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Comparative analysis of leach and improved leach protocol for apt data transmission in wireless sensor networks

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Abstract
Wireless sensor network is a network which engross large number of sensor nodes for data transmission. Data Transmission is transfer of relevant data from point-to-multipoint wireless communication channel. However efficiency of data transmission and energy consumption while data transferring depends largely influenced by the kind of protocol being used. Lower Energy Adaptive Clustering Hierarchy Leach and improved leach are kind of different protocols from the same class which can pomp different results and variations when used under same number of rounds. This paper appraises the comparative analysis of both the protocol in tabular and graphical form by using MATLAB software and Ant Colony Optimization (ACO) algorithm.

Keywords: wireless sensor network, data transmission, lower energy adaptive clustering hierarchy, ACO

1. Introduction
Data transmission in general is the transfer of data over a thorough (point-to-point) or cursory (point-to-multipoint) communication channel [1]. Such channels entail wires usually made of copper, optical fibers, storage media and wireless communication channels. Data may be either in the kind of electromagnetic signal or infrared signal. As we are stocking with wireless communication and in this crate with Wireless Network Sensors or WSNs. Wireless Sensor Networks (WSNs) are poised of small sensor nodes which are sprinkled in uniform as well as non-uniform or random style. The nodes are very miniature in size and depart from few hundreds to thousands of nodes. These nodes are sprinkled for the sensing of data and after sensing, the data has to be collected and constricted. This accumulated data is then forward to the main node which is called as Base Station (BS) [2]. The scope of main node or BS is to make contact with the client node which can only be done through BS. Vast supply of energy is dissipated by the nodes in this process. WSNs are proficient to fluctuate themselves. These networks can systematize themselves after the usual intervals of time [3]. WSNs are highly energy constraint networks which are incorporated with a restricted battery or power source which is not adequate to recharge or reinstate. Hence, energy efficiency is one of the major affairs in WSNs for their adequate working [3] [4]. Various techniques for routing have been mentioned earlier they are still facing many hindrances. The approach of hierarchical routing plays an accountable role in which the transference of data takes place by the formation of Cluster Head (CH) within the cluster [5]. The accession of Cluster Heads (CHs) counts on the silly selection of nodes. In hierarchical routing, all nodes play the significant roles and hence works on the accumulation of two layers. The layer which is on the upper side is used to select the CHs and the lower layer is fortified for the process of routing [6]. Lower Energy Adaptive Clustering Hierarchy (LEACH) protocol is one of an efficient hierarchical routing protocol which is also a cluster based protocol and possess the accumulation of distributed clusters. In LEACH protocol, the behaviour of all nodes is homogeneous and they perform the same task which is only the hindrance of LEACH [17, 18, 19]. However later on, an improved version of LEACH protocol is mentioned and used for better efficiency and data transmission. In improved LEACH, The nodes with higher energy were addressed as CHs, so that the information transmission from one node to another can become an efficient process. Ant Colony Optimization (ACO) algorithm, which works on the behaviour of real ants is used for the efficient, smooth and speedy transmission of data. ACO algorithm is applied for both the protocols [10] to boost the longevity of a network by the alleviation in the consumption of energy by the sensor nodes from the battery. After introduction of Data transmission, WSNs and brief of the paper, the rest of the paper is arranged as follows: The section II discusses both the LEACH protocol and the Improved LEACH protocol. The section III stresses on the Ant Colony Optimization algorithm which is applied for the lifetime enhancement of the network. The section IV aforethought the methodology of work and software used. Simulation Results and Discussion are explained in the section V. The conclusions and future scope is discussed in the last section followed by acknowledgement and references.

2. Leach and Improved Leach
Low Energy Adaptive Clustering Hierarchy (LEACH) is one of the most efficient routing protocol which focuses on the accumulation of CHs within a cluster. The CHs then make

