# Enhanced Routing Technique for Energy Conservation in Wireless Sensor Networks

**Aaradhna Dubey, Rajneesh Agrawal, Rajender Singh Yadav**

***Abstract-*** ***– Wireless Sensor Networks are being applied in many real world applications in recent years. For real time applications WSN are proving to be the best mechanism. Some of the important application examples for WSN are environment monitoring, health monitoring and military etc. Such applications require real time data to be delivered on time for critical evaluations. To ensure the reliability in wireless sensor networks applications, power efficiency needs to be focused since sensor nodes have a limited power supply. The power efficiency in wireless sensor networks is a main factor to ensure the success of these networks.***

***The main sources of energy consumption in WSN are routing process and initialization process in routing mechanism which applies a significant impact on energy level. The works proposed and implemented by the various authors examined energy level and performance in terms of the entire process of routing mechanism. This work proposes to reduce the usage of the energy and long sustaining energy levels in the WSN. As energy level is critical in evaluating the performance therefore an algorithm is being proposed to evaluate the best route on the basis of the energy levels of the nodes alongwith other metrics. This will be useful in forwarding the packets to even long distances with the least burden on the nodes having less energy level.***

***The store & forward technique is being applied for reducing the energy usage involved in getting routing information from other nodes.***

***Keywords-*** ***Wireless Sensor Networks, Store & Forward Technique, Power & Energy Levels***

## I. INTRODUCTION

Awireless sensor networks (WSNs) is a formation of number of nodes (even hundred of it) that communicates with each other to perform sensing process. Normally each node equip with a battery to power it up, a main board with a chip and memory that acts as a CPU for the nodes. Each node has sensing capabilities thus to able sense the environment information (temperature, earthquake and etc) and process the information to be send through the network. Nodes can be hundred (even thousand of it) and each of the nodes connects each other to form a network communication. All the nodes will be monitor and control by a base station or sink which responsible to receive all information sensed by the nodes.

In recent years, wireless sensor networks have been applied into real time application such as environment monitoring, health monitoring and military where the data in this application is considered as critical. Hence, reliability communication is crucial since real-time data must meet the deadline given for data transmission.

**Manuscript received on June, 2013.**

Aaradhna Dubey, Student, Digital Comm, Department of Electronics & Communication, GGCT, Jabalpur, India.

Rajneesh Agrawal, Student, Dept. of Computer Science & Engg, SRIT, Jabalpur, India.

Rajender Singh Yadav, Asstt. Professor, Department of Electronics & Communication, GGCT, Jabalpur, India

To ensure the reliability in wireless sensor networks application, power efficiency needs to be focus since sensor nodes has a limitation in power supply. As usage of wireless sensor networks application is rapidly grows, the power efficiency in wireless sensor networks is a main factor to ensure the success of the technology. Therefore, power efficient in wireless sensor networks is a critical part and in recent years, this part has been focus by researchers to improve the efficiency in power usage.

Routing protocol mechanism can contribute high power consumption if the routing algorithm doesn't have power management capabilities. In multihop wireless sensor networks, the intermediate nodes responsible to relay packet from the source to its destination based on the routing tables which list all nearest neighbor node available. Thus, routing protocol requires an efficient way to manage the route path based on the routing table in sensor nodes. In recent years, most energy efficient routing are usually using lowest energy path consume at a node to use as a route selection based on the routing table information. According to the researchers, an obstacles need to be solve to have a successful wireless sensor networks application in the future which is energy limitations, computation power and communication resources. These obstacles relates with one problem; energy. Each of the elements mentioned by them has shown that energy is one of the most important factors in wireless sensor network environment. The comprehensive studies on current problem of wireless sensor networks energy constraint are further described in.

## II. EXISTING SYSTEM

According to [1], Wireless sensor network (WSN) is a technology which consists of a number of sensor nodes distributed among of an area usually for monitoring purposes. As the emerging of this technology has been rapidly increased nowadays, the successful of the wireless sensor networks application is highly depends on the reliable communication among the sensor nodes. One major problem in wireless sensor networks environment is the limitation of the physical resource in sensor nodes which energy resource has been identified as a critical constraint for achieving the demanding capabilities in wireless sensor networks application. Packet dissemination is one of the data transmission methods in wireless sensor networks routing protocol where it would cause high energy consumption in sensor node due to the high energy consuming for disseminate the packet through the network.

