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# Review Paper on Modified LEACH Protocol for Network Lifetime Enhancement

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***Abstract:*** ***There are different roles of sensors (nodes) in Wireless Sensor Network (WSN). These are sense data, collect data from neighbors, then process this data, and forward this processed data to the other sensor node or to the base station. All these processes consumes energy. The energy consumption level is higher in transmitting stage as compared to sensing data, collecting data and processing the data stage. The requirement of transmission power is directly depends on the distance between the sender node and receiver nodes. This paper explains structure and working of Low Energy Adaptive Clustering Hierarchy (LEACH) protocol. This paper is based on survey of LEACH protocol and its variants protocols.***
***Keywords: WSN, LEACH, LEACH-T, LEACH-TLCH, TL-LEACH, LEACH-SCH, 2L-LEACH-M, IDE-LEACH, LEACH-I, LEACH-R, P-LEACH, EESNR.***

## I. INTRODUCTION

Wireless Sensor Networks contains number of tiny sensor nodes [4]. In a wireless sensor network, when battery dies, a node is not useful [3]. So to overcome this problem different protocols were introduced. But hierarchical routing protocols are more useful. LEACH protocol is most popular routing protocol. It uses cluster based routing to minimize energy consumption [1].
The Wireless Sensor Network generally consist of randomly deployed sensors. The available nodes are used to sense the data. If the node is a Cluster Head, it gathers data from neighbouring nodes, then processes these collected data and finally sends this data to the sink node. The nodes operates on battery, therefore protocols designed for WSN should be energy efficient. The analysis of this protocol can be done by optimizing the parameter used. The term energy efficiency shows the optimum utilization of the link, resources to achieve required goals like maximum throughput, maximum lifetime and minimum delay, connectivity etc [2].

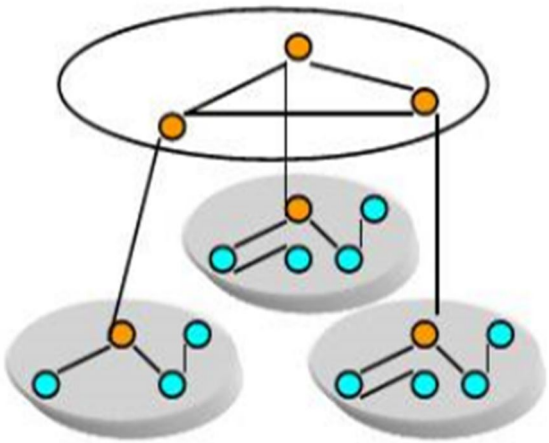

Fig.1: Structure of clustered wireless sensor network [1]

In WSN, nodes are grouped into different clusters. Each cluster consist of cluster head. The nodes in a cluster sends their data to the cluster head. Then the cluster head aggregates this data and send it to the sink node. The following Fig. 1 shows a clustered WSN which consist of three clusters and each cluster consist of a cluster head and remaining sensor nodes [1]. The consumption of energy can be examined at both levels i.e. at node [8] as well as at network level. At node level, energy consumption is observed with respect to energy per correctly received bit (Joules) or energy per reported events (unique). Another way to analyse energy consumption is network lifetime. Network lifetime is time for which the network is operational. Apart from this, the time during which the nodes present in network, fulfil their tasks is also known as network lifetime.

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## II. LEACH

LEACH protocol is the most popular routing protocol. It uses cluster based routing to minimize energy consumption. LEACH protocol is an energy efficient protocol. This protocol is implemented in heterogeneous network. In LEACH protocol, network is spatially divided into clusters. Each cluster consists of number of sensor nodes and out of this sensor nodes one node is elected as a Cluster Head. Cluster head collects data from remaining sensor nodes in the cluster and then send to base station [2].

