Improved LeDiR technique for Fault Node Recovery in Wireless Sensor Network

Dr.Amit Verma[1], Parminder Kaur[2], Jaspreet Kaur[3],
[1]Professor and Head CSE,Chandigarh University , [2]Assistant Professor CSE,Chandigarh University , [3]Research Scholar CSE,Chandigarh University,
Amit.verma@cumail.in, jasdhaliwal3114@gmail.com

Abstract-Wireless Sensor Networks have gained attention of researchers because of its wide area applications like search and rescue operation and battlefield reconnaissance. WSN consist sensor nodes which monitor the environmental conditions such as temperature, humidity. These Sensor nodes are inherently prone to failure due to constrained resources and there deployment in harsh environment. Nodes get failed because of limited energy. In this study we are dealing with those nodes whose energy get exhausted and act as fault node. In previous techniques when failure occur then its neighbor node moves towards failure position which extend the path between nodes and some load varies due to individual relocation of nodes, And LeDiR uses block movement from recovering failure, it contain less number of children replace the fault node which effect the coverage of the network. In this study we propose an Improved LeDiR technique for fault node recovery by providing extra node (actor node) when the energy of the cluster head going down. Actor nodes have high capabilities, high power. Simulation results indicate that propose technique perform better than previous technique i.e. LeDiR

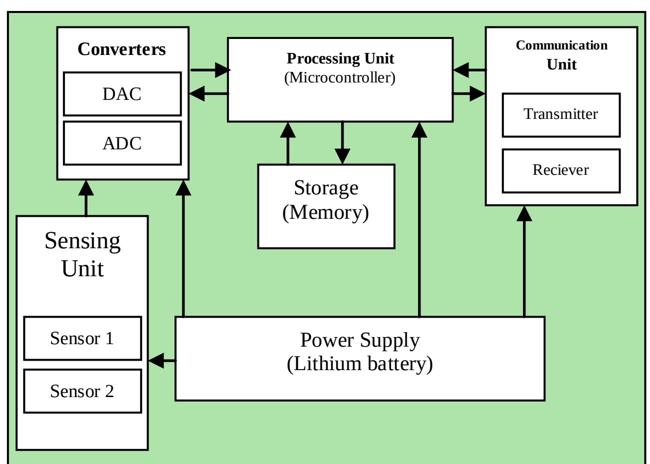
Keywords: WSN, LeDiR, actor nodes, RIM, DARA.

IJSER

Introduction

A WSN contains different types of sensor nodes that are used to sense and transfer the information to the base station or the next neighbour node. Recent technologies made it possible to minimise the cost and the bulkiness of the electronic devices. The wide range of sensors is available such as humidity, movement, temperature, pressure, and lightening conditions are monitored. Lower Power consumption restricts sensor to use the limited resources such as less low transmit power, memory requirement and less processing calculation. The aims is to provide better end-to-end delay, less number of dead nodes, a higher output, and overall lower power consumption compared to other protocols.

A state-of-the-art technology Wireless Sensor Networks (WSNs) is used to sense the data from all locations. Different parts of sensor nodes can be classified in six major units:



1. Communication Unit
2. Processing Unit
3. Sensing Unit
4. ADC/DAC Converters
5. Power Supply
6. Temporary Storage Unit

ISSN 2229-5518

Figure 1: General Architecture

Fig [1]. shows general architecture of sensor nodes. The sensors in the sensing unit interact physically with the environment. The sensed data is send to the ADC/DAC converters. The micro-controller receives digital data and does the required processing by using the temporary memory. The processed data are then transmitting to the transmitter of the communication unit for transmission towards the cluster head. On the other hand, the data from the Cluster Head is received by the receiver and then transferred to the processor for further processing. The power source used in sensor node can be a lithium battery. The two main parts where most of the power consumption occurs are:

1) The processing units and
2) The communication Unit.

The cluster head is either a mobile or fixed node, which has the capability to connect the sensor network to the internet where the user can access and process the data. Routing in WSNs is very essential due to the inherent traits that distinguish this network from other wireless networks or cellular networks. Limited memory and power are the parameters which affect the amount of data to process or store in an individual node. The architecture of typical WSN is shown in Figure 1.2.