link with each other for transmitting data from one node to another until the data destined to the final node i.e. BS. LEACH was aforethought in the year 2000 by Hein Zelman [8] which is also called as Hierarchical Clustering algorithm for sensor networks [9]. The working of LEACH protocol is based on hierarchical routing scheme in which two layered structure takes place. The first layer is used for selecting the CH while the second layer is used to route the data from one node to another. LEACH protocol works on the principle of two phases which are named as setup phase and steady state phase. The setup phase is used for selection of the CHs after the proper acquisition of clusters. On the other hand, the transmission of data from one node to another node is done in the second phase which is known as steady state phase. To minimize the effect of overhead, the lifetime of steady state phase is kept longer than that of setup phase [6]. In terms of transmitting and receiving of data, the working of LEACH protocol is based on the allotment of diverse set of Code Division Multiple Access (CDMA) codes. These CDMA codes play vital role in the secure interlink among them. The data received by the CH has to be attenuated first before the transmission of data to the BS. This prevents the traffic within the network which helps in increasing the efficiency of the network [11]. The nodes are homogeneous in nature due to which all the nodes are having equal amount of energy levels and are more capable to showcase the activities of sensing, collecting and transmitting the data [13]. Energy level of BS is same as that of other scattered nodes is the main hindrance in the LEACH protocol. It also minimizes the efficiency of LEACH protocol because the communication at far away distances gets affected by the same energy level of BS as that of other nodes [4, 5]. Therefore, to abolish this issue, an improved variant of LEACH protocol is put in action in this paper which is named as Improved LEACH. In this proposed protocol, the approach of heterogeneity between the nodes is being introduced which means that the energy of all the nodes are kept unique from other nodes. The nodes become able to perform different tasks such as the variation in the sensing range of the nodes takes place and the power abundance of nodes also changes [11]. This describes that the node with large amount of energy among other nodes become the Cluster Head (CH) within the cluster so that they can able to contact with the nodes at larger distances [12]. By introducing the approach of heterogeneity in the LEACH protocol, the nodes can perform abstract tasks by which the efficiency of the network can be improved in a positive manner. This also minimizes the overhead over the nodes because the node with higher energy will become the CH and it will be proficient to carry the attenuated data over larger distances.

3. Ant Colony Optimization Algorithm

Ant Colony Optimization (ACO) algorithm is one of an effective algorithm used to accelerate the efficiency of a network [10]. The performance of ACO algorithm depends upon the actions of real ants. The fundamental arrangement in ACO algorithm is to follow the pheromone trail implemented by real ants. These trails are implemented as a channel for the process of communication which is used to give response to other ants [14]. Primarily, ACO algorithm is a population-dependent, which is accepted to be arrived from the triumphs of real ants. ACO algorithm was agitated by the actions of ants to acknowledge the shortest path to food source from their nest [14]. A vast variety of ants deposit a chemical pheromone trail as they crossed from one place to another. The practice goes on till the largest quantity of ants finds the smallest route [15]. In this paper, ACO algorithm is being used with LEACH as well as Improved LEACH protocols which further depends upon the approach of hierarchical routing scheme. The accumulation of CHs in a well-organized way implies that the effectiveness of LEACH and Improved LEACH comes out to be more efficient when used with ACO. The information travels from one node to another always follows the same path as that of ants which accompanies the same pheromone field which is more proficient in nature. The functionality of ACO algorithm is based on four phases named as Initialization Phase, Construction Phase, Trail Update Phase and Termination Phase which are explained as follows.

A. Initialization Phase: A set of ants which is named as colony of ants passes through states of problem identical to restricted explanations of the difficulty to resolve. The ants shift by the implementation of a stochastic absolute judgment agreement based trails and attractiveness which are the two parameters of ACO algorithm [16].

B. Construction Phase: As an ant moves, it blueprints a result to the problem in an addition manner. After completing a resolution during construction phase, the ant studies the result. After the deep study of the result an ant acknowledge the value of trail on the mechanism implemented in the result. This information or pheromone data will direct the investigation of the ants in the near future.

C. Trail Update Phase: The trails by the ants are updated quickly when all the ants have accomplished a solution. However, the grade of trails increases or decreases respectively according to the moves that were a portion of Superior or Inferior solutions.

D. Termination Phase: The last phase in ACO algorithm is termination phase. In this particular phase, the ant initiates the entire process from the construction phase again if the ant unable to assemble the information [16].

4. Methodology

In WSNs the Efficiency of energy is one of the most important concerns on basis of which the network's lifetime can be calculated. WSNs are integrated with a small or restricted battery source which is very hard or impossible to recharge after the drainage. Many different routing protocols and algorithms have been come forward to minimize it. But, there are some of the hindrances in all the methods applied. Hence, in this paper an improved variant of LEACH protocol is aforethought which works on the heterogeneity of nodes due to which all the nodes can carry out diverse tasks. This variant of LEACH protocol is taken as Improved LEACH. The aforethought heterogeneity comes in the term of energy allocated to the nodes. The node with higher energy becomes the CH. The CH node make contact with the far away nodes to transfer the data to the longer distances. The overhead also get minimized between the nodes. The vying analysis of both of the protocols is discussed in the section of results and discussion. The flow of work is discussed as follows.