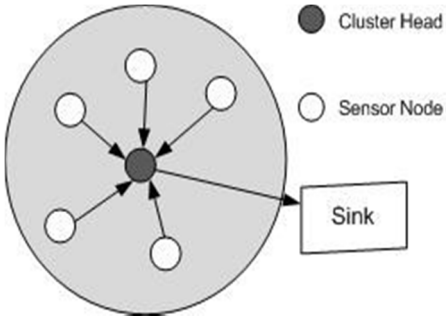



Fig.2: Structure in LEACH protocol [2]

The LEACH protocol works in four different phases. This are advertisement phase, set-up of cluster phase, schedule creation phase and data transmission phase.

The advertisement phase creates clusters, selects cluster head and advertises the remaining nodes in the cluster about its election. For advertising it uses Carrier Sense Multiple Access- Media Access Control (CSMA- MAC) protocol. Carrier Sense Multiple Access is a Media Access Control protocol in which a node verifies the absence of other traffic before transmitting on a shared transmission medium.

The second phase is set-up of cluster phase. In this phase, the remaining nodes of the cluster gives reply to the CH about their presence in the cluster. This phase also uses CSMA-MAC protocol [2], [4].

Next is schedule creation phase. In this phase, a Time Division Multiple Access (TDMA) schedule is created by cluster head for all the members for receiving data from other sensor nodes of that clusters [9]. Time Division Multiple Access is a channel access method useful for shared medium networks. It allows different users to share the same frequency channel by dividing the signal into different time slots. The nodes transmit data in rapid succession, one after the other, each using its own time slot. The energy consumption at each sensor node depends on the energy required for generation of data and energy required to be reached successfully [4].

Next phase is data transmission phase. In this phase, Cluster head collects data from remaining sensor nodes in the cluster and then send this data to sink node [10].

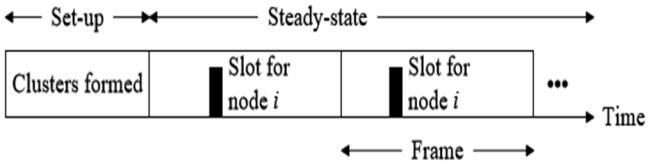



Fig.3: LEACH Protocol process [5]

LEACH protocol employs a cyclic process. It involves cluster set up stage and steady state stage. The steady state stage must be longer than the set up stage. It helps to reduce unnecessary energy costs. At the stage of cluster forming, a node randomly selects a number between 0 and 1 [5]. This number is compared with the threshold values. If the number is less than the threshold values, then node becomes cluster head otherwise it becomes common mode. After formation of cluster the nodes start to transmit the inspection data. Cluster heads receive data sent from the members of the cluster, the received data was sent to the gateway after fused [5]. The execution process of the Wireless Sensor Network with LEACH consist of construction of motes, frame the network ,selection of the cluster heads , Divide the network in to various clusters etc. At the end of round, check the energy consumption of every node. If the energy level is too low, then again select cluster head. Otherwise proceed the output through selected cluster head [6].

## III. LITERATURE REVIEW

Monika, Sneha Chauhan, Nishi Yadav proposed LEACH-I Algorithm for WSN. Proposed protocol reduces the consumption of the network resource as compare to LEACH algorithm in each round. Major focus of this paper is based on maximizing node-degree [1]. In another paper, Pallavi Yarde, Sumit Srivastava, Kumkum Garg focuses on number of alive nodes remains and energy consumption/residual energy of the nodes/network at the last of communication. The analysis is done among three protocols LEACH, LEACH-TLCH and one proposed protocol, Tertiary Head LEACH protocol. The proposed work emphasizes on improving the number of alive nodes and energy consumption in the network at the end of the communication [2].

Reenkamal Kaur Gill, Priya Chawla and Monika Sachdeva analyses LEACH protocol. This paper also explains different phases of LEACH protocol. It also includes advantages and disadvantages of LEACH and various kinds of attacks on this routing protocol. It explains Sybil Attack, Selective Forwarding attack & HELLO Flooding Attack which degrades the performance of LEACH protocol by dropping, altering, spoofing or replying the packets [4].