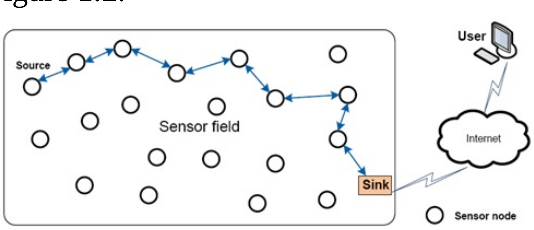


Figure 2: Wireless Sensor Network

The various areas including industry, commercial sector, or military fields are increasing its use rapidly all over the world. Healthcare becomes other area in industry and commercial sector where WSNs are being deployed. The deployed sensors help the hospitals and operators to monitor the patient's vital signs. The node recovery schemes are being discuss in section II. Mainly we are focus on Rim and LediR technique .we also compare these two in their performance in certain parameter.

Literature Survey

Intanagonwiwat, C [1] in 2003 has published a paper in which they described as follow:

- Authors proposed Directed Diffusion protocol to reduce the data relay to manage power consumption. It is a query transmission protocol. The collected data is sent only if they matches the query from the sink node thereby reducing the power consumption. In Directed Diffusion Protocol, there are several circle routes which are built when queries are broadcasted, result in wastage of power consumption and storage.

Asim, M., H. Mokhtar, and M. Merabti [2] in 2008 has published a paper in which they described as follow:

- Authors proposed fault management architecture, in which network is divided into virtual grid of cells, in each cells there are cell manager and gateway nodes to support management tasks. Nodes have equal no. of resources and back up each other in the case of recovery.

Asim, M., H. Mokhtar, and M. Merabti [3] in 2009 has published a paper in which they described as follow:

- Authors extend the cellular architecture and proposed a new technique in which network is divided into virtual grid to perform fault detection and recovery with minimum energy consumption. The proposed failure detection and recovery algorithm is compared with existing work and proven be energy efficient.

Akbari, A., and Neda B [4] in 2010 have published a paper in which they described as follow:

- Authors provide a cluster based and cellular approach for wireless sensor networks. This proposed algorithm is based on clustering to address many issues like, energy efficiency, routing and management. This algorithm is similar to previous as in that nodes are converted to virtual grid. But in this algorithm, if the connection with cluster head is break then choosing a new cluster head is energy consuming task, so at this place a backup node is placed which does not interrupt the previous functioning. These nodes are less energy consuming nodes and take no energy of network in order to recover cell manager failure.

Ho, J-H., et al. [5] in 2012 has published a paper in which they described as follow:

- Authors proposed an algorithm on ladder diffusion and ACO to resolve power utilization and broadcast routing troubles in wireless sensor systems. The algorithm balances the transmission load in order to increase the network lifetime of sensor node and transmission efficiency. Ladder diffusion algorithm avoid the generation of circle routes. To ensure the safety and data reliability ladder diffusion algorithm provide back-up routes to avoid wasted power consumption and giving out time when improvement the routing chart. The algorithm compared with DD and AODV and reduces power consumption by 52.36% and increase data forwarding efficiency by 61.11 as compared to Directed Diffusion.

Shih, H-C., et al [6] in 2013 has published a paper in which they described as follow:

- Authors proposed a fault node recovery algorithm in order to enlarge the life span of wireless feeler networks when some nodes shut down due to their energy depletion. The algorithm is based on grade diffusion algorithm combined with genetic algorithm. The algorithm replaces fewer sensor nodes and more reused routing path. The simulation result shows the increase the amount of active knobs up to 8.7 times decrease the rate of information lost by approximately 98.8% and decreases the rate of energy utilization by just about 31.1%.

Ameer A. Abbasi, Mohamed F. Younis [7] in 2013 has published a paper in which they described as follow:

- Authors have presented a LeDiR which overcomes the shortcomings of previous contemporary schemes. It relies on the local view of the node about network for recovery plan. LeDiR has partial

IJSER

ISSN 2229-5518

knowledge about route discovery activities.

Proposed work

LEDIR is a dispersed algorithm for Recovery all the way through Inward Motion. It does not achieve a network-wide scrutiny to review the crash of a knob crash. LEDIR activates a confined revival process by reposition the neighbours of the mislaid knob. LEDIR reduces messaging in the clouds and decreases the distance every entity node travels through the upturn.

LEDIR has been compared with Nearest Neighbor Algorithm and found to be superior to it. The validation for LEDIR is yet to be established and we here compare it with extra complicated approaches that need considerably superior part of the system state. We choose to assess the pros and cons plus classify the appropriateness of the accessible solutions to a variety of submission setups.

If in the existing LEDIR we can some get know and plan the critical nodes and critical sector we can to some extent solve the energy related issues with the actor node network and their movement. Also the scarcity of actor nodes due to their cost can be dealt with.

