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Enhanced the Stability and Network Lift Time of Heterogeneous WSN Protocols

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Abstract: *In this research work we simulate all four protocols in MATLAB software DEEC, Developed-DEEC, Enhanced-DEEC, and I-BEENISH Protocol. we implement improved advanced fuzzy logic concept in I-BEENISH Protocol we compare the living nodes during rounds, nodes died during rounds, packets send to the base station and the size of CH of in all four protocols we compare the result simulations in result shows that I-BEENISH is more efficient compared to DEEC, Developed-DEEC and Enhanced-DEEC in conditions of network life-time and stability.*

Keywords: Sensor Nodes, Cluster, DEEC, DDEEC, EDEEC, I-BEENISH, FIS (fuzzy interface system), CH (cluster head)

I. INTRODUCTION

WSNs have many of the sensory nodes prepared by sensory, computer and communication capabilities. Every node figure 1. Clustering on WSNs has capability to sense the environment of task and can execute simple calculations.

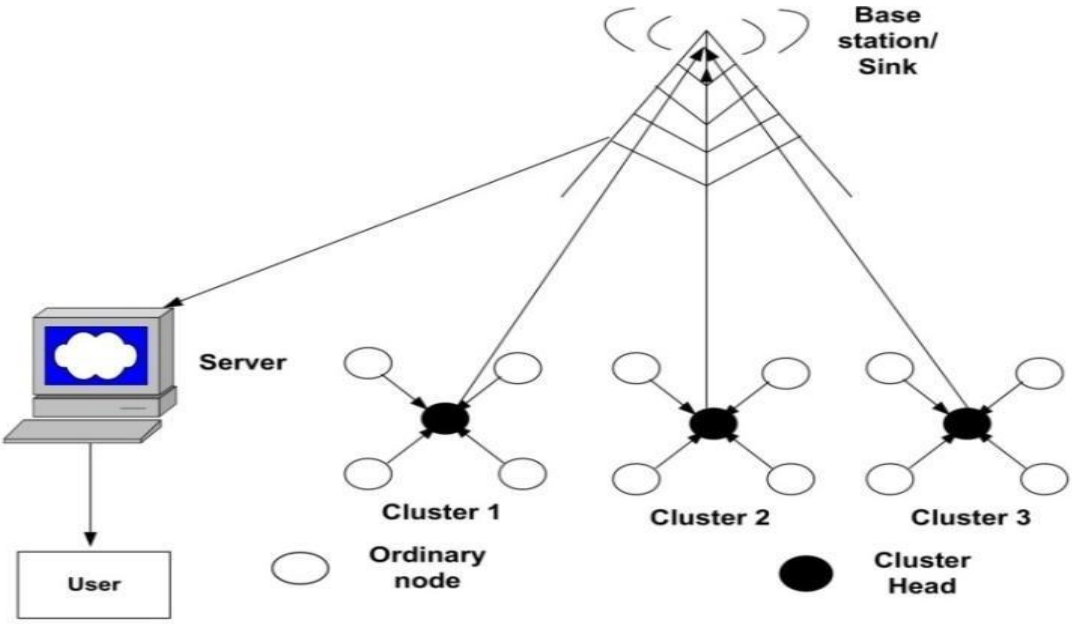

Figure 1: Clustering in WSNs

Sensor node communicate with its, peers to collect sensitive data or to send (receive) data to or (from) BS. [1] [2][3] The BSconnects sensor networks to any another network. Designing of sensor network protocols should be sensitive to power to extend network life, as replacing embedded sensor batteries is a very difficult process, once these are installed. WSNs must use the power of their network effectively to be able to observe the surroundings for a long time The included Method make the sensory network more efficient.

II. RELATED WORKS

To cut down on transmission and received time, employ modulation methods [4] [5] [6] [7]. Energy consuptin will be reduced and network lifespan will be extended by using energy-efficient protocols in these tiers. The energy model for each sensor node is taken into account by the routing protocols used in WSNs. Two energy level of node are taken into account by SEP. DEEC, and Developed-DEEC. Enhanced-DEEC takes into account three energy levels in WSNs. However the CH election Standards for Enhanced-DEEC are ineffective. When super and advanced nodes remaining energy depletes and they start to behave like normal nodes. super and advanced nodes and they start to behave like normal nodes. Enhanced-DEEC always punishes them more severely than it does comventional nodes. Super and advanced node experiens an earlier daths rate in this scenario. wide variations of energy levels are produced in WSNs as a result of random CH selection. i will thus achieve far better outcomes the more nergy levels I can quantify. Four energy introduced BEENISH. And multi heterogeneity level introduced by I-BEENISH based on their starting energy. When high level node drop energy in a four level heterogeneous WSNs. I-BEENISH adaptively modify the CH selection probability of such nodes. Nodes following the energy they have left. WSNs really have many more node energy levels than just two or three types. large variations of energy levels are produced in WSNs as a result of CH being randomly chosen. Therefore the more energy level I can quantify the better results will be. accroidng to their original energy I-BEENISH perform much better than other three protocol. Its enhanced the Stability and network Lifetime of heterogeneous WSNs.