In [2] authors have discussed that future wireless systems are being designed for extremely high data rates and are directly contributing to the global energy consumption. This trend is undesirable not only due to the environmental concerns, but to cost as well since energy costs are becoming a significant part of the operating expenditures for the telecom operators. Recently, energy efficient wireless systems have become a new research paradigm. Cooperative communication has shown good potential in improving

coverage, providing robust radio links, reducing infrastructure cost, and has the possibility to reduce the total system energy consumption. This paper looks at possible deployment strategies for wireless networks that can reduce the energy consumption.
Paper by authors in [3] elaborates as Energy consumption is a main research issue in wireless sensor networks; and particularly in those where nodes collaborate to reach a goal. This article explores the energy consumption in mobile devices participating in a human-based wireless sensor network. Specifically, the paper proposes the use of a message predictor to help detect and reduce the number of unnecessary control packets delivered by the nodes as a way to keep updated the network topology. In order to evaluate this proposal, the Optimized Link State Routing protocol was modified to add a message predictor between the routing and the network layers.
Authors [4] propose a grid-based routing protocol which divides the network area for large side length of square cells by using cell rotation to reduce the number of relay nodes between the source node and the mobile sink. The proposed scheme divides each cell into multiple sub-cells, and assumes one or two sub-cells to be active-cells. Then, the proposed scheme confines the existing area of active nodes to each active-cell. Because the maximum transmission range is a fixed value, the side length of square cells can be enlarged by confining the area where the active node exists in each cell.
Authors in paper [5] discuss energy efficiency in wireless communications is one of important research issues. Previous studies on reducing the energy consumption of IEEE 802.11 WLAN systems mainly focused on the energy consumption of a single-link transmission only. However, due to its carrier sensing property, all the WLAN stations in the network receive the transmitted frames. Hence, this single-link transmission not only consumes the energy of the transmitter and receiver of the link, but also consumes the energy of the other stations. Moreover, most of the previous works on energy efficiency optimization problems were considered in MAC perspectives.
According to authors [6] Wireless Sensor Networks (WSNs) consist of small nodes with sensing, computation and wireless communications capabilities. Evolution in wireless sensor network has broadened its pervasive and ubiquitous applications in numerous fields. These applications often require accurate information collecting as well as uninterrupted, prolonged active service. Routing protocols have significant impact on the overall energy consumption of sensor networks.

## III. PROPOSED ALGORITHM

Step 1: The Nodes will be initialized with an initial energy level available on them.

Step 2: A network topology shall be created with moving nodes and experiments shall be done with varying number of nodes.

Step 3: Route decision shall be done on the basis of energy levels of the nodes by retrieving their current energy level and hops as in DSDV.

Step 4: For deciding the routes a mathematical evaluation shall be done to decide the next hop address by taking energy levels of the neighbors into consideration.

Step 5: Packets shall be forwarded using CBR traffic generator of the NS2

Step 6: Store and forward technique shall be used to add the energy levels of the each of the communicating nodes in the network for future references.

Step 7: The PDR (packet delivery ratio) and Network throughput shall be calculated in a fixed time interval for measuring the energy level performance of the nodes. Also average energy consumption shall be checked to find the performance of the network.
Flow Chart drawn for the proposed work is as follows:

