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Enhanced Cluster head selection algorithm based on Artificial Intelligence technique

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Abstract-Energy consumption is the core issue in wireless sensor networks because nodes are battery operated. It is desirable to make these nodes as cheap and energy-efficient as possible and rely on their large numbers to obtain high quality results. Consequently many protocols have been proposed in order to maximize the throughput of these nodes. But the neural networks are unconventional explore and optimization algorithms, which impersonate several of the processes of neural evolution. Also Low Energy Adaptive Clustering Hierarchy is the first energy capable routing protocol for hierarchical clustering. It decreases the energy considerably. The leach protocol forms clusters in the sensor networks and by chance selects the Cluster-heads for each cluster. Non cluster-head nodes sense the data and put out to the cluster-heads. The cluster-heads cumulative the established data and then forwards the information to the sink. The main goal of this research is to improve the throughput rate. In this research, weight matrix is applied to calculate the average energy of the arrangement and make sure which block has lesser energy than average energy. The proposed technique is providing the promising results.

Keywords: WSN, LEACH Protocol, Neural Network, Throughput

1. Introduction

Communicating with different hubs or sensing activities expends a great amount of energy in preparing the information and transmitting the gathered information to the sink. Numerous scientists are in this field attempting to discover power-aware protocols for wireless sensor networks keeping in mind the end goal to overcome such energy effectiveness issues but they have their own assumptions and proposed several different approaches to optimizations of a wireless sensor network design (R. Ramadan, K. Abdelghany, 2006). However, most of the optimization procedures do not take into account the principles, characteristics and requirements of an application-specific WSN at the system level. So in this proposed work energy optimization will be done using neural network in LEACH protocol (KP Ferentinos, 2006). Wireless sensor networks consist of a number of sensing nodes which are distributed in a wide area. They sense an event occurring in the environment and these sensing nodes are distributed or placed according to the requirements of the application. A Wireless

Sensor System includes a gang of nodes connected with typically low functionality. They work with others collectively to execute realizing tasks during granted surroundings (M.T. Schmitz, 2004; D. Ganesan, 2001). In this research, the problem of routing is solved by Neural Network on LEACH protocol. The simulation is executed in MATLAB 2010a environment.

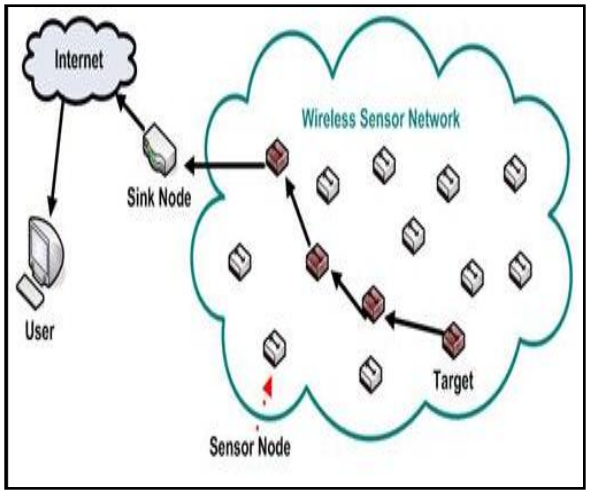

Figure 1: Wireless Sensor Network

Different metrics like Lifetime, Delay, and Throughput and Bit error rate are used.

1.1 LEACH Protocol

Low Energy Adaptive Clustering Hierarchy (LEACH) is the first hierarchical cluster-based routing protocol for wireless sensor network which divides the nodes into clusters, in each cluster a devoted node with additional privileges called Cluster Head (CH) is accountable for creating and manipulating a TDMA (Time division multiple access) calendar and sending collective data from nodes to the BS where these data is required using CDMA (Code division multipleaccess). Throughout LEACH, cluster-heads are usually selected at random even so the power put in for every single circular is actually well-balanced as each of the sensor nodes employ a chance to get selected as being a cluster-head. This protocol is separated into rounds; every round consists of two phases (S. Lindsey);