Chunyao FU , Zhifang JIANG, Wei WEI and Ang WEI proposed LEACH-TLCH protocol. This proposed protocol is LEACH Protocol with Two Levels Cluster Head. The probability of CH is more to die because it has to aggregate data from the remaining nodes of the cluster and forward that data to next hop or sink. To overcome the situation of dying CH earlier, a LEACH-TLCH is introduced. This protocol is based on LEACH Protocol. The methods of cluster-head selection and clusters forming are similar to the LEACH protocol. It introduces one more level of CH in the cluster. It is called as Secondary Cluster Head (SCH). The selection of SCH is depend on energy as well as distance. LEACH-TLCH protocol is proposed to balance the energy consumption of the entire network and extend the life of the network [5].

Mustafa A. Al Sibahee, Songfeng Lu, Mohammad Z. Masoud, Zaid Alaa Hussien, Mohammed Abdulridha Hussain1, Zaid Ameen Abduljabbar proposes a new routing protocol called LEACH-T. It is based on the data-routing techniques and the technique of power consumption of routing protocols. This protocol is a hopeful solution for the WSN problems. This paper compares LEACH protocol with new protocol, which optimizes the total energy consumed by all nodes in the network by using known conservation techniques. The new protocol LEACH-T improve network performance by prolonging network lifetime and reducing power consumption in LEACH protocol [11].

Deng Zhixiang, Qi Bensheng proposed TL-LEACH protocol. Due to the limitation of power and memory size for WSN, the routing protocol of wireless sensor networks must built small routing information and must reduce the power consumption as much as possible. This paper consist of analysis of LEACH protocol and PEGASIS protocol . They use this two protocols for the reference of the ideas of reducing power dissipation and a three-layered routing protocol for WSN based on LEACH (TL-LEACH) is proposed. Then, this is simulated and the simulation results show that TL-LEACH protocol greatly improves WSN lifetime than LEACH protocol [12].

Another paper is Two-Level Routing Protocol for Mobile Sensor Network Based on LEACH Algorithm. In this paper Cunguang Zhang, Jianming Liu, Hongzhou Li, Xiaohong Jiang proposes proposes a novel routing protocol supporting node mobility called "2L-LEACH-M" protocol [13].

In another paper, Kamaljot Singh had analyzed the various LEACH Based protocols. Paper consists of analysis of LEACH-A; LEACH-B; LEACH-C; LEACH-Cell; LEACH-E; LEACH-EEE; LEACH-F; LEACH-K; LEACH-M; LEACH-Multihop; LEACH-S; LEACH-TL;LEACH-V protocols. The utilization of energy is very important task in wireless sensor networks. It increases the lifetime of the sensor network. By considering the energy utilization as important task the researchers had explored different new protocols in WSN. LEACH protocol is the most common protocol among the all present energy efficient Sensor networks protocols. All other protocols are developed by taking the LEACH as reference [14].

Shweta Gupta, Nikhil Marriwala recommends a different collecting procedure named as Improved Distance Energy based LEACH (IDE-LEACH) protocol. It is based on energy and distance for homogeneous and heterogeneous WSN. IDE-LEACH uses the enduring energy of the nodes and an expanse of nodes from the sink node. The suggested procedure increases the steadiness, lifespan of the network and simulation outcome displays that the IDE-LEACH is superior to the LEACH. IDE-LEACH decides that nodes which are far from the sink node will become cluster head only when they have a satisfactory energy for accomplishment this duty. This protocol improves network lifetime, stable region and quantity of WSN. To make better use of the energy, it uses the enduring energy and an expanse built cluster head election scheme [15].

Ankit Solanki, Prof. Niteen B. Patel described about evolution of routing protocol with its important classification for wireless sensor network. In this paper, survey of different classification of routing protocol is done with the description of classification into four main schemes: Network Structure Scheme, Communication Model Scheme, Topology Based Scheme and Reliable Routing Scheme. Developed routing protocol is LEACH-SCH. It is a multi clustering type of routing protocol for some definite wireless

sensor network. The simulation results of LEACH-SCH protocols are compared with LEACH protocol for its network life time [16].

