Performance Analysis of DSEP Using Neuro Fuzzy in WSN

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Abstract : A wireless sensor network (WSN) is a network of gadget that distinguish hubs that can detect the earth and convey the data gathered from the field throughout wireless connections and information is send to next stage, by means of numerous bounces handing-off, to a sink that can use it locally, or is related to different networks through a portal. To enhance the vitality use, clustering is one of the prototypical techniques for partition sensor bits into a no. of cluster where one hub continues as a cluster head (CH). Cluster Head selection is one of the enhancement approach for developing security and network life expectancy. Deterministic Stable Election Protocol (DSEP) is a clustering protocol, which makes three sorts of hubs with various or isolate leftover vitality for Cluster Head(CH). Neuro fuzzy rationale technology is utilized to extend vitality level of Deterministic stable Election Protocol by utilizing Neuro fuzzy rationale Cluster Head by enamoring into four semantic factors such as node or sensor energy, concentration, separation and centrality to base station (BS). Reproduction comes about show that our proposed technique gives more productive outcomes as far as life expectancy of network and dependability as compare to the execution of other clustering protocols.

Index Terms - DSEP-Neuro Fuzzy Logic, Wireless Sensor Network, centrality, distance, concentration.

I. INTRODUCTION

[1]A wireless sensor network (WSN) is comprise of some no. of sensors, each of which are physically minute gadget, and are outfitted with the capacity of detecting the physical condition, conveying, information processing, wirelessly with different sensors. Accept that each sensor in a wireless sensor network has certain imperatives as for its vitality, power, computational, source, and memory abilities. [2]Wireless sensor network is fundamentally all around enjoyed benefit use in business and modern applications, on account of its technical movement in processor, correspondence and custom of low power Embedded registering gadgets. Sensor hubs are for the most part used to screen condition conditions like temperature, weight, control, position sound, moistness, vibration. [3] The sensor hubs are performing distinctive errands like information stockpiling, neighbor hub revelation, keen detecting and preparing. The correspondence model of wireless sensor network has its root in wireless specially appointed networks, where network hubs self-sort out in an impromptu approach for the most part on a transitory premise. In a wireless impromptu network, an accumulation of wireless hubs precipitously shape a network without settled and brought together infrastructure. There are two sorts of storage room schemes have been found. In the first place, we have the clustering calculations down to earth in homogeneous networks; those are known as homogeneous schema, where all hubs have the comparable beginning vitality. [4]Furthermore we have the clustering calculation is viable in heterogeneous networks, those are called heterogeneous schemes. [16]There are plenitude of heterogeneous clustering calculations, such as LEACH-B, DEEC, Stable Election protocol, Energy productive clustering, and stochastic and Equitable DEEC and stochastic and adjusted DEEC. The EECS that choose the cluster heads with more lingering vitality all through nearby radio correspondence. In cluster creation stage, EECS considers the exchange off of vitality consumption among hub to cluster-head (CH) and the cluster heads to the Base Station (BS). Stable Election Protocol (SEP) is a scheme for heterogeneous wireless sensor network (WSN).Here two kinds of hubs are considered with altogether different starting vitality. The exceptionally create hubs are outfitted with more vitality than the common hub toward the start. It has been watched that the Stable Election Protocol (SEP) yields longer steadiness area for raised estimations of additional vitality purchased by more ground-breaking hubs, it can't be useful to multi-level heterogeneous Wireless Sensor Networks (WSN). [5]In WSN the Three-level hub setting in a clustering calculation approaches, hubs choose themselves as cluster head (CH) based on their vitality levels, hold all the more reliably dispersed vitality among sensor hubs. .[6]In genuine heterogeneous application sciences, through a few hubs may have lingering vitality than others, in light of the computational heterogeneity; these hubs may devour much more vitality than others in the following round cluster head (CH) activity. Considering the vitality dispersal in sequent rounds is correlative, Deterministic stable Election protocol utilizes altogether different normal vitality utilization of two sections of cluster heads (CH) in continuing round as vitality utilization in the following round to estimate the cluster heads (CH).

The more residual energy following the following round activity and bigger is the likelihood of being chosen as a cluster head (CH). The weighted race likely for two, three and multi-level heterogeneity is specify. The two kinds of nodes perceived as normal and advanced nodes are considered with their distinctive beginning energy for two level heterogeneous networks.