Set-up Phase

(1) Advertisement Phase

(2) Cluster Set-up Phase

Steady Phase

(1) Schedule Creation

(2) Data Transmission

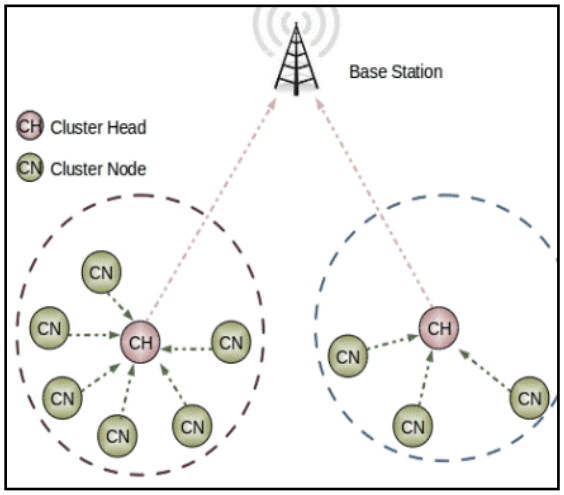

Figure 2: LEACH protocol

1.2 Neural Network

For some application areas, neural models show promise in achieving human-like performance over more traditional artificial intelligence techniques. Neural networks are composed of simple elements which operate parallel. A neural network can be trained to perform a particular function by adjusting the values of the weights between elements. Network function is determined by the connections between elements. There is activation functions used to produce relevant output. Input processes [7] with neural network that including weights produced output. The output is compare with the target, if the produced output compatible with output then the input is correct otherwise that output adjust with weight. Neural network basically worked with weights.

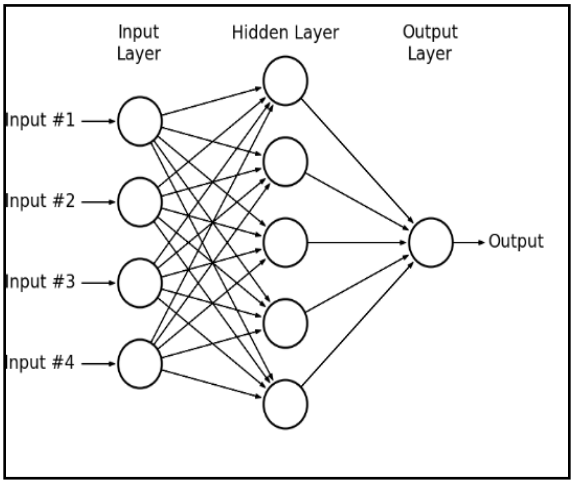

Figure 3: LEACH protocol

Training can be either supervised or unsupervised. In supervised training system trying to predict outcomes for known examples. System compares its predications with the known results and learns from is mistakes. In unsupervised training system, no output or result is shown as part of training process.

2. Related Work

Sandra Sendra et.al, 2011 has shown a study of energy saving as well as energy optimization systems for wireless sensor networks, which improves the ones in presence and acquaints the pursuer with the most surely understood accessible routines that can be utilized to conserve energy. The investigations are done from few perspectives: Device hardware, transmission, MAC and routing protocols. **Gogu, A. et.al, 2011** has analyzed the most central optimization issues identified with coverage, topology control, scheduling, routing and mobility in WSNs. At that point, the authors has concentrated on their unpredictability and investigated the distinctions that exist with counterpart hypothetical issues or those effectively considered in conventional systems. **M. M. Chandaneet.al, 2013** has proposed re-enactment model for WSN. The research done on energy-aware routing procedures, in which, the aforementioned is found in which, Minimum Total Transmission Power Routing and Minimum Battery Cost Routing Protocol, most extensively catches exchange offs of energy proficiency in addition to and system lifetime individually. Frameworks for further research take a shot at improvements in augmenting the system lifetime of WSN. The result demonstrates that there is a dependably on an exchange off between energy productivity and system lifetime. **TariqueHaider et.al, 2009** has investigated the advancement of energy use in WSNs. Routing is one of these regions in which endeavours for proficient usage of energy have been made. These endeavours utilization settled measurements for making energy-aware routing decisions. The author has displayed a summed up fuzzy logic dependent on methodology for energy-aware routing in WSNs. **Bojan, S.et.al, 2013** has introduced a technique for minimization of energy utilization for the duration of package sending technique in WSNs that make use of genetic algorithm. The proposed arrangement relies on upon cautious perception of the advancement space and complete customization of GA to suit the particular kind of energy function. **Chunyao FU et.al, 2013** has proposed an enhanced algorithm of LEACH protocol (LEACH-TLCH) which is intended to adjust the energy utilization of the whole system and amplify the life of the system. The new algorithm is imitated by MATLAB recreation platform, the re-enactment results demonstrate that both energy proficiency and the lifetime of the system are superior toanything that of LEACH Protocol.