Step1: Deployment of random nodes.

Step2: Divide the network into virtual grid of cells and each cell consist equal no. of nodes.

Step3: Calculation of Critical sectors

Step4: Calculation of critical nodes

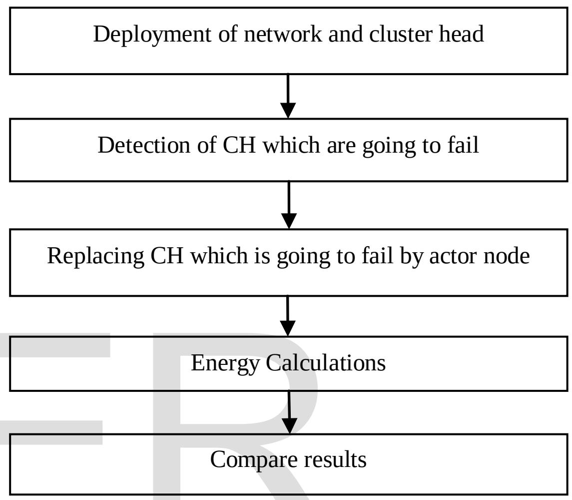
Step5: Enabling routing between cluster heads

Step6: Taking energy observation after each round.

Step7: Replacing the cluster head which going to fail with the actor node.

Step8: A critical chart will be developed and node with least criticality will be selected as a cluster head and do the most iteration.

Step9: Performance evaluation of improved LeDiR



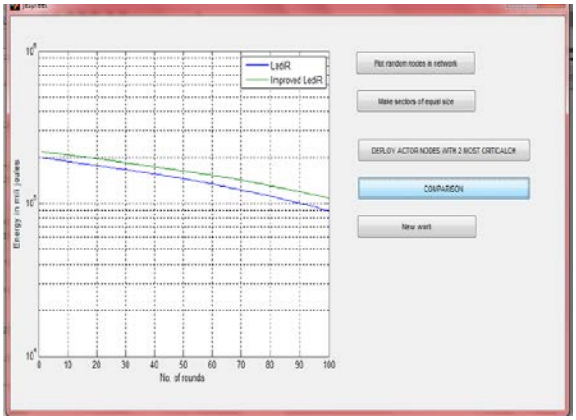
Algorithm of Proposed Methodology

```
Deploy N   \\ number of nodes
Divide Network into Grid
c (1:16)      \\ count for all sector
sector (1-16) = c(1-16)  \\ node count for each sector
set c(1-16)              \\in descending order.
If c(i) second last or last = critical sector.
E(1-N)        \\ Take energy reading of all nodes
if E(i)<T
then N(i)=critical node.
ECh(1-16)      \\Take energy reading of all Cluster heads
if ECh(i)<=0
then CH(i)=dead.
CH(i)← actor node
```

IJSER

ISSN 2229-5518

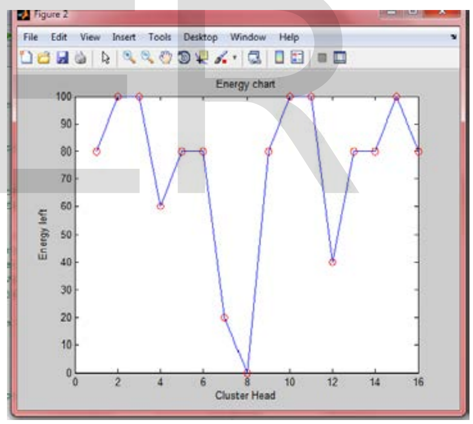
Results



In this figure we make comparison of over technique with the previous technique used. Over here the graph shows energy in mille joules vs. number of rounds. Blue line represents the LediR and green line curve show the improved LediR

Comparison Table

Energy in mili Joules (mJ)		
Round	**LEDIR**	**IMP. LEDIR**
Round 1	18881	20754
Round 2	17776	19729
Round 3	16742	18578
Round 4	15697	17434
Round 5	14622	16370
Round 6	13488	15283
Round 7	12326	14243
Round 8	11236	13187
Round 9	10125	12138
Round 10	9043	11015
Round 11	7933	10006
Round 12	6856	8867
Round 13	5721	7737
Round 14	4650	6667
Round 15	3554	5511
Round 16	2346	4412
Round 17	1221	3296
Round 18	102	2192
Round 19	0	1089
Round 20	0	9



This figure represents the energy chart in the network. The graph in plotted between the energy left and cluster head. When the energy exceed then there is drop down in cluster heads.