The figure 1 represents the flowchart of the proposed work. The first phase indicates the generation of environment using MATLAB. In the second phase, the nodes are scattered to provide the heterogeneity. After the implementation of Improved LEACH protocol the selection of CH within the cluster starts in fourth phase. The node with higher energy within the cluster becomes the CH for the data transmission to other CH or nodes at nearer as well as larger distances. In fifth phase the ACO algorithm gets applied to the protocol aforethought for the efficient routing of signal. In sixth and seventh phase, the energy utilization of nodes is reduced to enhance the lifetime of the network,

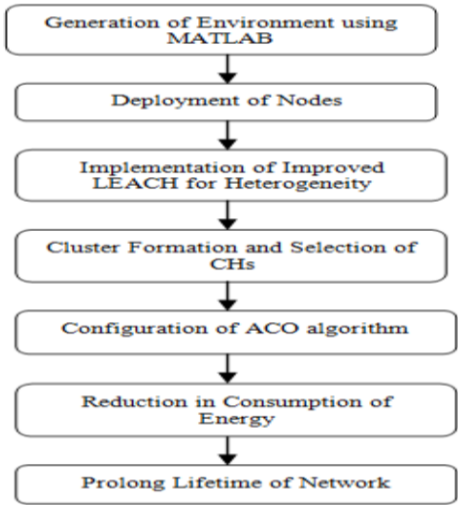

Fig 1: Flow of Work

5. Results and Discussion

In this section, the results of simulation and discussion have been accumulated to show the vying analyzation between traditional LEACH and Improved LEACH protocol. The simulator used for the process of simulation is MATLAB 7.1. The results of simulation showing the average remaining energy of the nodes used in LEACH and Improved LEACH protocols. Figure 2 depicts the comparison of number of nodes and round number of both the protocols whereas figure 3 illustrates the formation of clusters. Similarly corresponding tables depicts the detail in tabular form.

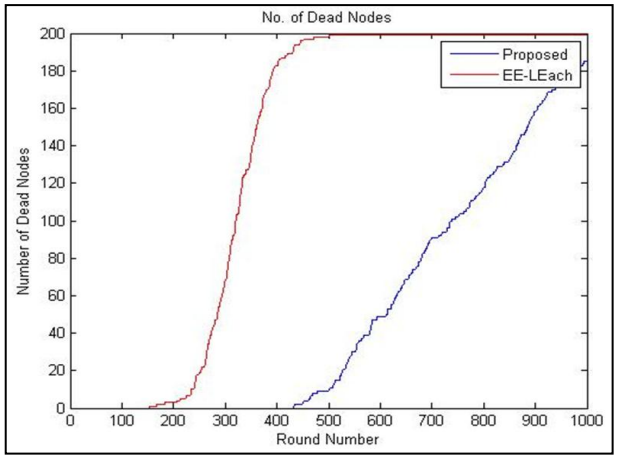

Fig 2: Comparison of both protocols

Table below shows the results in tabular form:

Table 1: Comparison of both protocols

S. No	Number of Dead Nodes	EE-Leach	Proposed
1	0-20	250	525
2	21-40	270	580
3	41-60	280	640
4	61-80	300	675
5	81-100	310	750
6	101-120	320	800
7	121-140	345	865
8	141-160	370	900
9	161-180	390	970
10	181-200	490	1000

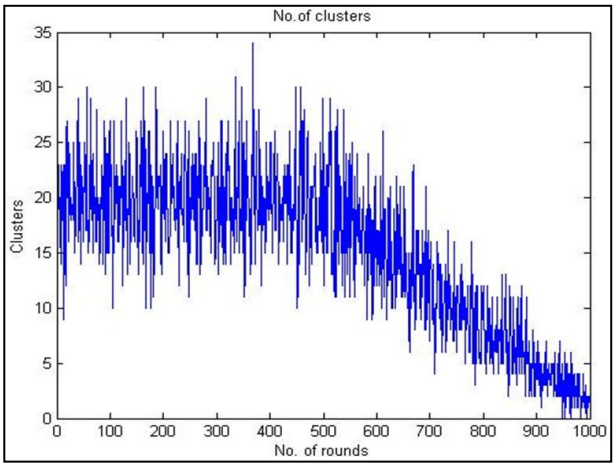

Fig 3: Formation of Clusters

Below is the Results in Tabular form

Table 2: Formation of Clusters

S. No	Number of Rounds	Clusters
1	0-100	30
2	101-200	29
3	201-300	28
4	301-400	34
5	401-500	30
6	501-600	29
7	601-700	27
8	701-800	18
9	801-900	13
10	901-1000	7