Cluster formation and cluster head selection techniques are employed to achieve better operation and the prolong network lifetime by minimizing energy consumption. LEACH (Low Energy Adaptive Clustering Hierarchy) includes a new distributed cluster formation technique that enables self-organization of large number of nodes, algorithms for adapting clusters and rotating cluster head positions to evenly distribute the energy load among all the nodes. In the existing work, PSO (Particle Swarm Optimization) Technique has been utilized using various parameters for optimizing the energy consumption in network. In proposed work, PSO is replaced by neural network to enhance the rate of energy optimization.

3. Simulation Model

This section explains the simulation model for the research as shown in Figure 3. Following are the steps that are explaining the flow of the work undertaken:

Step: 1 Start
Step: 2 Define the Network Length and Width to construct a network area for the simulation of proposed code.
Step: 3 Initialise No. of Nodes within the specified area of Length X Width.
Step: 4 After the nodes initialisation, identify X and Y coordinates of Nodes and plot the Nodes.
Step: 5 Define source and destination nodes.
Step: 6 Define the random energy value for each generated node including source and destination nodes.
Step: 7 Set the coverage set area for all nodes and defined the route between source node and destination node according to the various parameters with the help of LEACH protocol.
Step: 8 Check for the distortion. After this, calling to neural network will be done to find out the cluster heads.
Step: 9 Optimize Qos parameters and also plot Qos parameters to check the performance of the proposed work.

3.1 Proposed Algorithm

Deploy network
Sort energy of all nodes in decending order
Get round 5; rounds is total number of times the data has to be transferred
Get total no of nodes in the network
Starting throughput would be 100 as there is no packet drop
Computing Cluster Heads
{
computing that how many clusters heads would be there
assigning energy to the nodes
assigning id to the nodes
sorting the nodes into descending order
creating the x and y locations for the nodes
plotting the nodes into the network
plotting the source object with green color
plotting the source object with green color
apply energy model
Find throughput without at initial path distortion
Utlization of neural network
$net = newff(training\_data, group, 20);$
$net.trainparam.epochs = 20;$
$net = train(net, training\_data, group);$
$result = sim(net, training\_data);$
$result = round(mean(result));$
try
$improvement = training\_data(result);$
catch
$improvement = (nodes * rand)/10;$
end
Find other metrics
End

4. Simulation Results

The outcome from the execution of the simulation work is shown in the section. Various parameters like Throughput, Bit Error rate, network lifetime and delay are used for the same.

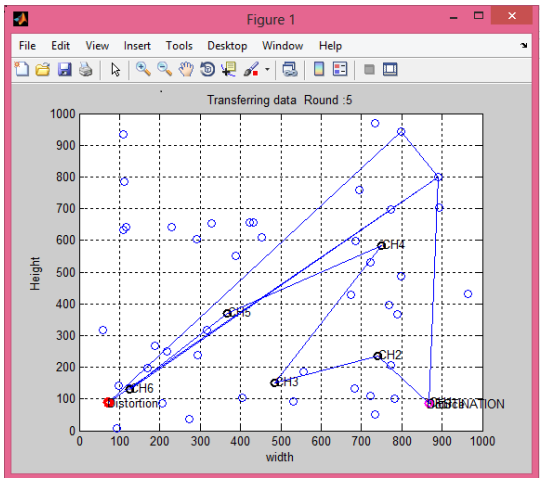

Figure 4: Network Deployment diagram

Above figure show Network deployment diagram for the proposed work with height of 1000 and width of 1000. All blue color circles denote the nodes and the black color circle denotes the cluster head with source and destination nodes within the network area. When

