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An Energy Efficient Protocol With Optimize Cluster Head Selection Approach

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Abstract: Energy consumption is the most important aspect of designing an efficient wireless sensor network. Finite electrical energy in each sensor node is defined by the capacity of the onboard battery [1]. Due to size and cost, variations of solar radiance, and constraints imposed by the rechargeable battery, solar energy harvesting modules have to face a problem in the continuous power supply. There are various protocols that have been developed for the purpose of reducing the energy consumption such as LEACH, DEEC, TEEN etc. But all of these protocols lacks somewhere to support the network in various terms such as the lifetime of the network, energy consumption by the nodes, the number of dead nodes in the network, the number of alive nodes. The proposed work is based on the firefly algorithm which is quite efficient for increasing the lifetime of the network. This performs the cluster head selection on the basis of two parameters that is the amount of residual energy of a node and the distance between the nodes. On the basis of these two parameters the fitness parameter is evaluated and then from these fitness values best fitness value is selected and its corresponding node is selected as a cluster head. The result section shows the efficiency of the proposed work.

Keywords: LEACH, MATLAB, EEP, HEED, DEEC

I. INTRODUCTION

EEP refers to the energy efficient protocols for routing in a wireless sensor network for various purposes such as enhancement in lifetime of the network, reducing the energy consumed by nodes for data transmission, for proper data transmission from source to destination or node to sink.

Issues Related To Wireless Sensor Networks.

- Power transmission and distribution substations include some pivotal parts like circuit breakers and transformers that are continuously monitored in order to minimize the possibility of expensive and disruptive power outages (i.e. when power is supply is not available or equipment is closed) [1].
- Energy consumption is the most important aspect of designing an efficient wireless sensor network. Finite electrical energy in each sensor node is defined by the capacity of the onboard battery [1]. Due to size and cost, variations of solar radiance, and constraints imposed by the rechargeable battery, solar energy harvesting modules have to face a problem in the continuous power supply. Hence, all design related features of wireless sensor nodes must include facts regarding energy conservation. Since radio transmission consumes a high amount of energy and the average energy consumption mostly depends on the number of packets send and received by the node. Other parameters which affect the energy use are sensing and actuation current, which is important for some applications like vibration sensing and gas density sensing. Hence all the facts directly affect the lifetime of the network. If energy consumption is high then it will exhaust earlier which leads to the halt in the network process.

The focus of this research work is to enhance the lifetime of the network by improving those parameters which directly harms the lifetime of the network. Most of the researchers focus on routing process to implement the objective but in this cluster head formation process is improved which was ignored earlier. In order to efficient cluster formation along with cluster head formation, firefly algorithm is designed and implemented. There are various techniques which were developed specifically for clustering process but firefly algorithm has many advantages over that technique such as it is based on Metaheuristic nature.

Various techniques used for clustering are as follows:

1. LEACH(Low Energy Adaptive Clustering Hierarchy)
2. DEEC(distributed energy efficient clustering)
3. HEED(Hybrid Energy-Efficient Distributed Clustering)
4. PEGASIS(Power-Efficient Gathering in Sensor Information Systems)
5. TEEN(Threshold sensitive Energy Efficient sensor Network)

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II. FIREFLY ALGORITHM IMPLEMENTATION

The algorithms which are the based on natural behavior of particular living thing is referred as Metaheuristic algorithm. These algorithms are meant for designing a high-level solution to a problem by combining science and mathematics by selecting efficient optimization algorithms. Metaheuristic algorithm is a combination of up to date optimization algorithms, soft computing, and computational intelligence in order solve a particular problem. Swarm Intelligence is considered as a sub-part of Metaheuristic techniques. Because the algorithm is based on the nature swarms like birds, fishes. Similarly, Firefly algorithm is based upon the flashing pattern of tropical fireflies. It was developed by Xin-She Yang in 2007.