6. Conclusions

In this paper, the comparison of two protocols i.e. LEACH and Improved LEACH for Wireless Sensor Networks is been conducted and depicted in graphical as well as in tabular form. The simulator used is MATLAB software whereas algorithm preferred is Ant Colony Optimization (ACO). The results favors the improved leach protocol against LEACH for same algorithm and number of nodes as represented in results.

7. References

1. Clark AP. Principles of Digital Data Transmission", Published by Wiley, 1983.
2. Akyildiz IF, Su W, Sankarabramaniam Y, Cayirci E, A

survey on sensor networks, IEEE Communications Magazine. 2002; 40:102-114.
3. Singh BP. Anish Arora and Ashish Kumar, Security in Wireless Sensor Networks, Journal of Advances in Physics. 2013; 1(3):1-4.
4. Singh BP, Rajni, Singh G. Investigation of Efficient Energy Coverage Problem in Wireless Sensor Networks with ACO and ACB-SA, in Proceeding of international conference on Emerging research in computing, information, communication and application, Elsevier, ERCICA. 2014, 559-563.
5. Al-Karaki JN, Kamal AE. Routing Techniques in Wireless Sensor Networks: A Surevey, Wireless Communications, IEEE. 2004; 11(6):6-28.
6. Bhattacharyya D, Kim TH, Pal S. A Comparative Study of Wireless Sensor Networks and their Routing Protocols, Sensors. 2010; 10:10506-10523.
7. Limin S, Jianzhong L, Yu C. Wireless Sensor Networks, Tsinghua publishing company Beijing, 2005.
8. Singh BP, Rajni, Singh G. Comparative Analysis of Efficient Energy Coverage Problem of WSN with ACO and ACB-SA, International Journal of Recent Trends in Engineering and Technology, ACEEE. 2014; 11(2):371-377.
9. Lee W, Lee JJ. Ant-Colony-Based Scheduling Algorithm for Energy-Efficient Coverage of WSN, IEEE Sensors Journal. 2012; 12(1):3036-3046.
10. Heinzelman WR, Chandrakasan A, Balakrishnan H. Energy-efficient Communication Protocol for Wireless Microsensor Networks, in Proc. of 33rd Annual Hawaii Inter Cord on System Sciences, Hawaii, USA, IEEE Computer Society, 2000.
11. Megha, Pawan Luthra, Gagandeep Singh. A review paper on enhancing energy efficiency of Wireless System Network using LEACH protocol and ACO algorithm, International Conference in "Novel Approaches in Engineering and Technology" ICNAET, 2017.
12. Han L. LEACH-HPR: An Energy Efficient Routing Algorithm for heterogeneous WSN, IEEE, 2010.
13. Mhatre V, Rosenberg C. Homogeneous Vs Heterogeneous Clustered Sensor Networks: A Comparative Study, In Proceeding of IEEE International Conference on Communications (ICC). 2004, 3646-3651.
14. Dorigo M, Maniezzo V, Colorni A. Ant System: Optimization by a colony of cooperating.Agents, IEEE Transactions on Systems, Man, and Cybernetics-Part B, 1996; 26(1):29-41.
15. Dorigo M, Stutzle T. Ant Colony Optimization, MIT Press, 2004.
16. Blum C. Ant colony optimization: Introduction and recent trends, Physics of Life Reviews. 2005; 2(4):353-373.
17. Syed Jakeer Hussain and Mrs. Manju Khanna, Implementation on Energy Efficient Multilevel Hierarchical Data Aggregation Mechanism for Wireless Sensor Networks. IJSRD - International Journal for Scientific Research & Development, 2016.
18. Yick J, Mukherjee B, Ghosal D. Wireless sensor network survey, Computer Networks. 2008; 52(12):2292-2330.
19. Megha, Pawan Luthra, Hierarchal routing protocol for enhancement of energy efficiency by transference of data in WSN, International Conference on Recent Trends in Computer Science and Technology, ICRTCT, 2017.