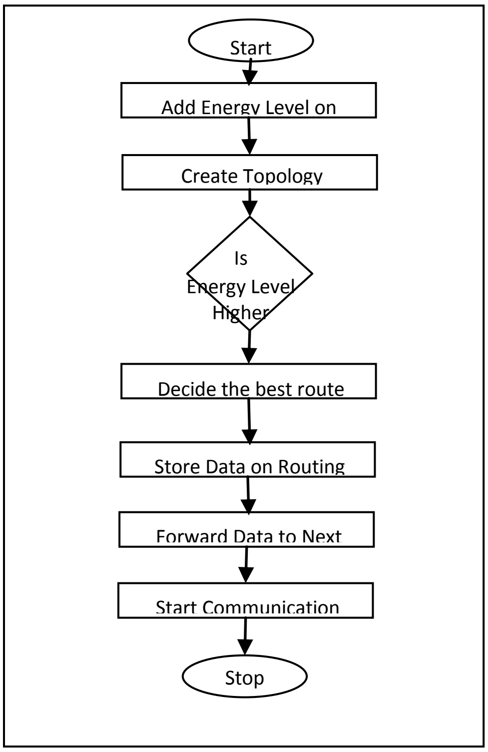


Fig.1 Flowchart Showing Proposed Work

## IV. RESULTS & DISCUSSION

The proposed work has been implemented using NS2 simulator and 802.11 wireless protocols have been used. DSDV protocol has been modified for incorporating the Energy Level and routing table of DSDV protocol has been added with an energy level column which is used to decide the route as per the proposed algorithm. Throughput of the existing DSDV and modified DSDV has been calculated for various node counts (5, 10, 15, 20, 25, 30, 35, 40, and 50). Following graphs shows that the modification done improves the throughput of the system which indicates that the proposed work improves the energy performance of the overall system.
We have proposed a WSN network which is energy efficient and performs high speed communication even when the nodes are away from each other. We will also consider to have energy level of the nodes involved in making route decision alongwith the other metrics.
Figure 2 depicts the throughput for packet size 128 bytes which shows that the throughput is high on all cases i.e. for both low and high density networks proposed work gives the better throughput and high energy performance.

International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249 – 8958, Volume-2, Issue-5, June 2013

Table:-I

Throughput of Conventional Vs. Proposed Work for Packet Size 128 Bytes

| Number of Nodes | Existing | Modified |
|---|---|---|
| 2 | 325.68 | 338.75 |
| 5 | 338.09 | 338.32 |
| 10 | 311.95 | 321.14 |
| 15 | 325.83 | 337.17 |
| 20 | 328.64 | 341.24 |
| 25 | 327.20 | 330.16 |
| 30 | 320.97 | 325.32 |
| 35 | 313.41 | 319.67 |
| 40 | 326.85 | 334.21 |
| 50 | 296.05 | 301.82 |

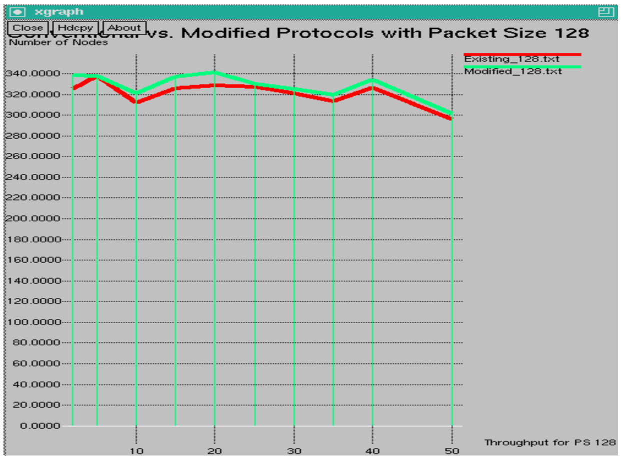


*Fig.2* Throughput of Conventional Vs. Proposed Work for Packet Size 128 Bytes

Figure 3 depicts the throughput for packet size 256 bytes which shows that the throughput is high on all cases i.e. for both low and high density networks. Even with the bigger packet size the proposed work is performing better than the existing work.

From the discussion above it is expected to work for energy conservation in WSN nodes is required to be focused on maximum local processing and least processing during input-output. Also decision making for route detection can be made efficient to reduce the energy usage on each node. Energy levels of the nodes can also be taken into consideration during route decision and data transfers over the network.

Table:-II

Throughput of Conventional Vs. Proposed Work for Packet Size 256 Bytes

| Number of Nodes | Existing | Modified |
|---|---|---|
| 2 | 513.69 | 513.81 |
| 5 | 515.44 | 515.21 |
| 10 | 490.36 | 515.45 |
| 15 | 478.86 | 484.54 |
| 20 | 457.85 | 458.02 |
| 25 | 476.14 | 479.72 |
| 30 | 428.64 | 449.44 |
| 35 | 400.50 | 409.91 |
| 40 | 385.55 | 389.25 |
| 50 | 372.21 | 417.43 |

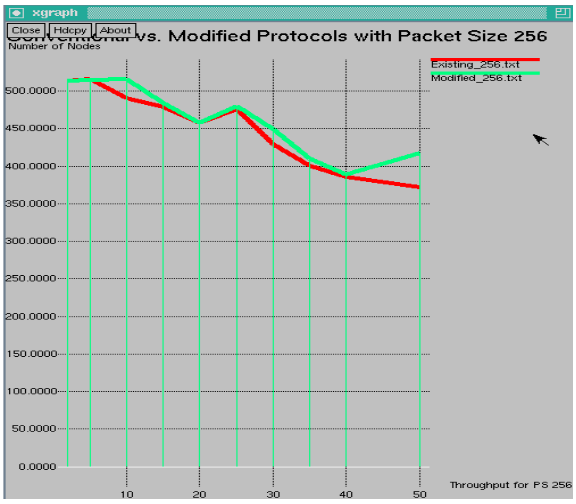


*Fig.3* Throughput of Conventional Vs. Proposed Work for Packet Size 256 Bytes

## V. FUTURE WORK

This work can further be tested on other routing protocols such as AODV, DSR etc and can be applied in future for real application which require energy efficient networking nodes.