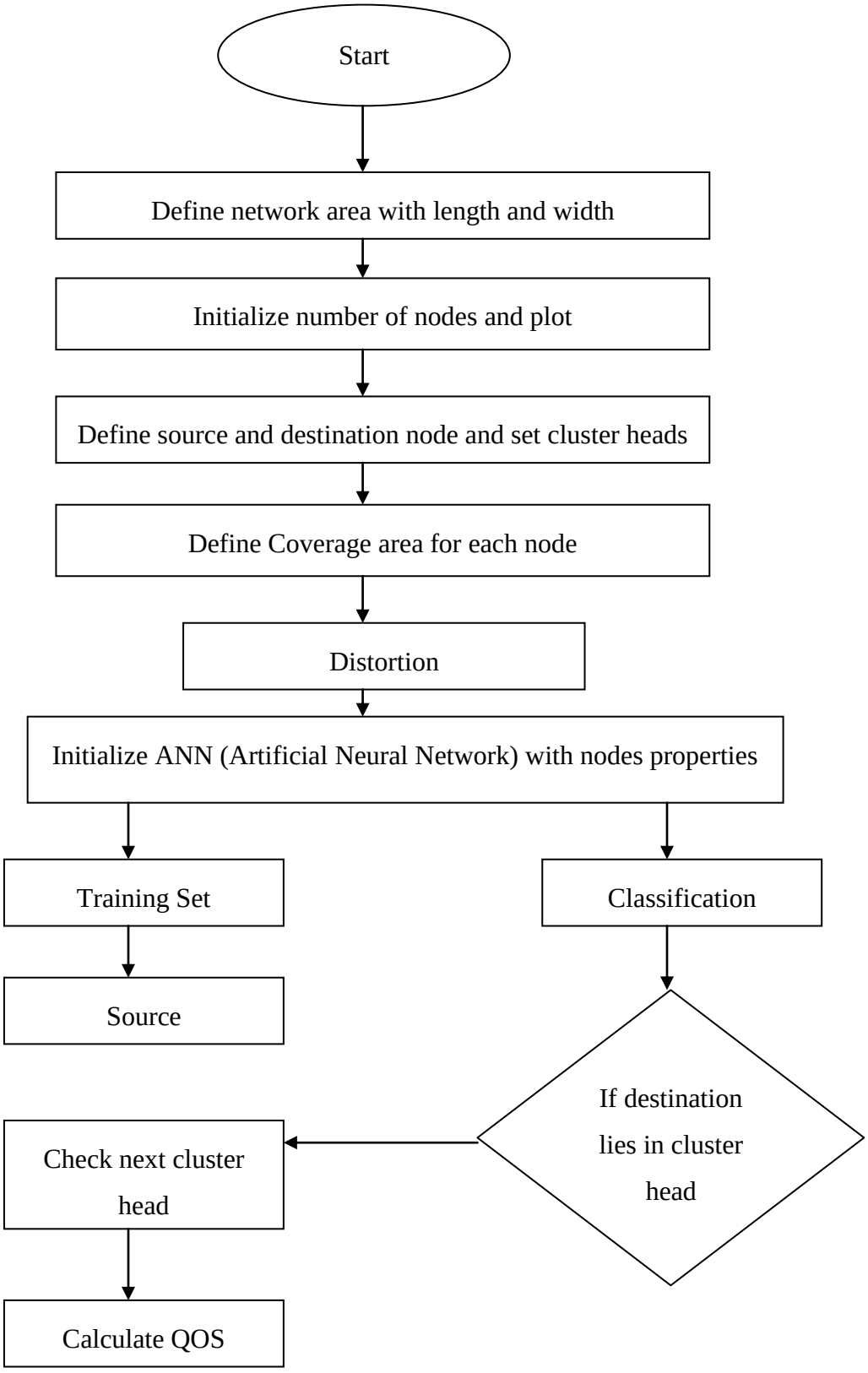

Figure 3: Proposed Methodology

all nodes and source and destination are plotted then we find the route between the source and destination using the cluster heads. On the basis of proposed model we check the performance metrics like;

i. Throughput

Throughput is the number of packets sent over the network in given time. Throughput is the average rate of successful messages delivered over a communication channel. Unit: bits per second (bps).

ii. End delay

Latency in a network usually includes four parts: The transmission delay, queuing delay, propagation delay and processing delay. End to End Delay signifies the total amount of time taken by a packet from source to destination.

iii. BER

The bit error rate (BER) is the numeral of bit errors per unit time. BER is a unit less calculation, frequently taken as percentage.

iv. Network Lifetime

Network lifetime is the time span from the consumption to the time when the network is taken as non-functional. It can be defined as the time when the coverage breakdown develops, new sensor dies, loss of proportion of sensors.