Table 1: Comparison of Wireless Sensor Network and AdHoc Networks [10]

Parameters	Wireless Sensor Network	Ad Hoc Networks
Data rates	Low	High
Redundancy	High	Low
Computational capacities and memory	Limited	Not Limited
Centric	Data Centric	Address Centric
Fusion/ aggregation	Possible	Not Suitable
Number of sensor nodes	Large	Medium
Failure rates	Prone failure	Very rare
Deployment	Densely deployment	Scattered
Topology	Changes very frequently	Very rare
Communication paradigm	Broadcast communication	Point-to-point communication
Battery	Not replaceable/ not rechargeable	Replaceable

For this situation of three kinds of nodes known as normal, advanced and intermediate nodes are viewed as in light of fragmentary distinction in their underlying energy level. In multi-level heterogeneity each nodes have been considered with various starting energy.

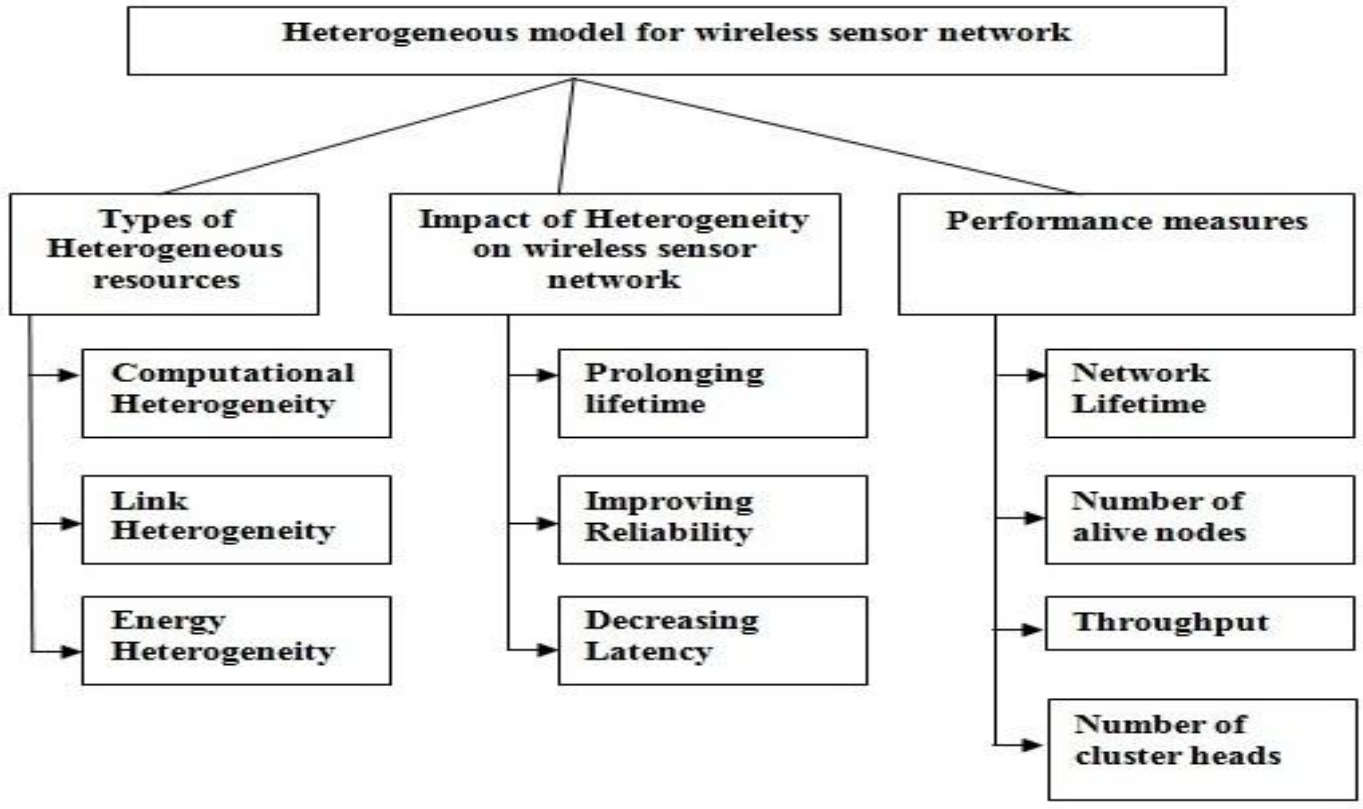

Figure 1: Heterogeneous model for wireless sensor network [8]

II. N ETWORK MODEL AND RELATED WORK

NETWORK MODEL:

Information gathering application is a regular application in remote sensor arrange(WSN). This paper means to ponder that includes the sort of utilization. In this paper we will make a few suspicions about the system show before issue statement.