Algorithm:
In the firefly algorithm, the optimization process depends on the brightness of the fireflies and the movement of fireflies towards their brighter counterparts. Every firefly is attracted to the other depending on brightness because the fireflies are all unisexual according to the first assumption about artificial fireflies. The firefly algorithm is as follows:

1. Define an initialize benchmark function$f(x), x = (x1, x2, \dots \dots \dots xd)$
2. Generate initial population of fireflies x_i $(i = 1,2,3 \dots \dots \dots, n)$
3. Determine light intensity for xi by calculating $f(x_i)$
4. Define light absorption coefficient γ
5. While t < Maximum Generation
6. Make a copy of the generated firefly population for move function
7. For $i = 1: n$ all n fireflies
8. For $j = 1: n$ all n fireflies
9. If $(I_j > I_i)$
10. Move fireflies i and j according to attractiveness
11. Evaluating new solutions and updating light intensity for next iteration
12. End if
13. End for j
14. End for i
15. Sorting the fireflies to find the present best
16. End while
17. Begin post process on best results obtained

Advantages:
The advantages of firefly algorithm are: it has the capability of dealing or handling the multimodality. It can perform sub-division of the modules automatically without any interruption. Because, it is based on the attraction and attractiveness decrease with distance. It is applicable to highly non linear, multimodal optimization problems efficiently.

III. PROBLEM FORMULATION

A routing protocol specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network. Routing algorithms determine the specific choice of route. An energy efficient protocol in wireless sensor networks, nodes have limited energy resources and, consequently, protocols designed for sensor networks should be energy-efficient, but old routing protocol and energy efficient protocol find route source to destination basis on shortest distance and cluster head selection is choose on basis of the weight value but to choose the best weight values is main concern which is very complex and for that user have to perform hit and trail to get efficient weight value selection approach. There is not sufficient algorithm for more network stability and also very time-consuming. We need to design a protocol which provides the less power consumption in sensor network for data transfer source to destination and selection of cluster head use new algorithm.

IV. PROPOSED SYSTEM

As discussed or review from the literature for various researchers related to this field. It is observed that there were many routing or energy efficient protocols available. But the problem was that all of these protocols or methods perform the cluster head selection randomly. Later to update these methods optimization algorithms like particle Swarm Optimization is attached with their implementation. But still, they are not suitable in some environments since they do not consider the enough number of parameters for cluster-heads selection. Hence in proposed work, we propose a technique by using firefly algorithm. This performs the cluster head selection on the basis of two parameters that is

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the amount of residual energy of a node and the distance between the nodes. On the basis of these two parameters the fitness parameter is evaluated and then from these fitness values best fitness value is selected and its corresponding node is selected as a cluster head. In order to check the efficiency of the technique performance parameters like number of dead nodes, number of alive nodes and number of cluster heads n a network is also calculated.

V. METHODOLOGY

The algorithm of proposed work is as follows:

1. The first step is to deploy nodes in the given network with respect to given area of the network
2. Initialize the energy parameters or energy to nodes in the network.
3. Initialize the random population in the network for the purpose of cluster head selection.
4. Now apply Firefly algorithm to the network for selecting the cluster heads.
5. Evaluate the fitness parameters of the candidate cluster head nodes. Parameters are the residual energy of the nodes and distance between the nodes.
6. On the basis of fitness parameters, cluster head is selected. A node with the higher residual energy and loss distance will be treated as cluster head node only.
7. After selecting cluster head perform the communication in the network.
8. Evaluate performance parameters for measuring the efficiency of the technique. Performance parameters are the number of dead nodes, the number of alive nodes, the number of cluster heads in the network.
9. After performance evaluation, a comparison is performed between traditional and proposed technique.