## REFERENCES

[1] Ismail Ahmedy, Md Asri Ngadi, Syaril Nizam Omar "Using Store-Forward Technique to Conserve Energy in Wireless Sensor Networks: Initial Step for Routing Mechanism".

[2] Tafzeel ur Rehman Ahsin and Slimane Ben Slimane, "Energy Efficient Resource Allocation and Deployment Strategies for Wireless Networks", 978-1-4673-0229-6 © 2012 IEEE.

[3] Roc Meseguer, Carlos Molina, Sergio F. Ochoa3, Rodrigo Santos, "Reducing Energy Consumption in Human-centric Wireless Sensor Networks", 2012 IEEE International Conference on Systems, Man, and Cybernetics October 14-17, 2012, COEX, Seoul, Korea, 978-1-4673-1714-6 © 2012 IEEE

[4] Hidetoshi Kajikawa, I-Te Lin, and Iwao Sasase, "Grid-based Routing Protocol Using Cell Rotation to Reduce Packets Latency and Energy Consumption in Wireless Sensor Networks", 3rd IEEE International Research Student Workshop, 978-1-4244-8790-5 © 2012 IEEE

[5] Byoung Hoon Jung, Hu Jin, and Dan Keun Sung, "Adaptive Transmission Power Control and Rate Selection Scheme for Maximizing Energy Efficiency of IEEE 802.11 Stations", 2012 IEEE 23rd International Symposium on Personal, Indoor and Mobile Radio Communications - (PIMRC), 978-1-4673-2569-1 © 2012 IEEE

[6] Raghunandan.G.H, Sagar Metri, "A Novel Approach to Increase Overall Efficiency in Wireless Sensor Networks", 2012 International Conference on Computing, Electronics and Electrical Technologies [ICCEET], 978-1-4673-0210-4 © 2012 IEEE

[7] J. Zhao, R. Govindan. "Understanding packet delivery performance in dense wireless sensor networks," Proc. of 1st International Conference on Embedded Networked Sensor Systems, pp. 1-13, 2003.

M. Z. Zamalloa, B. Krishnamachari. "Analyzing the transitional region in low power wireless links," Proc. of 1st International Conference on Sensor and Ad hoc Communications and Networks, pp. 517-526, 2004.

[9] W. Fang, D. Qian, Y, Liu. "Transmission control protocols for wireless sensor networks," Journal of Software, vol. 19, no. 6, pp. 1439-1451, 2008

[10] S. Kim, R. Fonseca, D. Culler. "Reliable transfer on wireless sensor networks," Proc. of 1st International Conference on Sensor and Ad Hoc Communications and Networks, pp. 449-459, 2004

[11] A. Nosaratinia, T. E. Hunter, A Hedayat. "Cooperative communication in wireless networks," IEEE Communications Magazine, vol. 42, no. 10, pp. 74-80, 2004

[12] J. E. Wieselthier, G. D. Nguyen, A. Ephremides. "Algorithms for energy-efficient multicasting in ad hoc wireless networks,"

ACM/Springer Mobile Networks and Applications, vol. 6, no. 3, pp. 251- 263, 2001
[13] S. Biswas, R. Morris. "ExOR: opportunistic multi-hop routing for wireless networks," ACM SIGCOMM Computer Communication Review, vol. 35, no. 4, pp. 133-144, 2005
[14] G. Fairhurst, L. Wood. "Advice to link designers on link Automatic Repeat reQuest (ARQ)," IETF RFC, 2002
[15] Q. Cao, T. Abdelzaher, T. He, R. Kravets. "Cluster-based forwarding for reliable end-to-end delivery in wireless sensor networks," Prof. of 25th Annual IEEE Conference on Computer Communications, pp. 1928-1936, 2007
[16] J. Wang, H. Zhai, W. Liu, Y. Fang. "Reliable and efficient packet forwarding by utilizing path diversity in wireless ad hoc networks," Proc. of IEEE Military Communications Conference 2004, pp. 258-264, 2004