSN is the need of the today's communication technology and has been able to capture the attention of several researchers. The dual mode working of the sensor nodes in the WSN has been able to reduce the delay. The lifetime is improved by not eliminating the nodes directly when then go in the isolation state. Energy of the node being one of the several important factors, has to be worked upon by monitoring and with the help of the knowledge acquired by the survey. It also motivates to consider the mobile nodes and not just the stationary nodes and we can improve the computational power by optimal sensor deployment in wireless sensor network. Additionally proposed work managed to implement the resource in the presence of faulty nodes in the network. The comparison with the existing system is also mentioned.

Table 1. Comparison table with the existing system.

Sr. no	Existing system	Proposed system
1	The path is already decided for the packet transmission and does not undertake the energy level of the sensor nodes.	The path is decided using the shortest path algorithm and considers only those nodes whose energy level is more. Thus the data
2	The data packets are sent to the every node so the time and energy of the nodes is wasted	The data is transferred only to the cluster heads and then to the destination node. Thus saving the energy of the node.
3	The failure of the nodes and hole generation can lead to the network fragmentation.	In order to save the network from the fragmentation, we use the bridge protection algorithm making the network more Reliable.

Table 2. Comparison table of proposed and existing technical terms.

Goals	**Existing System**	**Proposed System%**
Throughput	60	80
Communication Range	30m sensing	Radio Frequency with clustered
Algorithm	ReDast	Shortest Path
Security	Network protection	Bridge Protection by Node security
Protocol	DSDV	DSR

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REFERENCES

[1] PushpenduKar, Student Member, IEEE and SudipMisra, Senior Member, IEEE, Reliable and Efficient Data Acquisition in Wireless Sensor Networks in the Presence of Transfaulty Nodes, IEEE TRANSACTIONS ON NETWORK AND SERVICE MANAGEMENT, 8th Jan, 2016.

[2] KealanMcCusker, Noel E. OConnor, Low-energy symmetric key distribution in wireless sensor networks, IEEE Transactions on Dependable and Secure Computing May/June 2011.

[3] CesareAlippi, Fellow, IEEE, Giuseppe Anastasi, Mario Di Francesco, and Manuel Roveri, Adaptive Sampling Algorithm for Effective Energy Management in Wireless Sensor Networks With Energy-Hungry Sensors, IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, VOL. 59, NO. 2, FEBRUARY 2010.

[4] LeventeButtya n, La szloCzap, and IstvanVajda, Detection andRecovery from Pollution Attacks in Coding-Based Distributed Storage Schemes, IEEE TRANSACTIONS ON DEPENDABLE AND SECURE COMPUTING, VOL. 8, NO. 6, NOVEMBER/DECEMBER 2011.

[5] Ing-Ray Chen, Member, IEEE, AnhPhan Speer, and Mohamed Eltoweissy, Senior Member, IEEE, Adaptive Fault-Tolerant QoS Control Algorithms for Maximizing System Lifetime of Query-Based Wireless Sensor Networks, IEEE TRANSACTIONS ON DEPENDABLE AND SECURE COMPUTING, VOL. 8, NO. 2, MARCH-APRIL 2011.

[6] Masanori Miyazawa and Michiaki Hayashi Rolf Stadler, vNMF: Distributed Fault Detection using Clustering Approach for Network Function Virtualization, 2nd Jan, 2015.

[7] Steven S. McClure, L. D. Edmonds, R. Mihailovich, A. H. Johnston, Fellow, IEEE, P. Alonzo, J. DeNatale, Member, IEEE, J. Lehman, and C. Yui, Radiation Effects in Micro-Electromechanical Systems (MEMS): RF Relays, IEEE TRANSACTIONS ON NUCLEAR SCIENCE, VOL. 49, NO. 6, DECEMBER 2002.

[8] ErfanSoltanmohammadi, Student Member, IEEE, Mahdi Orooji, Student Member, IEEE, and Mort Naraghi-Pour, Member, IEEE, Decentralized Hypothesis Testing in Wireless Sensor Networks in the Presence of Misbehaving Nodes, IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY, VOL. 8, NO. 1, Jan 2013.

[9] Tapas Kanungo, Senior Member, IEEE, David M. Mount, Member, IEEE, Nathan S. Netanyahu, Member, IEEE, Christine D. Piatko, Ruth Silverman, and Angela Y. Wu, Senior Member, IEEE, An Efficient k-Means Clustering Algorithm: Analysis and Implementation, IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 24, NO. 7, JULY 2002.

[10] VibhaParadkar, Gajendra Singh Chandel, KailashPatidar, Fault Node Discovery and Efficient Route Repairing Algorithm for Wireless Sensor Network (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 6 (2), 2015, 1710-1715.

[11] Saad Ahmad Khan, LadislauBlni, DamlaTurgut, Bridge protection algorithms A technique for fault-tolerance in sensor networks Ad Hoc Networks 24 (2015) 186199.

[12] Anasane, AboliArun, and Rachana Anil Satao. "A Survey on Various Multipath Routing Protocols in Wireless Sensor Networks." ProcediaComputer Science 79 (2016): 610-615.

[13] Kudale, Roma, and Rachana Satao. "STESA: Self Transmission Energy Saving Algorithm for road surveillance." 2013 Tenth International Conference on Wireless and Optical Communications Networks (WOCN). IEEE, 2013.

[14] Amit Sharma, KshitijShinghal , Neelam Srivastava, Raghuvir Singh,Energy management for wireless sensor network nodes International Journal of Advances in Engineering Technology, Vol. 1, Mar 2011.

[15] Borawake-Satao, Rachana, and Rajesh Prasad. "Mobility Aware Path Discovery for Efficient Routing in Wireless Multimedia Sensor Network." Proceedings of the International Conference on Data Engineering and Communication Technology. Springer Singapore, 2017.

[16] Borawake-Satao, Rachana, and Rajesh Prasad. "Comprehensive survey on effect of mobility over routing issues in wireless multimedia sensor networks." International Journal of Pervasive Computing and Communications 12.4 (2016).

[17] Borawake-Satao, Rachana, and Rajesh Shardanand Prasad. "Mobile Sink with Mobile Agents: Effective Mobility Scheme for Wireless Sensor Network." International Journal of Rough Sets and Data Analysis (IJRSDA) 4.2 (2017): 24-35.