Network Model: The sensor hubs are arbitrary scattered in a two-dimensional Square field A. furthermore, the remote sensor organize has the few properties. [7], [8] It demonstrate an extensive no. of sensor hubs are thickly conveyed in two-dimensional

geographic space. There exists one base station (BS), which is sort out at a changeless place outside A. The vitality of the sensor hubs can't be additionally revived. Sensor hubs area uninformed i.e. a sensor hub can't secure its area data through other component, for example, GPS or position calculation and the radio power likewise are controlled.

Related Work:
To conduct literature survey it has been initiated that the outcome of compression and the unique effects of the failures in the most of the energy efficient routing protocols have been overlooked by the most of the researchers. According to research gaps we initiate in the study of Wireless Sensor Network (WSN) associated energy issues we originate the subsequent problems and can be defined in such a way as given. The problem to locate the suitable CH (cluster head) using such a approaches where by apply least time by using the process of fuzzification inference.

III. STABLE ELECTION PROTOCOL:

[5], [9]Cluster heads (CH) devour more essentialness than cluster people in getting identified data from their part hubs and performing signal taking care of limits on the data and sending the total data to the accompanying ricochet center or base station (BS), the piece of the cluster head (CH) must be turn among all sensor hubs. As needs be the movement of EAP is part into rounds as LEACH. Each round being with a set-up arrange while clusters are sorted out and the routing tree is created, trailed by a working stage when data send to the sink center.

Routing: In view of the reduced figuring, battery resources and radio in sensors, routing traditions in remote sensor compose (WSN) are obvious to fulfill the going with essentials.

Energy Efficiency: Routing tradition should defer the framework lifetime while ensure a stunning assessment or accessibility to permit the correspondence between hubs. It is basic to observe that the battery substitution in the sensors is infeasible since by far most of the sensors are randomly set.

Autonomy: The announcement and presumption of a conferred unit that controls the radio and routing assets does not remain in remote sensor arrange (WSN) as it could be a simple purpose of assault. There won't be any incorporated element to make the routing choice, the exchanged to the system hubs.

Resilience: sensors may arbitrarily quit working because of condition reasons or to the battery utilization. Routing convention ought to make do with this projection so when a current-being used hub could be found.

Scalability: remote sensor arrange (WSN) are made out of numerous and many hubs so routing conventions should work with this amount of hubs.

Device heterogeneity: Although the vast majority of the common uses of remote sensor arrange (WSN) depend on homogeneous hubs, the presentation of a wide range of sorts of sensor could report critical advantages. The utilization of hub with various handsets, processors, detecting segments and power units may develop the characteristics of the system.

Mobility Adaptability: The a wide range of utilizations of remote sensor systems (WSN) could expect hubs to adapt to their own particular mobility, or the mobility of the occasion and the mobility of the sink to detect. Routing conventions ought to provide appropriate bolster for these developments.

Clustering:
[10]Clustering is one of the very important technique for prolonging the network lifetime in wireless sensor network (WSN). It occupy grouping of sensor nodes into cluster and electing cluster heads for all the clusters. [11], [12]Cluster Heads collect the data from respective cluster nodes and forward the aggregated data to base station (BS) .a major challenge in Wireless Sensor Network (WSN) is to decide on appropriate cluster heads (CH). All the selected Cluster Head send advertisement message in the network declaring their presence as cluster head (CH).Every node now measures the distance from all the cluster heads (CH).[13] The nodes join the CH with minimum distance and send a message to the adjacent cluster head (CH). If the distance between the node and the Cluster Head is more than its distance to the Base Station, the node will communicate with Base Station directly or else it unite cluster based on the nearest distance. The node is re-clustered based on the distance matrix, DM (m×n), gives following:.

$$DM = \begin{matrix} dCH1,x1 & dCH1,x2 & \ldots\ldots & dCH1,xn \\ dCH2,x1 & dCH2,x2 & \ldots\ldots & dCH2,xn \\ \vdots & & & \\ dCHm,x1 & dCHm,x2 & \ldots & dCHm,xn \end{matrix}$$