Table 1: Comparison of throughput

No. of Rounds	*Base Paper Value*	*Value with Distortion*	*Value with NN*
1	89.45215392983	91.2353365575767	99.1854602270994
2	90.4865465756787	91.1457878967573	98.9887267648565
3	92.9185215392983	95.7256345645654	98.8681075349436
4	92.7634546456474	98.6545634534535	99.1752450629240
5	88.4647568353465	97.8668579333546	98.8791425050844

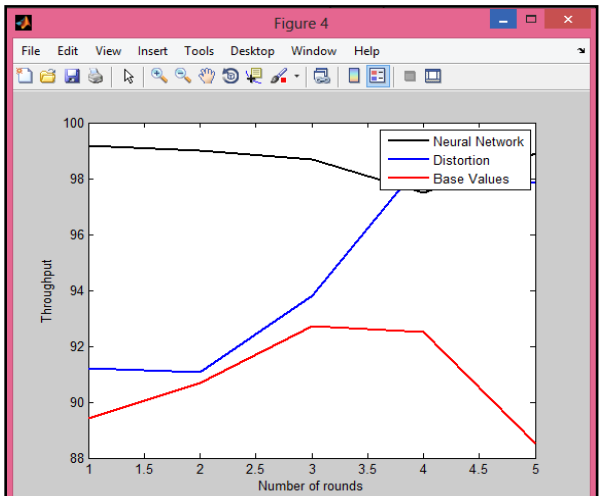

Figure 5: Throughput

In above table and graph shows the throughput value according to the number of rounds. Throughput is the number of packets sent over the network in given time. Throughput is the average rate of successful messages delivered over a communication channel. Unit: bits per second (bps).We observe that the throughput value for proposed work with neural network is better than the previous base paper work and work with distortion. In above graph the average throughput value with neural network is 98.64, with distortion are 96.55 and for base paper work are 91.97.

Table 2: Comparison of Delay

No. of Rounds	*Base Paper Value*	*Value with Distortion*	*Value with NN*
1	12.247138767371354	17.206411778726332	7.287865756016338
2	14.107483328308485	19.066756339663453	9.148210316953516
3	12.702864748201390	17.662137759556360	7.743591736846422
4	15.491565901754088	20.450838913109056	10.532292890399120
5	7.922063991218568	12.881337002573536	2.962790979863600

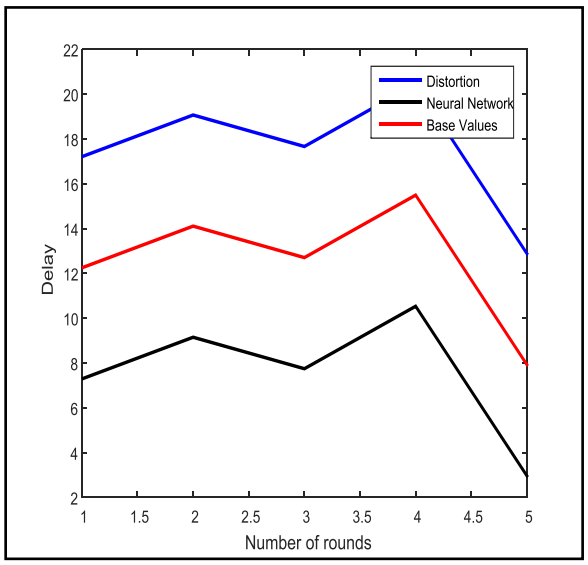

Figure 6: Delay

In above table and graph shows the delay value according to the number of rounds. Delaysignifies the total amount of time taken by a packet from source to destination. Unit: milli second (ms). We observe that the delay value for proposed work with neural network is very less than the previous base paper work and work with distortion. In above graph the average delay value with neural network is 7.54 ms, with distortion are 17.45 ms and for base paper work are 12.49 ms.