Block Diagram:

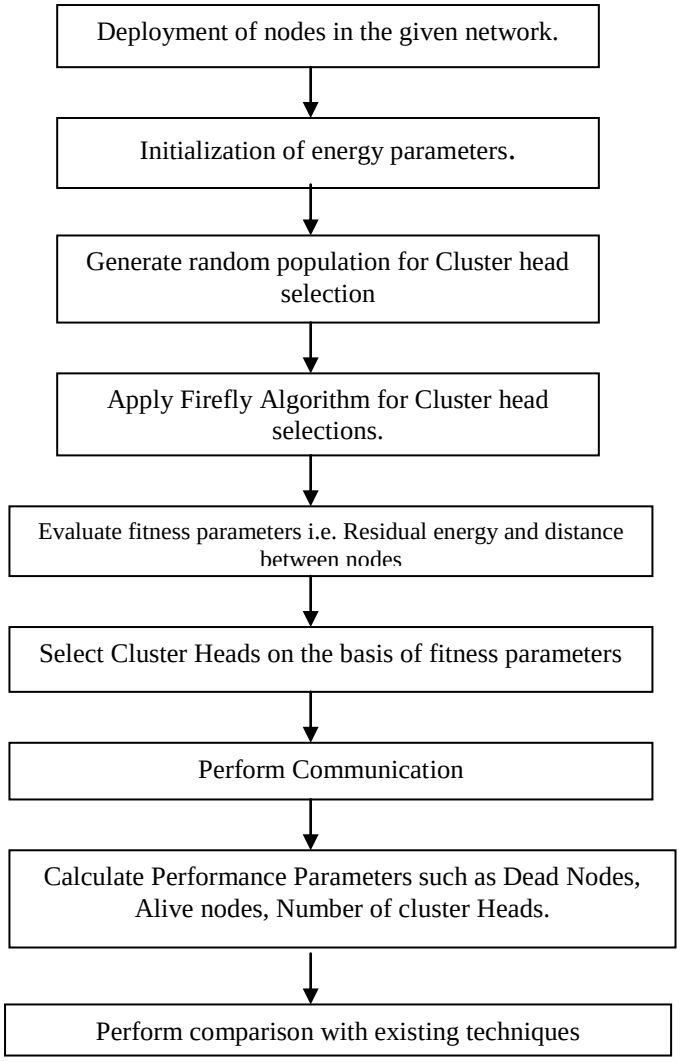

Fig. 1. Block diagram of proposed work

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VI. RESULTS AND DISCUSSIONS

This section represents the results that are obtained after implementing the proposed work is as follows:
The figure 2 represents a network with the formation of cluster heads. It shows that the sink node is placed at the top of the network and marked as a cross sign. The total area covered by the network is 500*500.