III. PROPOSED MODEL

3.1 Advanced Fuzzy Logic Based Improved I-BEENISH HWSNs

The detail of protocol is presented in this section. I-BEENISH implements the same concept and logic in [8][9] BEENISH as it is the improvement and modified of BEENISH protocol. The selection of CH is totally based on remaining energy level of the nodes in the network with average energy of the network. BEENISH uses the concept of four level heterogeneity model while I-BEENISH uses the concept of multi level heterogeneity modal in which its contain five energy level nodes.

$$P_i = \left[\frac{P_{opt} * Ei\,(r)}{1+m\left(a+m_0(-a+b+m_1(-b+u))\right)E(r)}\right] \text{ normal nodes (3.1)}$$

$$P_i = \left[\frac{P_{opt} *(1+a) * Ei\,(r)}{1+m\left(a+m_0(-a+b+m_1(-b+u))\right)E(r)}\right] \text{ intermediate nodes (3.2)}$$

$$P_i = \left[\frac{P_{opt} *(1+b) * Ei\,(r)}{1+m\left(a+m_0(-a+b+m_1(-b+u))\right)E(r)}\right] \text{ advanced nodes (3.3)}$$

$$P_i = \left[\frac{P_{opt} *(1+c) * Ei\,(r)}{1+m\left(a+m_0(-a+b+m_1(-b+u))\right)E(r)}\right] \text{ super nodes (3.4)}$$

$$P_i = \left[\frac{P_{opt} *(1+d) * Ei\,(r)}{1+m\left(a+m_0(-a+b+m_1(-b+u))\right)E(r)}\right] \text{ ultrasuper nodes (3.5)}$$

We implement better fuzzy logic concept in I-BEENISH Protocol [10] [11] [12] The fuzzy inference systems fill a dual duty, namely the management of numerical data and language information. The usage of FIS in this study is designed so that each node can be provided a random value to eliminate the uncertainties that occur in cluster head (CH) selection. Three input variables named residual energy, movement speed, and rest time are employed as evidence. The output parameter is likelihood that a node will be picked as a CH. It's called potential. A likelihood of a node being selected as a CH is higher if the randomness value is bigger than that of other nodes. Figure 2 (a) depicts the fuzzy set utilised to observe the residual energy input variable. For this fuzzy set, the available he speed at which the CH candidate progresses is offered as another fuzzy input variable. Figure 2(b) displays a fuzzy set representing the speed of movement of the input variables. Very slow (VS), slow (S), medium (M), fast (F) and very fast (VF) are linguistic variables offered for this fuzzy set. Candidate C's pause time is presented as another unique input variable. Figure 2(c) demonstrates a fuzzy-set through which the input variable of the pause time is presented. The language variables offered for this fuzzy set are Very Short (VS), Slow (S), Medium (M), Fast (L), and Very Fast (VF). The candidate CH

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pause time is provided as another fuzzy input variable. Figure 2(c) displays a fuzzy set via which the pause time input variable is shown. The linguistic variables utilised in this fuzzy set are Very Short (VS), Short (S), Medium (M), Large (L), and Very Large (VL). Figure 2 (d) represents a fuzzy set for observing the input variables of node density. The linguistic variables supplied for this fuzzy set are very low (VL), medium (M), high (H) and very high (VH). indicated in Figure 2(e), the chance of the candidate CH is presented as the output variable of the fuzzy set. The nine language variables in this collection are Very Low (VL), Low (L), Rather Low (RL), Medium Low (ML), Medium (M), Medium High (MH), Rather High (RH), High (H) and very high (VH) (VH). Triangular membership, functions are employed here to decrease the computational effort to a minimum. To deal with any form of uncertainty, preset fuzzy if-then estimation methods are utilized to calculate the coincidence. According to the three fuzzy input variables, 125 estimation rules are obtained. The rules used to compute the possibility of fuzzy output variable. In order to put this application into effect, the fuzzy variable should be turned into a single crisp integer. System suggested here leverages the surface diffusion approach. Thus, distinct sharp values emerge between zero and 1, if several sensors consisting of the same language variables. All sensors will be selected as cluster head if varied numbers of sensors have the same sharp chance value. Based on the Leach design, the Leech-MF technology is introduced. Here, the no. of clusters is estimated to be roughly 5% of the total nodes present in a network. Fuzzy rules can generally be produced using human inference or test data. In this publication, the basic heuristic rule is created. The essential premise for this rule is that a node is more likely to be picked as CH if the remaining energy is larger, the movement speed is low, and the rest time is longer. Rule 105 is an excellent case of this scenario, while Rule 21 is the exact reverse.