Where d is the Eucliden distance between Cluster Head and a node based on its location information. If y and z represents the location of the two nodes p and q then the Euclidean distance is:

$$d_{p,q} = \sqrt{[(p_x - q_x)2 + (p_y - q_y)2]}$$

METHODOLOGY

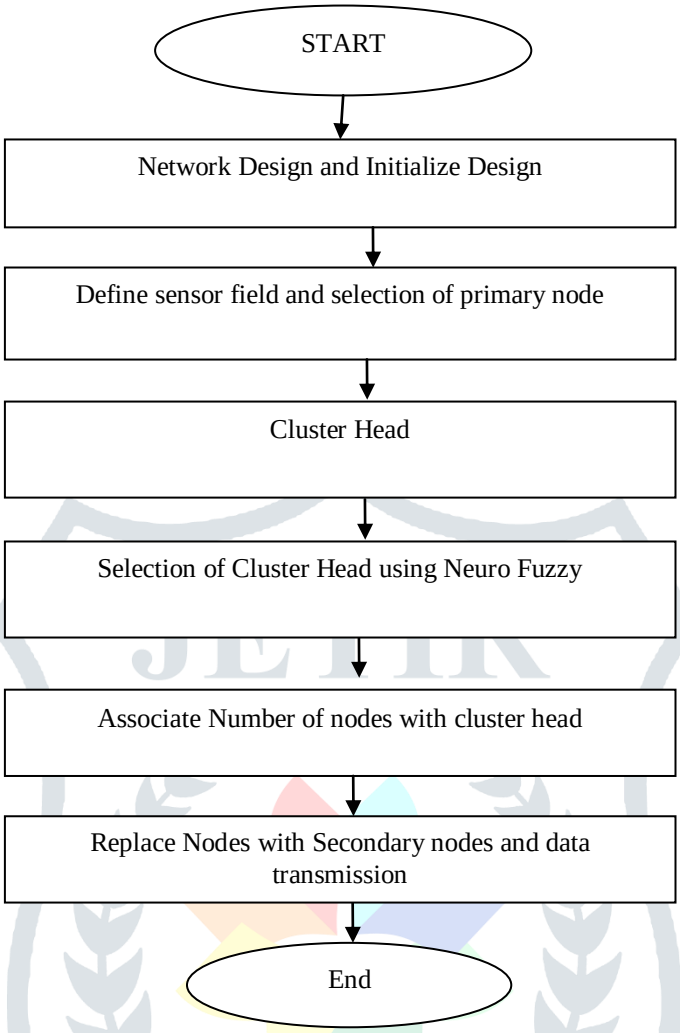

Figure 2: Methodology of performance analysis of DSEP using neuro fuzzy network

[14], [15]According to do the research gaps initiate in the study, it has been determined to apply Neuro-Fuzzy lpgic instead of only Fuzzy for the DSEP protocol where the abovespecified problems and gaps can be privileged easily. Using neuro fuzzy approach along with DSEP protocol which will call as DSEP-NF protocol in our designed work, the time can be reduced for Cluster Head selection with similar implementation of the process occurred in the fuzzy inference. Instead of using single membership function we can favor top three membership function for fuzzification method and can implement and run corresponding as the neural network technique has its interior benefit.The establishedobjectives of dissertation are: To study the many different Energy efficient routing algorithms and Compression approaches for Wireless Sensor Network (WSN). Analyze and Design Fault Tolerant Compression based Energy Aware Routing Algorithm for Wireless Sensor Network (WSN) and estimate the proposed Fault Tolerant Compression based Energy Aware Routing Algorithm with an existing algorithm based on the parametersRemaining energy, Throughput, Packets sent to cluster head (CH) , No. of alive nodes, Number of dead nodes.

Parameters: Each input variables have special membership function depending upon the value of chance. The four linguistic variables used for enhance the results:

a. Energy:the first parameter used os energy, in this parameter the remaining energy of the node in the network proportion or fraction to whole energy of the network. Energy is mainly divided into three values are Low, Medium and High values.

b. **Distance:** The other variable is distance in which measures the Distance of the node from the core location. Distance split or divided into the three values are Near, Medium and far values.

c. **Concentration:** The concentration is the Number of nodes in cluster with nodeconnected to cluster head. Concentration value is divided into Low value, medium and highvalues.

d. Centrality: The centrality is display the closeness from node to cluster head (CH). Centrality is divided into close, adequate and far values.