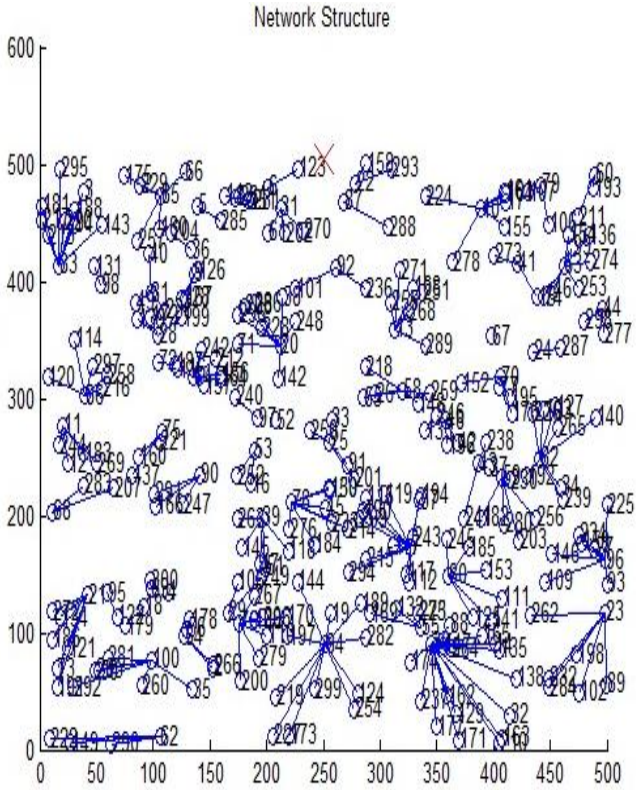

Fig. 2.Cluster formation in network

The figure 3 defines the comparison graph of various techniques i.e. WCERA, TEEN and proposed work on the basis of a number of alive nodes in the network. The graph shows that the proposed system has a large number of alive nodes in the network as compared to other works. As the numbers of rounds are increasing the number of Alive nodes will also reduce. Total 3500 rounds are considered for implementation.

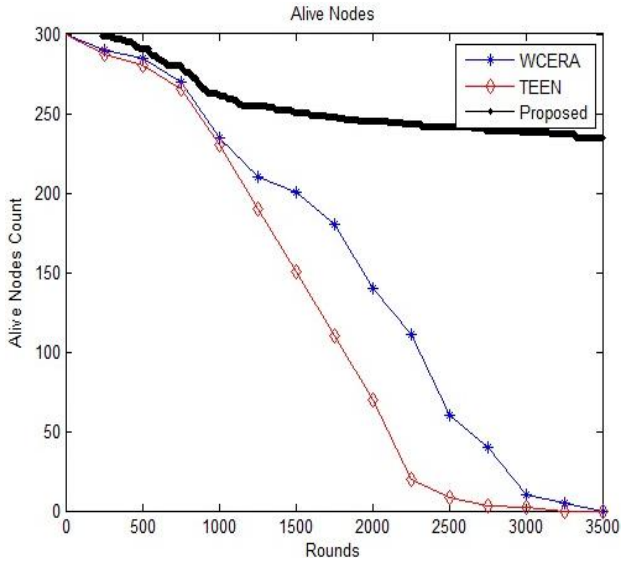

Fig. 3. Comparison graph on the basis of a number of alive nodes in the network

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The figure 4 shows a comparison graph on the basis of average residual energy in the network. The graph shows that the average residual energy of WCERA is exhausted after 60 rounds, in the case of TEEN it is exhausted after 80 rounds whereas in the case of proposed work the residual energy remains until the completion of rounds.

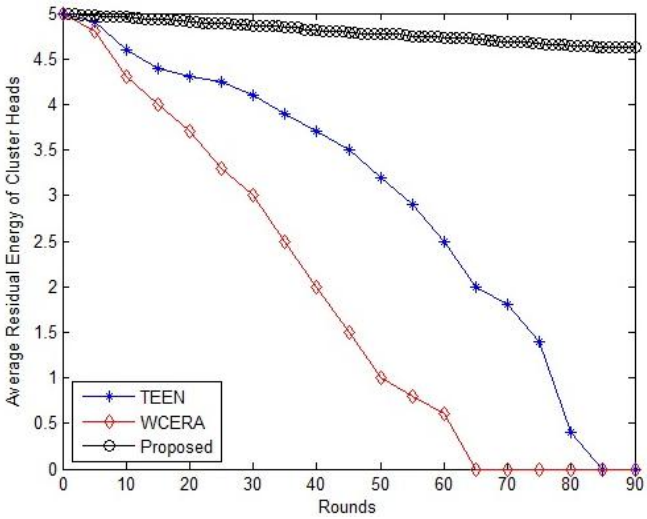

Fig. 4. Comparison graphs on the basis of residual energy on the nodes.

The graph below shows the comparison between three techniques on the basis of number cluster formation in the network. The total number rounds are 500 and as the cluster formation is increasing correspondingly it enhances the lifetime of the network also. The graph represents that the proposed work as better efficiency in case of cluster formation as compared to other two techniques.