V. Loscrì, G. Morabito, S. Marano builds a two-level hierarchy to realize a protocol which saves better the energy consumption. Proposed TL-LEACH protocol uses random rotation of local cluster base stations i. e. primary cluster-heads and secondary cluster-heads. Paper evaluated the performances of TL-LEACH protocol with NS-2. TL-LEACH protocol outperforms the LEACH in terms of energy consumption and lifetime of the network [17].

In another paper Manisha Guray, Nikhil Marriwala, Nafeesh Ahmed explains Hybrid Leach Based Cluster Head Election in Wireless Sensor Networks. Different routing protocols like LEACH protocol, HEED protocol and D-HEED protocol have abilities to attain energy efficiency. This paper includes comparison of IH-LEACH protocol is with H-LEACH protocol. This paper proved that IH-LEACH protocol is efficient than H-LEACH protocol. In this paper, simulations for LEACH, H-LEACH, IH-LEACH are done using MATLAB [18].

Yong-Zhen Li, Ai-Li Zhang, Yu-Zhu Liang proposes a hierarchical routing improved algorithm (i.e, LEACH-R) based on the LEACH algorithm. This protocol solves the disadvantage that cluster-head frequently built cluster and consumes lots of energy. The simulation results in this paper shows that the improved algorithm makes the more balanced energy distribution & the LEACH-R is better than LEACH-M and LEACH-C in terms of system lifetime/quality of the network lifetime and energy consumption in large-scale networks [19].

Abdul Razaque, Musbah Abdulgader, Chaitrali Joshi, Fathi Amsaad, Mrunal Chauhan introduce PEGASIS-LEACH (P-LEACH) protocol. It is a near optimal cluster-based chain protocol that is an improvement over PEGASIS and LEACH both protocol. P-LEACH protocol uses an energy- efficient routing algorithm to transfer the data in WSN [20].

Awais Ahmed, Muhammad Adeel Pasha , Zahoor Ahmad, Shahid Masud and Axel Sikora propose a new hierarchical routing protocol suitable for large area environmental monitoring. The proposed Energy Efficient Sensor Network Routing (EESNR) Protocol resolves the issues faced by traditional multi-hop routing protocols such as LEACH, M-LEACH and I-LEACH, and it enhances the lifespan of each WSN node that results in an increased lifespan of the whole network [21].