Table 3: Network life time

No. of Rounds	*Base Paper Value*	*Value with Distortion*	*Value with NN*
1	39.8080035 32357730	34.8487305 21002764	44.7672765 43712700
2	23.9161387 24573145	18.9568657 13218180	28.8754117 35928115
3	14.9101362 76048467	9.95086326 4693500	19.8694092 87403435
4	21.0976340 61671670	16.1383610 50316700	26.0569070 73026636
5	38.9607091 519714	34.0014361 40616450	43.9199821 63326442

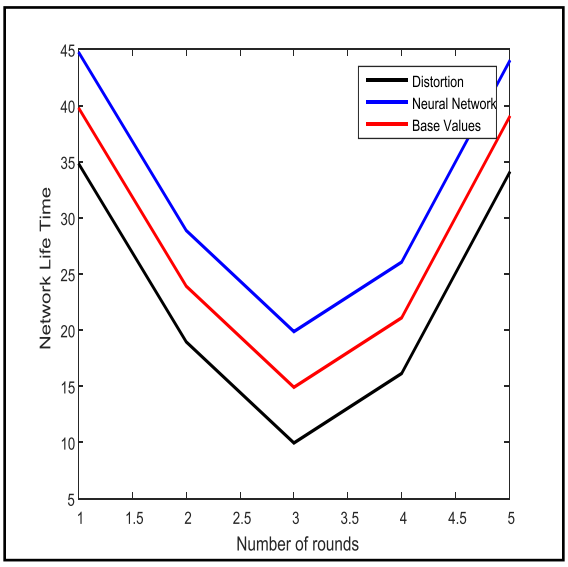

Figure 7: Network lifetime

In above table and graph shows the network life time value according to the number of rounds. Network life time signifies the total amount of time in whichmy network will be stable. We observe that the network life time value for proposed work with neural network is higher than the previous base paper work and work with distortion. In above graph the average network life time value with neural network is 32.69, with distortion are 22.78 and for base paper work are 27.74.

Table 4: Bit error rate

No. of Rounds	*Base Paper Value*	*Value with Distortion*	*Value with NN*
1	2.78563561 8307732	7.74490862 96627002	2.1736373 93047236
2	5.62937880 4117813	10.5886518 15472781	0.6701057 92762845
3	6.13207851 832188	11.0913515 29676844	1.1728055 06966908
4	14.5543235 93626703	19.5135966 04981670	9.5950505 82271735
5	18.2363293 821769	23.1956023 93531896	13.277056 3708220