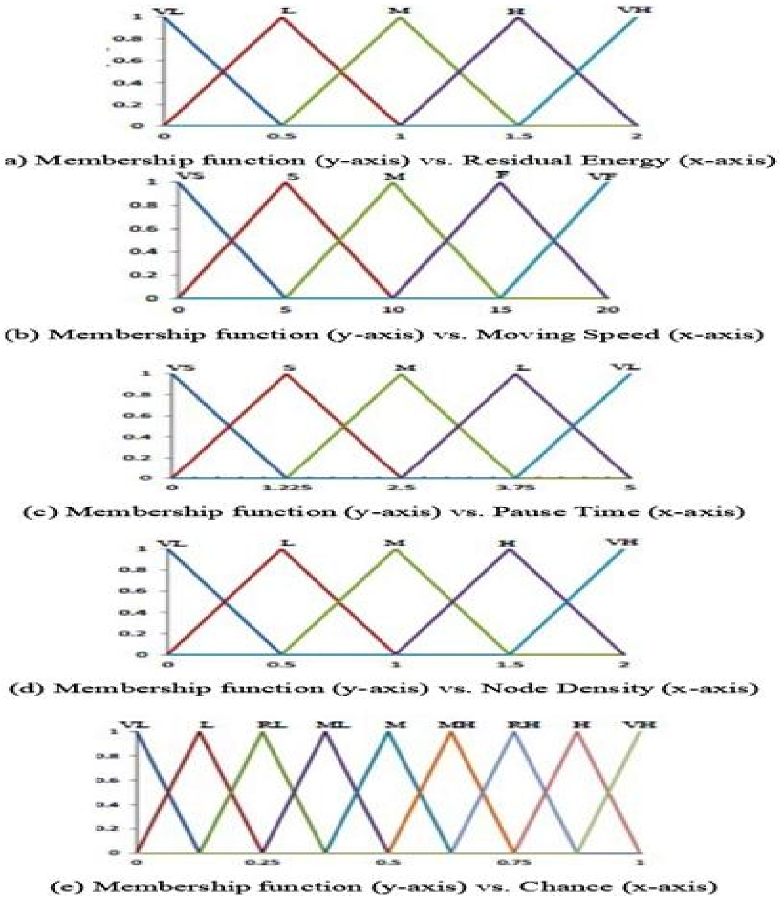

Figure 2: Advanced fuzzy sets various input variables

IV. SIMULATION AND RESULTS

We Perform the simulation of DEEC, Developed-DEEC, Enhanced-DEEC, and Fuzzy logic based Improved Balan I-BEENISH HWSNs in MATLAB software. We utilize the CPU of intel core i3 11th generation and 8 GB RAM in lab for simulation environment. We set the following parameters in MATLAB programme mentioned below. We simulate

DEEC, Developed-DEEC, Enhanced-DEEC and I-BEENISH in MATLAB software in lab in simulation [13] [14] [15] [16] environment. give values for zero energy and remaining energy of nodes at various interval of rounds and packets sent to BS and CH size different values of parameters m, m_o, a and b. These values are evaluated for DEEC, Developed-DEEC, Enhanced-DEEC and I-BEENISH.