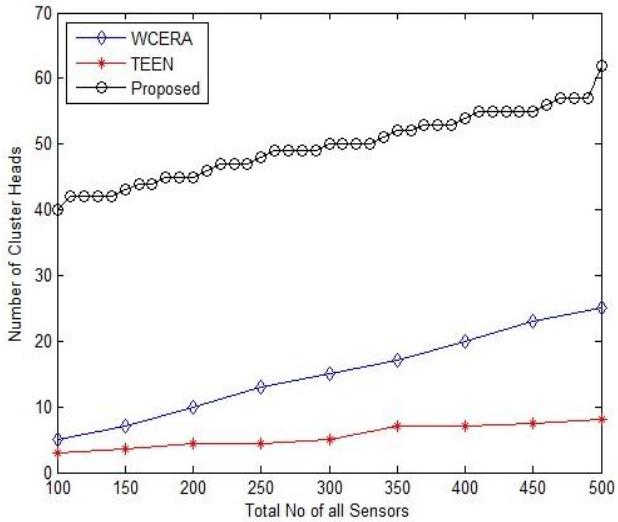

Fig. 5. Number of Dead nodes in the network in proposed work

VII. CONCLUSION AND FUTURE SCOPE

After reading the related work section it is concluded that the wireless sensor network relies on the amount of energy consumed by its nodes for data transmission and the nodes which are selected as the cluster heads directly affects the performance of the network. There are various techniques have been developed which are helpful for efficient cluster head selection and route selection. But all of these techniques have some lacking point. This work proposes a new technique for enhancing the lifetime of the network on the basis of firefly algorithm. The efficiency of the proposed work is measured in various terms such as the number of alive nodes, the number of dead nodes and formation of clusters till the end of last round. Hence proves that the proposed work is able to enhance the lifetime of the network.
In future various parameters rather than energy can be used for selecting the cluster heads such as throughput, delay, packet loss etc. Various techniques can also be introduced to enhance the work.