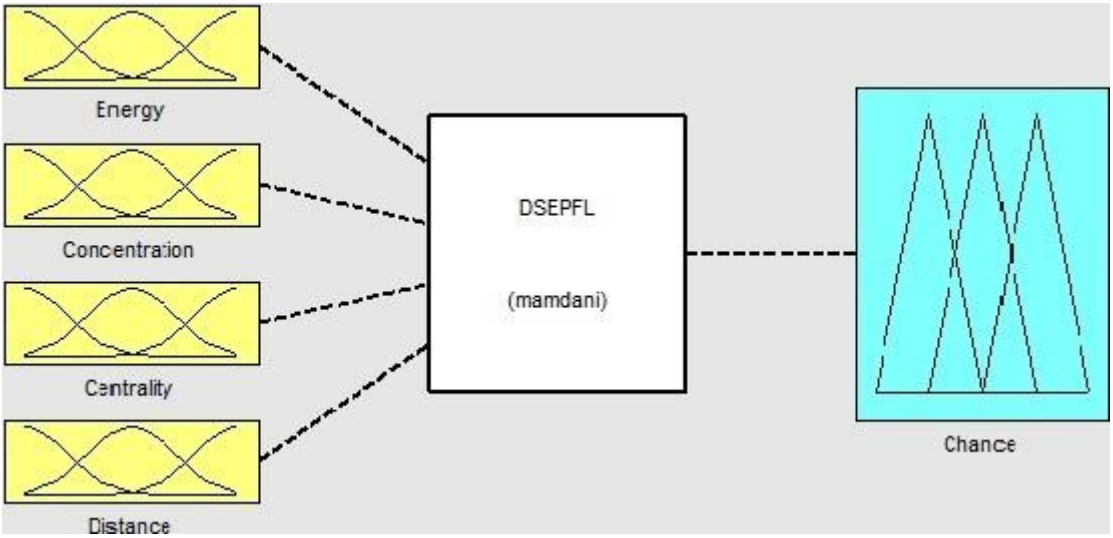

Figure 3: Working of DSEP-FL with four inputs and single output [17]

Neuro fuzzy Interface: A neural network is a authoritative data modeling tool that is capaable to captured and represent complex input and their output relationships. A neural network obtain knowledge through learning a neural network knowledge is accumulate within inter-neuron connection strenghts well known as synaptic weights A.neuro fuzzy us a hybrid system incorporating the learning capability of Artificial Neural Network (ANN) and outstanding knowledge represents and interface capabilities of fuzzy logic that have the capability to self modify their membership function to accomplish a desired performance. ANFIS is a straightforward data learning that yses a fuzzy inference system model to convert a given input into a target output. This predictioin occupy membership functions, fuzzy logic operationsand if-then rules.There are two parts of fuzzy systems, commonly well known as the MAMDANI and SUGENO models. The five main processing phases in the ANFIS operation, including input fuzzification,application method,application of fuzzy operators, defuzzification and output aggregation.