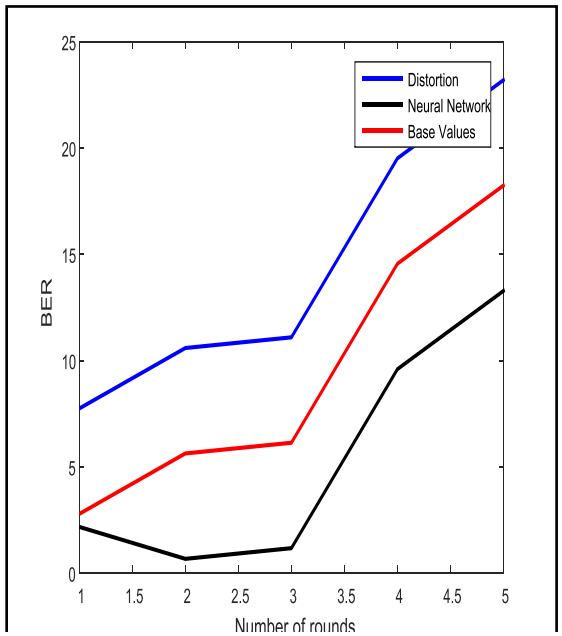

Figure 8: Bit error rate

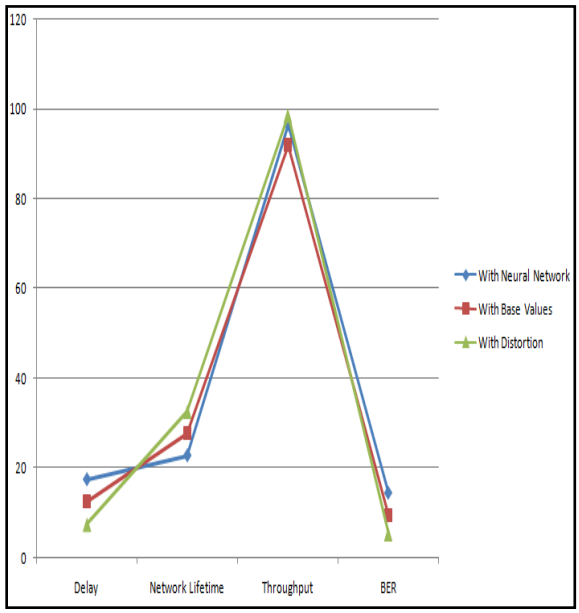

Figure 9: Metric Evaluation with all methods

In above table and graph shows the bit error rate value according to the number of rounds. We observe that the bit error rate value for proposed work with neural network is lesser than the previous base paper work and work with distortion. In above graph the average bit error rate value with neural network is 5.38; with distortion are 14.43and for base paper work are 9.46.

Table 5: Metric Evaluations with all methods

Metrics	*With Distortion*	*With Base Values*	*With Neural Network*
Delay	17.45	12.49	7.54
Network Lifetime	22.78	27.74	32.69
Throughput	96.55	91.97	98.64
BER	14.43	9.46	5.38

Above table and figure presents the comparison graph among the base paper, with distortion and with neural network (proposed work) on the basis of the performance metrics like throughput, delay time, network life time and bit error rate. The performance metric is better for the proposed work with neural network as compare to the base paper work.

5. Conclusion

In this research, an advanced neural network version algorithm has been implemented to maximise the throughput when leach protocol is used. Main concept behind the wireless sensors network is to save energy more and more so that it works last long enough. This is due to fact that the size of a sensor node is expected to be small and this leads to constraints on size of its components i.e. battery size, processors, data storing memory, all are needed to be small. So any optimization in these networks should focus on optimizing throughput to enhance WSN life time. In this research, WSN is implemented for variety of nodes by deploying it in the network designed. In our proposed algorithm the throughput is more balanced as compared to the other optimization algorithms. The simulation result shows that the network lifetime is improved in case of proposed scheme. In case of neural network, throughput is better than the existing techniques and with

distortion, delay is less than base paper and with distortion, network lifetime is for proposed is higher in case of proposed algorithm as compare to base paper and with distortion, BER for proposed is less in proposed work as compare to existing work and with distortion. As from the simulation results, it has been also concluded that the nodes are balanced in the network.