Conclusion

In this paper we presented a node recovery approach for Wireless sensor networks suffering from problem discussed earlier. The approach is based on intelligence use of

IJSER

existing information about neighboring nodes. We consider that improved LEDIR is more efficient to select the appropriate communication for each terminal according to their surrounding environment and topology. They also make use of network resource very well. We carry out the research, and established that the algorithm functions properly. We are functioning further on the execution to get better the algorithm. Our additional investigation includes experiments with high network stack and different topology. Additionally, analysis of the maintenance of the proposed algorithm is needed. The critical node selection is based only on the basis of energy. However, traffic load on nodes should also be considered for critical node selection. This will remain the area of future scope.

References

[1] Intanagonwiwat, c., et al. "Directed diffusion for wireless sensor networking." networking,transactions on 11.1 (2003),pp. 2-16.

[2] Asim, m., H. Mokhtar, and M. Merabti. "A fault management architecture for wireless sensor network." wireless communications and mobile computing conference, 2008. Iwcmc'08 ". International ieee, 2008.

[3] Asim,m., H.Mokhtar, and M.Merabti, "A cellular approach to fault detection and recovery in wireless sensor networks", ieee 2009 third international conference on sensor technologies and applications.

[4] Akbari, A., and Neda B., "Cluster-based and cellular approach to fault detection and recovery in wireless sensor networks." advanced computer theory and engineering (icacte), 2010 3rd international conference on. Vol. 5. Ieee, 2010.

[5] Ho, j-h., et al. "A ladder diffusion algorithm using ant colony optimization for wireless sensor networks." information sciences 192 (2012) pp.204-212.

[6]. Shih, h-c., et al. "Fault node recovery algorithm for a wireless sensor network."sensors journal, ieee 13.7 (2013),pp. 2683-2689.

[7]. Ameer a. Abbasi, mohamed f. Younis, senior member, ieee, and uthman a. Baroudi, "Recovering from a node failure in wireless sensor-actor networks with minimal topology changes", ieee transactions on vehicular technology, vol. 62, no. 1, january 2013.

[8]. Gorre, n., prudhvi r.,k.,and mohamed el-s., "Performance evaluation of least disruptive topology repair algorithm (ledir) using ns-2." network 1 (2014): 2.

[9] Ashwini Yenegur, Basawaraj.s.Mathpati. "An algorithm for fault node recovery of wireless sensor network". 2014. International journal of research in engineering and technology.

[10] Anuradha M S,Deepapatil. "An implementation of recovery algorithm for fault nodes in a wireless sensor network". 2014. International journal of research in engineering and technology.

[11] Abolfazl Akbari , Arash Dana , Ahmad Khademzadeh and Neda Beikmahdavi. " Fault detection and recovery in wireless sensor network using clustering". 2011.

IJSER

International journal of wireless & mobile networks.

[12] A.Manikandan, S.Rathinagowri. " An efficient detection and recovery of fault node in wireless sensor networks". 2014. International journal of innovative research in science, engineering and technology.

[13] Pavithra B Raj, R Srinivasan. " Fault node identification and route recovery indistributed sensor networks". 2014. International journal of advanced research in computer and communication engineering.

[14] Resmi.S.J and Jiby J Puthiyidam. " A study on fault node recovery algorithms in wireless sensor networks". 2014. International journal of advance research in.

[15] D.suguna. " Fault node recovery algorithm to enhance the lifetime of a wireless sensor network". 2014. International journal of computer science and mobile applications.

[16] Ameer A. Abbasi, Mohamed F. Younis, and Uthman A. Baroudi. " Recovering from a node failure in wireless sensor-actor networks with minimal topology changes". 2013. Ieee transactions on vehicular technology.

[17] G.Sumalatha , N.Zareena , Ch.Gopi Raju. " A review on failure node recovery algorithms in wireless sensor actor networks". 2014. International journal of computer trends and technology.

[18] P.Sivaranjanadevi and T.Poongothai. " Energy efficient routing and fault node replacement algorithm for wireless sensor networks". 2013. International journal of communications networking system.

[19] Elmira Moghaddami Khalilzad , Sanam Hosseini. " Recovery of faulty cluster head sensors by using genetic algorithm (rfga)". 2012. Ijcsi international journal of computer science issues.

[20] Shuo Guo, Ziguo Zhong and Tian he. " Find: faulty node detection for wireless sensor networks". 2009.

[21] Amlan Kumar Nayak and Bibhas Mishra. " Fault detection in wireless sensor network using distributed approach". 2012.

IJSER