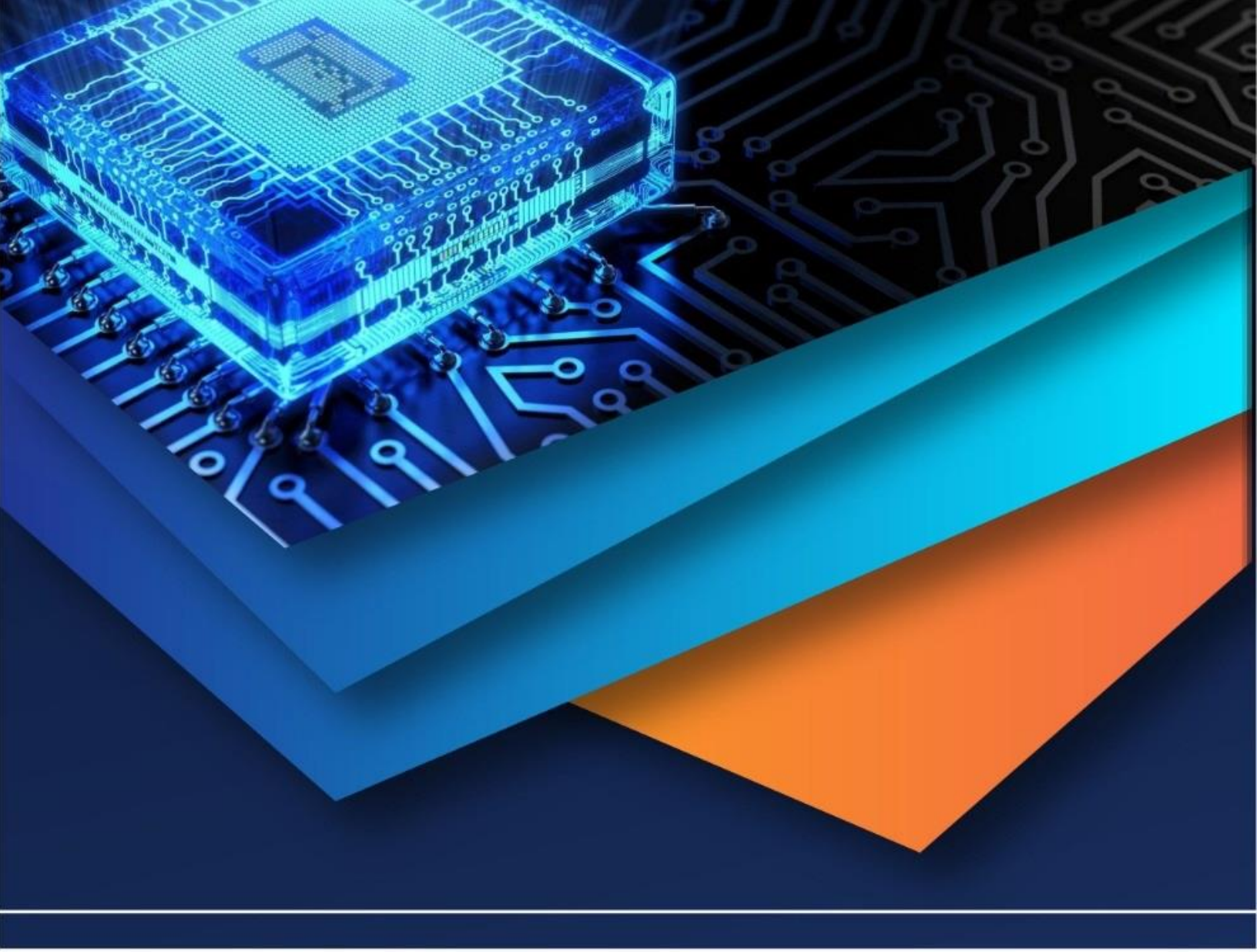
## IV. CONCLUSION

There are number of ways available to analyse the performance of Wireless sensor networks. To make the protocol energy efficient, designer must concentrate on the energy consume by sensors of the networks. There are different ways to further improve the energy efficiency of the LEACH protocol. This paper explains structure and working of Low Energy Adaptive Clustering Hierarchy (LEACH) protocol. It also includes survey of different LEACH protocols like LEACH-T, LEACH-TLCH, TL-LEACH, LEACH-SCH, 2L-LEACH-M, IDE-LEACH, LEACH-I, LEACH-R, P-LEACH, EESNR protocol.