REFERENCES

[1] Arun K. Kumar, "Energy-Efficient Mobile Data Collection in Wireless Sensor Networks with Delay Reduction using Wireless Communication", IEEE, 978-1-4244-5489-1
[2] Asis Nasipuri,Robert Cox et al., "Design Considerations for a Large-Scale Wireless Sensor Network for Substation Monitoring", 5th IEEE International Workshop on Practical Issues in Building Sensor Network Application,Pp 866-873,2010
[3] B. Manzoor£, N. Javaid, "Q-LEACH: A New Routing Protocol for WSNs",ELSEVIER, Pp 1-6,2013
[4] Buyanjargal, "An Energy Efficient Clustering Algorithm for Event-Driven Wireless Sensor Networks (EECED)", IEEE, pp 1758 – 1763, August, 2009
[5] Chu-Fu Wang, "A Network Lifetime Enhancement Method for Sink Relocation and Its Analysis in Wireless Sensor Networks", IEEE SENSORS JOURNAL, VOL. 14, NO. 6, pp 1932-1943, JUNE 2014
[6] DHANASHRI V, AMBEKAR AMOL D. BHOI, R. D KHARADKAR, "A SURVEY ON SENSORS LIFETIME ENHANCEMENT TECHNIQUES IN WIRELESS SENSOR NETWORKS", INTERNATIONAL JOURNAL OF COMPUTER APPLICATIONS,VOL 107,2014
[7] EZ-ZAIDI Asmaa, "Efficient data collection in wireless sensor networks using mobile sink", IEEE, 978-1-4799-7391-0, Vol:14, 2014
[8] Georgios Smaragdakis Ibrahim Matta Azer Bestavros, "SEP: A Stable Election Protocol for clustered heterogeneous wireless sensor networks",Pp 1-11
[9] Guillermo Molin, Enrique Alba ,El-Ghazali Talbi, "Optimal Sensor Network Layout Using Multi-Objective Metaheuristics", Journal of Universal Computer Science, vol. 14, no. 15 (2008), 2549-2565 submitted: 13/3/08, accepted: 30/6/08, appeared: 1/8/08 © J.UCS
[10] Haitao Zhang and Cuiping Liu, "A Review on Node Deployment of Wireless Sensor Network", I International Journal of Computer Science Issues, Vol. 9, Issue 6, No 3, November 2012
[11] hunyao FU,Zhifang JIANG, Wei WEI and Ang WEI, "An Energy Balanced Algorithm of LEACH Protocol in WS", IJCSI International Journal of Computer Science Issues, Vol. 10, Pp 354-359, 2013
[12] Jianguo SHAN, Lei DONG, Xiaozhong LIAO, Liwei SHAO , Zhigang GAO, Yang GAO, "Research on Improved LEACH Protocol of Wireless Sensor Networks",Pp 75-77,2013
[13] Kemal Akkaya, Mohamed Younis, "A survey on routing protocols for wireless sensor networks", ELSEVIER, Vol 3, Pp 325-349,2003
[14] Lalita Yadav1, Ch. Sunitha, "Low Energy Adaptive Clustering Hierarchy in Wireless Sensor Network (LEACH)",IJCSIT,Vol 5, Pp 4661-4664
[15] M. J. Handy, M. Haase, D. Timmermann, "Low Energy Adaptive Clustering Hierarchy with deterministic Cluster-Head Selection",IEEE, Pp 1-5,2002
[16] Meena Malik, Dr. Yudhvir Singh, Anshu Arora, "Analysis of LEACH Protocol in Wireless Sensor Networks", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Pp 178-183,2013
[17] Ping Yang, "An Energy Effective Routing Algorithm for Event-driven Wireless Sensor Networks", IEEE, DOI 10.1109, pp 96-99, 2015
[18] Priya Vyas, Manoj Chouhan," Survey on Clustering Techniques in Wireless Sensor Network", International Journal of Computer Science and Information Technologies, Vol. 5 (5) , 2014, 6614-661
[19] R. Renuga Devi," A Study on Classification of Energy Efficient Routing Protocols in Wireless Sensor Networks**",**IJIRD, Vol 5,Pp 264-271,2016
[20] R.Rajeshwari, "Towards Energy Efficient Cluster Based Approach In Wireless Sensor Networks Using Mobile Sink", IJETCSE, Volume 13 Issue 1, pp 183-186, MARCH 2015
[21] Rui Chen, "An Event and Rule-driven Immune Clustering Routing Algorithm of Wireless Sensor Network with Mobile Sink", IEEE, 978-1-4673-9323-2, pp 196-202, 2015
[22] S Taruna, Megha R. Tiwari," Event Driven Hierarchical Cluster based Routing Protocol for Wireless Sensor Network", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Pp 549-556,2013
[23] SamerA. B.Awwad, "Cluster Based Routing Protocol for Mobile Nodes in Wireless Sensor Network", Springer, DOI 10.1007, pp 251-281, May, 2010
[24] Sharath S.T, Veena N," Quad Clustering Routing Protocol to Enhance the Stability in WSN",IJIRCCE, Vol 2, Pp 3982-3988,2014
[25] SHINICHI MOMMA ," POWER AWARE ROUTING AND CLUSTERING SCHEME FOR WIRELESS SENSOR NETWORKS", IEEE, PP 1-6,2010
[26] Shounak Chakraborty, "A Noble Approach for Self Leaming and Cluster based Routing Protocol with Power Efficiency in WSN", IEEE, 978-1-4799-3358-7, pp 773-777, 2014
[27] Sunita Rani, Er.Tarun Gulati," AN IMPROVED PEGASIS PROTOCOL TO ENHANCE ENERGY UTILIZATION IN WSN",International journal of computing and corporate research, Vol 2, 2012
[28] Yan Sun, "Energy-Efficient Routing Protocol in Event-Driven Wireless Sensor Networks", IEEE, pp 1-5, May 2010