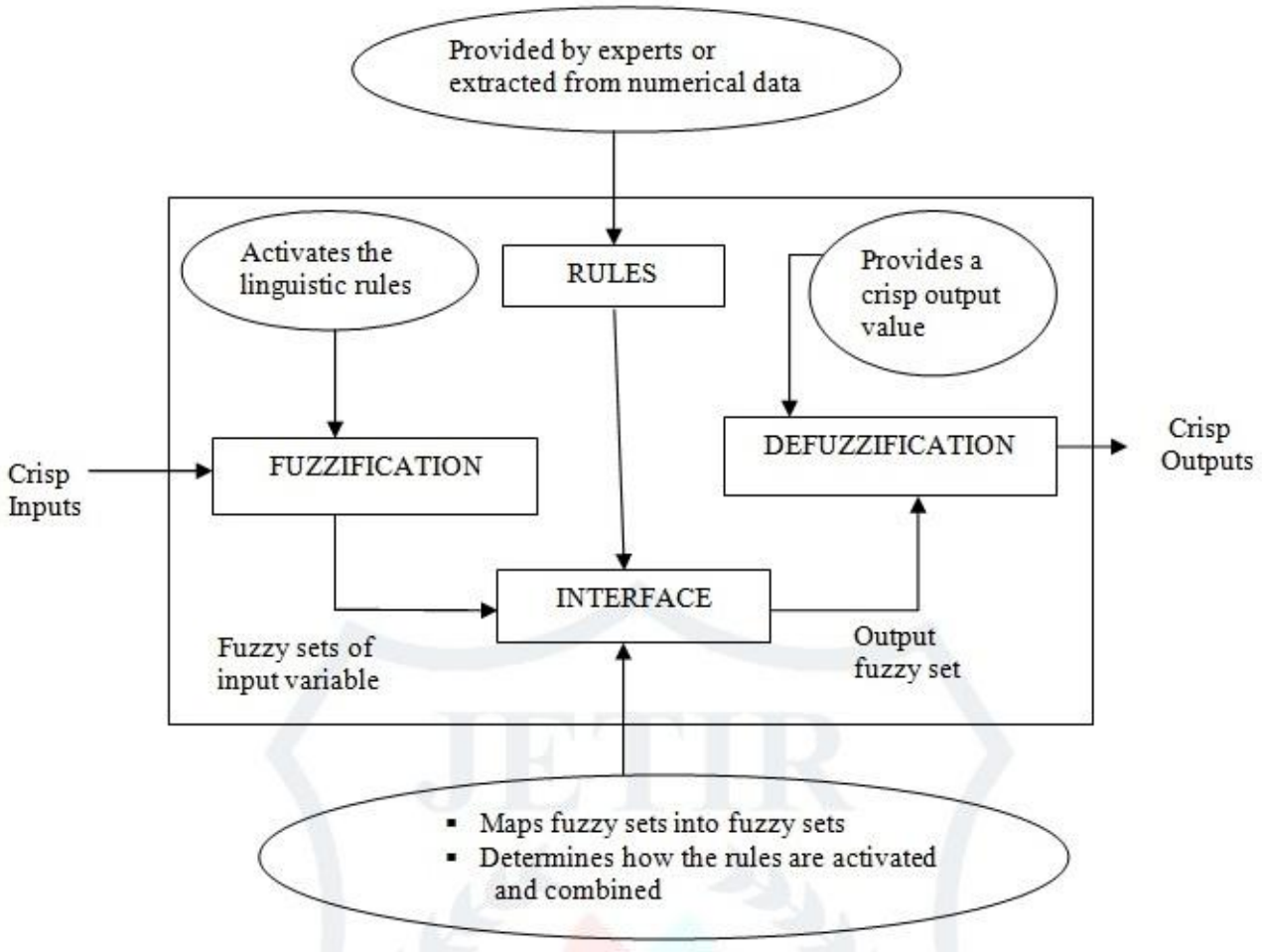

Figure 4: Neuro Fuzzy Network

1. **Algorithm:**

A. For each node;
ti = ((Em(i) – Er(i)/Em(i)) X TCH ;
// energy calculator
di = ((Dm (i)- Dr (i) / Dm ((i)) X TCH;
// distance
Ci = ((cm (i) – cr (i) / Cm ((i)) X TCH;
// centrality
ni = ((Nm (i) –Nr (i) / Nm (i)) X TCH
// concentration
End for

B. f (i) = fuzzify (ti, di, ci, ni);
defuzzify (f (i))

C. if (f (i) = = 0) then
node i broadcast (CH adut. in the range R)
end if

if (node j receives CH adut. msg) then node j switches off its timer and becomes non- CH node;
updates NCH (j);
end if

for neuro fuzzy the part B becomes as
f (i) = neurofuzzy (ti, di, ci, ni);
Defuzzify(f (i));

Here the neuro system applies with fuzzification in parallel execution to reduce time consumption over cluster head selection.

Cluster formation algo */

/* Cset (i): set of CMs of clusion :*/
For each non- CH node j
Sum= 0.0 ;
for each CH k belongs to NCH (j)
Sum= sum + Er (k);
End for
u (j) = sum / 1 NCH(j)/;
for each CH k belongs to NCH (j)
if (Er (k) > H and D (j,k) < MIN) then// initially, MIN= 999
MIN = D (j,k);
Q = K;
End if
End for
Cset (Q) = union (Cset (Q), j);
End for

IV. Results

We are running a network of 100 nodes with initial energy of 0.05 J for 5000 rounds. X-Axis represents number of rounds.

Figure 5 describes the number of packets to the Cluster Head for DSEP-NF, with initial energy of 0.05J.

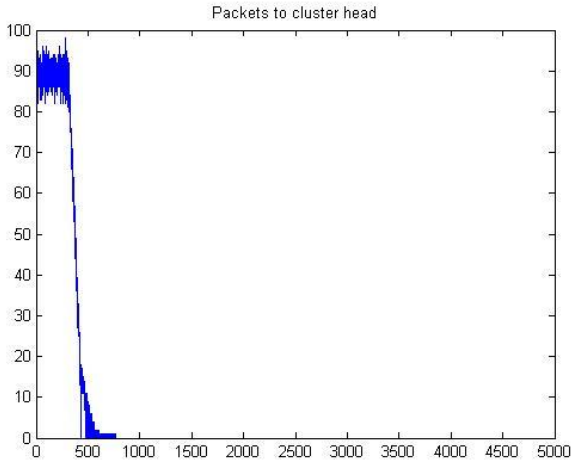

Figure 5: Packets sent to cluster head at Eo= 0.05J in DSEP-NF

Figure 6 describes the number of packets sent to base station for DSEP-NF with initial energy of 0.05J.