## REFERENCES

[1] Monika, Sneha Chauhan, Nishi Yadav, “LEACH-I Algorithm for WSN”, International Journal of Innovative Research in Computer and Communication Engineering, Vol. 4, Issue 3, March 2016.
[2] Pallavi Yarde, Sumit Srivastava, Kumkum Garg, “A modified energy efficient protocol for optimization of dead nodes and energy consumption in wireless sensor networks”, 2017 Eleventh International Conference on Sensing Technology (ICST).
[3] Khushboo Manohar, A.I. Darvadiya, “Study of Leach Protocol- A Review”, International Journal of Modern Trends in Engineering and Research (IJMTER) Volume 01, Issue 06, [December - 2014].
[4] Reenkamal Kaur Gill, Priya Chawla and Monika Sachdeva, “Study of LEACH Routing Protocol for Wireless Sensor Networks”, International Conference on Communication, Computing & Systems (ICCCS– 2014)
[5] Chunyao FU, Zhifang JIANG, Wei WEI and Ang WEI “An Energy Balanced Algorithm of LEACH Protocol in WSN”, IJCSI International Journal of Computer Science Issues, Vol. 10, Issue 1, No 1, January 2013.
[6] Dr. S. G. Santhi, N. Tamilarasi, “A Comparative Study on LEACH Protocol for Wireless Sensor Network”, International Journal of Innovative Research in Computer and Communication Engineering, Vol. 5, Issue 6, June 2017.
[7] H. Karl, A. Willig, “Protocols and Architecture for Wireless Sensor Networks”, John Wiley and sons publication, 2005
[8] Heinzelman W.R., “Energy efficient protocol for wireless micro-sensor networks”, published in proceeding of the Hawaii International Conference on system science, January 4-7, 2000, Maui, Hawaii, pp. 110, 2000
[9] Akkaya, Kemal, and Mohamed Younis. "A survey on routing protocols for wireless sensor networks." Ad hoc networks 3.3 (2005): 325-349.
[10] K. Sohrabi et al., Protocols for self-organization of a wireless sensor network, IEEE Personal Communications 7 (5) (2000) 16–27.
[11] Mustafa A. Al SIBAHEE, Songfeng LU, Mohammad Z. MASOUD, Zaid Alaa HUSSIEN, Mohammed Abdulridha HUSSAIN, Zaid Ameen ABDULJABBAR, “LEACH-T: LEACH Clustering Protocol Based on Three Layers”, 2016 International Conference on Network and Information Systems for Computers.
[12] Deng Zhixiang, Qi Bensheng, “Three-layered Routing Protocol for WSN Based on LEACH Algorithm”.
[13] Cunguang Zhang, Jianming Liu, Hongzhou Li, Xiaohong Jiang, “Two-Level Routing Protocol for Mobile Sensor Network Based on LEACH Algorithm”, 2010.
[14] Kamaljot Singh, “WSN LEACH Based Protocols: A Structural Analysis”,2015.

[15] Shweta Gupta, Nikhil Marriwala, "Improved Distance Energy Based LEACH Protocol for Cluster Head Election in Wireless Sensor Networks", 4th IEEE International Conference on Signal Processing, Computing and Control (ISPCC 2k17), Sep21-23, 2017, Solan, India.
[16] Ankit Solanki, Prof. Niteen B. Patel, "LEACH-SCH: An Innovative Routing Protocol for Wireless Sensor Network", 4th ICCCNT July 4 - 6, 2013.
[17] V. Loscrì, G. Morabito, S. Marano, "A Two-Levels Hierarchy for Low-Energy Adaptive Clustering Hierarchy (TL-LEACH)", 2005.
[18] Manisha Guray, Nikhil Marriwala, Nafeesh Ahmed, "Hybrid Leach Based Cluster Head Election in Wireless Sensor Networks", 4th IEEE International Conference on Signal Processing, Computing and Control (ISPCC 2k17), Sep21-23, 2017, Solan, India.
[19] Yong-Zhen Li, Ai-Li Zhang, Yu-Zhu Liang, "Improvement of Leach Protocol for Wireless Sensor Networks", 2013 Third International Conference on Instrumentation, Measurement, Computer, Communication and Control.
[20] Abdul Razaque, Musbah Abdulgader, Chaitrali Joshi, Fathi Amsaad, Mrunal Chauhan, "P-LEACH: Energy Efficient Routing Protocol for Wireless Sensor Networks",2016.
[21] Awais Ahmed, Muhammad Adeel Pasha, Zahoor Ahmad, Shahid Masud and Axel Sikora, "Energy Efficient Sensor Network Routing (EESNR) Protocol For Large Distributed Environmental Monitoring Applications", the 9th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications 21-23 September, 2017, Bucharest, Romania.



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