References

1. A. Brindle, "Genetic algorithms for function optimization (Doctoral disser-tation and Technical Report TR81-2", PhD thesis, University of Alberta, Department of Computer Science, 1981.
2. Ali Norouzi and A. Halim Zaim, "Genetic Algorithm Application in Optimization of Wireless Sensor Networks", Hindwai, 2013.
3. Bojan, S. Inst. Mihajlo Pupin, Univ. of Belgrade, Belgrade, Serbia; Nikola, Z., "Genetic algorithm as energy optimization method in WSN", IEEE, pp.97-100, 2013.
4. C. Intanagonwiwat, R. Govindan, and D. Estrin., "Directed diffusion: a scalable and robust communication paradigm for sensor networks", Proceedings of MobiCom'00, pp. 56–67, 2000.
5. Chunyao FU, Zhifang JIANG, Wei WEI and Ang WEI, "An Energy Balanced Algorithm of LEACH Protocol in WSN", IJCSI, vol.10, pp.354-359, 2013.
6. C. Alippi and G. Vanini, "Application-based routing optimization in static/semi-staticWireless Sensor Networks", Fourth Annual IEEE International Conference, pp. 47-51, 2006.
7. D. Mahmood, N. Javaid, S. Mahmood, S. Qureshi, A. M. Memon and T. Zaman, "MODLEACH: A Variant of LEACH for WSNs", Broadband and Wireless Computing, Communication and Applications (BWCCA), Eighth International Conference on, Compiegne, pp. 158-163, 2013.
8. D. Ganesan, R. Govindan, S. Shenker, and D. Estrin., "Highly-resilient, energy-e_cient multipath routing in wireless sensor networks", 2001.
9. DE GOLDBERG., "Genetic and evolutionary algorithms come of age", Communications of the ACM, vo. 37, issue 3, pp. 113-119, 1994.
10. D. J. Cook and S.K. Das., "Smart Environments: Technologies, Protocols, and Applications", John Wiley, New York, 2004.
11. Debmalya Bhattacharya1 and R.Krishnamoorthy, "Power Optimization in Wireless Sensor Networks", IJCSI, vol.8, pp.415-419, 2011.
12. D.E. Goldberg, "Genetic Algorithms in Search, Optimization, and Machine Learning", Addision-Wesley. Reading, MA, pp. 170-174, 1989.
13. Eduardo F. Nakamura, Antonio A. F. Loureiro, and Alejandro C. Frery," Information fusion for wireless sensor networks: Methods, models, and clas sifications", ACM Comput. Survey, vol. 39, issue 3, 2007.
14. F. Bouhafs, M. Merabti, and H. Mokhtar, "A node recovery scheme for data dissemination in wireless sensor networks", Communications, IEEE International Conference on, pp. 3876-3881, 2007.
15. Gogu, A.; Nace, D. ;Dilo, A., "Optimization Problems in Wireless Sensor Networks", IEEE, pp. 302-309,2011.
16. I. Marn, E. Arceredillo, A. Zuloaga, and J. Arias, " Wireless Sensor Networks: A Survey on Ultra-Low Power-Aware Design. Transactions on Engineering", Computing and Technology, pp.44-49, 2005.
17. J. Pouwelse, K. Langendoen, and H. Sips., "Dynamic voltage scaling on a low-power microprocessor", In Proceedings of the 7th annual international conference on Mobile computing and networking, ACM, pp. 251-259, 2001.
18. Jun Luo and Liu Xiang, "Prolong the Lifetime ofWireless Sensor Networks through Mobility: A General Optimization Framework", IEEE, pp. 583-590.
19. J. Elson and A. Parker. Tinker, "A tool for designing data-centric sensor networks. In Information Processing in Sensor Networks", The Fifth International Conference on, pp. 350-357, 2006.
20. K. P. Ferentinos, T. A. Tsiligiridis, and K. G. Arvanitis., "Energy optimization of wirless sensor networks for environmental measurements," In Proceedings of the International Conference on Computational Intelligence for Measurement Systems and Applicatons,2005.
21. KP Ferentinos and TA Tsiligiridis, "Heuristic dynamic clustering in wireless sensor networks towards uniform sensing", 15th IST Mobile & Wireless Communications Summit, Myconos, Greece,2006.

22. L. Benini, A. Bogliolo, and G. De Micheli, "A survey of design techniques for system-level dynamic power management", Very Large Scale Integration (VLSI) Systems, IEEE Transactions on, vol. 8, issue 3, pp. 299-316,2000.
23. M. Gen and R. Cheng, "Genetic Algorithms and Engineering Optimization", Wiley-Interscience, 1999.
24. M. M. Chandane, S. G. Bhirud, S. V. Bonde, "Mobile Communication and Power Engineering", Communications in Computer and Information Science, vol. 296, pp 33-40, 2013.
25. M. Ali and Z. A. Uzmi., "An energy-efficient node address naming scheme for wireless sensor networks", In IEEE International Networking and Communications Conference, 2004.
26. Meena Malik, Dr.Yudhvir Singh, Anshu Arora., "Analysis of LEACH Protocol in Wireless Sensor Networks", IJARSCCE, vol.3, pp. 178-183, 2013.
27. M.T. Schmitz, B.M. Al-Hashimi, and P. Eles., "Iterative schedule optimization for voltage scalable distributed embedded systems", ACM Transactions on Embedded Computing System, vol. 3, issue1, pp.182-217, 2004.
28. Raghavendra V. Kulkarni, and Ganesh Kumar Venayagamoorthy, "Particle Swarm Optimization in Wireless Sensor Networks: A Brief Survey", IEEE, 2010.
29. Sandra Sendra, Jaime Lloret, Miguel García and José F. Toledo., "Power saving and energy optimization techniques for Wireless Sensor Networks", IEEE, vol.6 pp. 439-452, 2011.
30. Tarique Haider1 and Mariam Yusuf., "A Fuzzy Approach to Energy Optimized Routing for Wireless Sensor Networks", IJAIT, vol.6, pp.179-180, 2009.