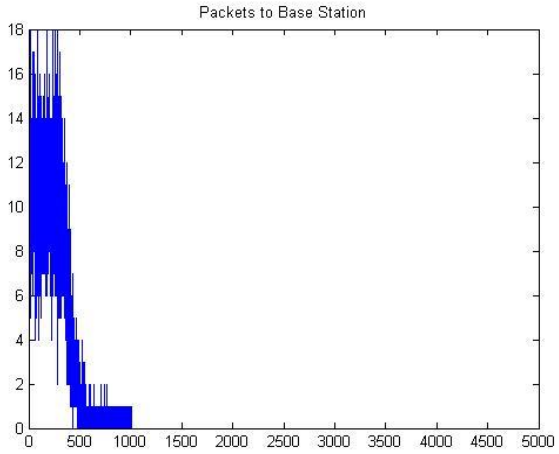

Figure 6: Packets sent to Base Station at Eo= 0.05 J in DSEP-NF

Figure 7 shows the Energy consumed during overall process (Residual energy of nodes) for DSEP-NF, with initial energy of 0.05J.

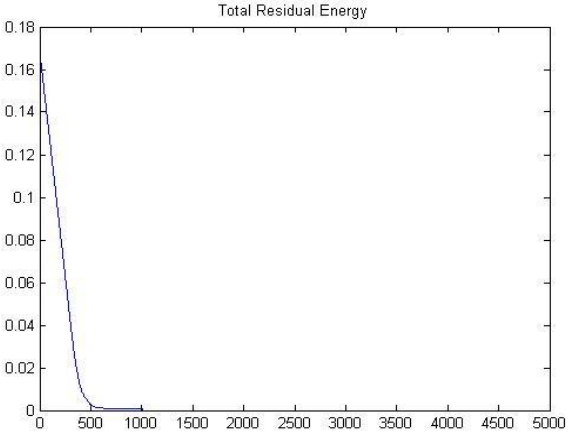

Figure 7: Residual Energy of Nodes at Eo = 0.05 J in DSEP-NF

Figure 8 shows us the total throughput of the network with DSEP-NF when energy is 0.05J.

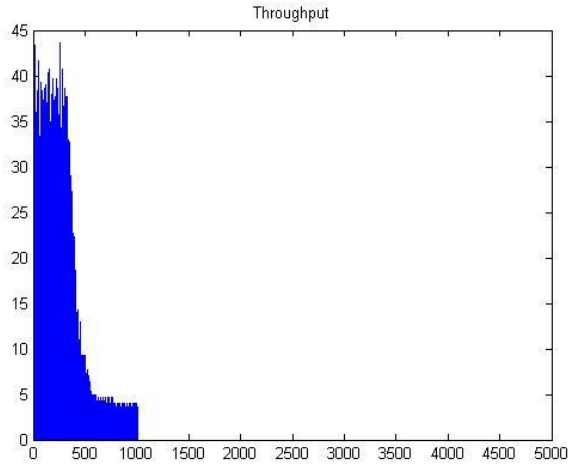

Figure 8: Throughput of Network at Eo= 0.05 J in DSEP-NF

Figure 9 shows the dead nodes w.r.t. network lifetime (Number of rounds) for DSEP-NF with Initial energy 0.05J. First and last dead node for DSEP-NF is at 296 and 1010 rounds respectively.

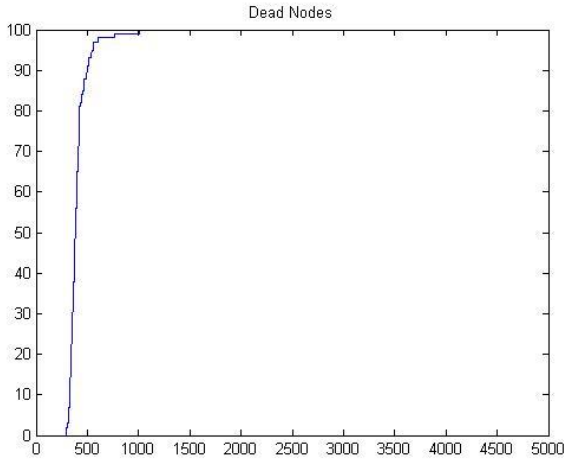

Figure 9: Number of Dead Nodes w.r.t. number of rounds at Eo= 0.05 J for DSEP-NF

V. CONCLUSION

The main pitfall in Wireless Sensor Network is the deployment of sensor energy which leads to network dead and falls off stability of the network. To improve network lifespan several clustering routing protocols are involved. Deterministic stable Election protocol is one of the approaches to improve network performance with three elevation of nodes. The proposed protocols DSEP-NF distribute workload and expand the lifespan of the network by using neuro fuzzy logic (NF). Selection of Cluster Head depends upon four parameters such as energy, centrality, concentration and distance to Base Station. Simulation outcome execute by MATLAB tool prove considerable improvement in network lifespan of DSEP-FL protocol as compared as Stable Election Protocols and DSEP protocol with randomly strew sensor nodes.

REFERENCES

[1] Z. Zhou, C. Du, L. Shu, G. Hancke, J. Niu, and H. Ning, "An Energy-Balanced Heuristic for Mobile Sink Scheduling in Hybrid WSNs," *IEEE Trans. Ind. Informatics*, vol. 12, no. 1, pp. 28–40, 2016.

[2] G. S. Arumugam and T. Ponnuchamy, "EE-LEACH : development of energy-efficient LEACH Protocol for data gathering in WSN," *IEEE Access*, 2015.

[3] S. Muhammad, S. Hussain, and M. Yousaf, "Neighbor Node Trust Based Intrusion Detection System for WSN," *Procedia - Procedia Comput. Sci.*, vol. 63, pp. 183–188, 2015.

[4] P. Li, W. Jiang, H. Xu, and W. Liu, "Energy Optimization Algorithm of Wireless Sensor Networks based on LEACH-B," *IEEE ACcess*, 2017.

[5] D. R. Prasad, P. V Naganjaneyulu, and K. S. Prasad, "Modified LEACH Protocols in Wireless Sensor Networks — A Review," *IEEE ACcess*, pp. 681–688, 2018.

[6] J. Joshi, J. Rathod, and K. Wandra, "Performance Enhancement of LEACH for Secured Data Transmission," *IEEE ACcess*, vol. 10, no. May, pp. 2–5, 2017.

[7] R. Kumar, "Evaluating the Performance of DEEC Variants," *IEEE ACcess*, vol. 97, no. 7, pp. 9–16, 2014.

[8] P. Saini and A. K. Sharma, "E-DEEC - Enhanced distributed energy efficient clustering scheme for heterogeneous WSN,"

2010 1st Int. Conf. Parallel, Distrib. Grid Comput. PDGC - 2010, pp. 205–210, 2010.

[9] B. Elbhiri, S. Rachid, S. El Fkihi, and D. Aboutajdine, "Developed Distributed Energy-Efficient Clustering (DDEEC) for heterogeneous wireless sensor networks," *2010 5th Int. Symp. I/V Commun. Mob. Networks, ISIVC 2010*, pp. 1–4, 2010.

[10] B. Pati, J. Lal, S. Chhabi, and R. Panigrahi, "ECS : An Energy-Efficient Approach to Select Cluster-Head in Wireless Sensor Networks," *Int. Confeerence Parallel Process.*, 2016.

[11] A. Preethi, E. Pravin, and D. Sangeetha, "Modified balanced energy efficient network integrated super heterogeneous protocol," *2016 Int. Conf. Recent Trends Inf. Technol. ICRTIT 2016*, 2016.

[12] F. Shang, "A Single-Hop Active Clustering Algorithm for Wireless," *IEEE ACcess*, pp. 397–406, 2009.

[13] T. Shah, N. Javaid, and T. N. Qureshi, "Energy Efficient Sleep Awake Aware (EESAA) Intelligent Sensor Network Routing Protocol," *IEEE ACcess*, pp. 1–6, 2016.

[14] W. Wang and Y. Zhang, "On fuzzy cluster validity indices," *Fuzzy Sets Syst.*, vol. 158, no. 19, pp. 2095–2117, 2007.

[15] P. Pahwa, D. Virmani, A. Kumar, V. Rathi, and S. Swami, "ScienceDirect Dynamic Cluster Head Selection Using Fuzzy Logic on Cloud in Wireless Sensor Networks," *Sci. Direct*, vol. 00, pp. 2–6, 2014.

[16] Manju Bala, Lalit Awasthi, "Proficient D-SEP Protocol with Heterogeneity for Maximizing the Lifetime of Wireless Sensor Networks, I.J Intelligent Systems and Applications, pp: 1-15, 2012.

[17] Sumanpreet Kaur, Harjit Pal Singh, Vikas Khullar, "Performance Analysis of Deterministic Stable Election Protocol Using Fuzzy Logic in Wireless Sensor Network" World Academy of Science, Engineering and Technology, International Journal of Electrical, Computer, Energetic, Electronic and Communication Engineering Vol:11, No:7, pp: 1-7, 2017