Sr. no.	Parameters	Descriptions	Value
1	Xm x Ym	Area of the network	100m x100m
2	N	Number of nodes	100
3	*Rmax*	Number of rounds	1000
4	Threshold distance	Distance from centre	70m
5	P	Probability selected as CH	0.1
6	*E0*	Initial energy of node	0.5 J
7	*Etrans*($d < d0$)	Transmission energy of node	50nJ bit^{-1}
8	*Ereceive*	Receiving energy of node	50nJ bit^{-1}
9	*EDA*	Data aggregation energy	5nJbit^{-1}message
10	$\mathcal{E}fs$	Energy dissipation on free space	10pJ $bit^{-1}m^{-2}$
11	packets	Packet size	4000 bits
12	$\alpha''\beta'$ and $'\gamma'$	Threshold value	0.35
13	$\mathcal{E}mp$	Energy dissipation of multi-path delay	0.0013pJ $bit^{-1}m^{-4}$

For **:** $m = 0.5,\ m_o = 0.4,\ a = 0.5$ and $b = 1$

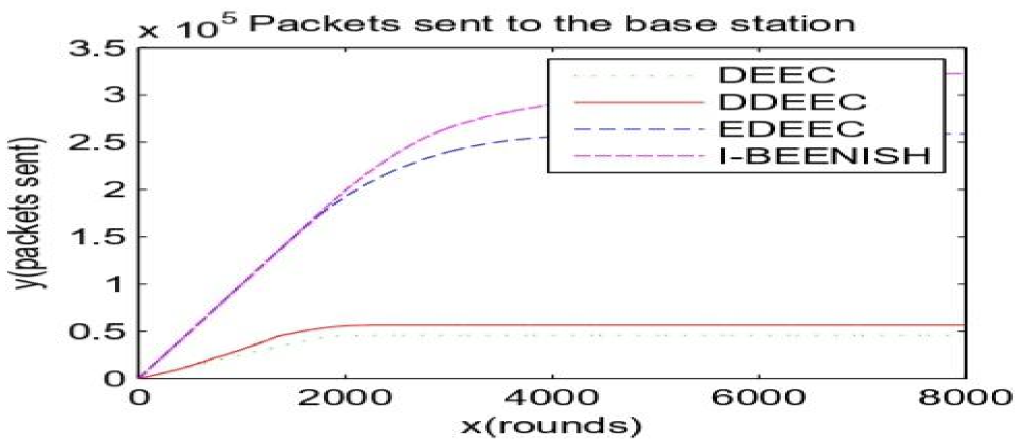

Figure 3: packets reached to BS

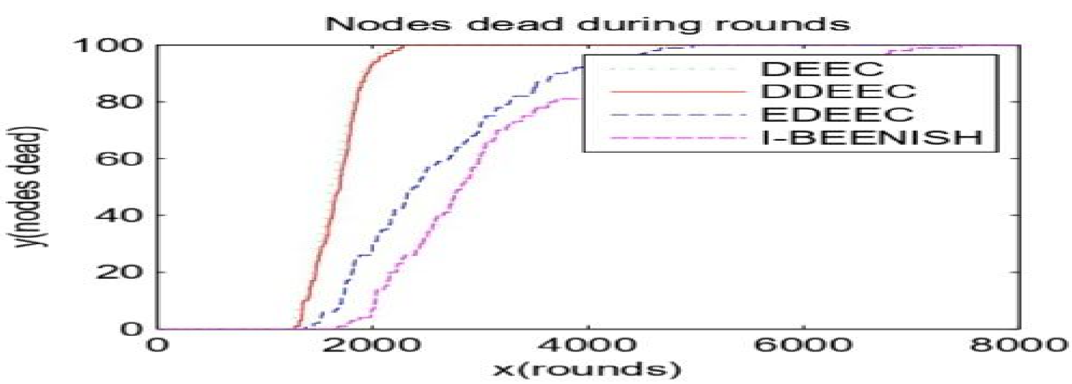

Figure 4 Dead nodes

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From figure 3 we observed that DEEC protocol sent $0.4x10^5$ packets to BS, Developed-DEEC protocol sent $0.55x10^5$ packets BS, Enhanced-DEEC protocol sent $2.6x10^5$ packets to BS .and I-BEENISH sent $3.25x10^5$ packets to BS. So I-BEENISH performs much batter then all other three protocols.

From figure 4 and 5 we discovered that first node of DEEC dies in 1281 cycles. Tenth node of DEEC dies in 1345 rounds. All nodes of DEEC perished in 2215 rounds. First node of DDEEC dies in 1331 rounds. Tenth node of Developed-DEEC dies in 1410 rounds. All nodes of Developed-DEEC perished in 2482 rounds. First node of Enhanced-DEEC dies in 1515 rounds. Tenth node of Enhanced-DEEC dies in 1626 rounds. All nodes of Enhanced-DEEC perished in 5035 rounds. First node of I-BEENISH dies in 1690 rounds.

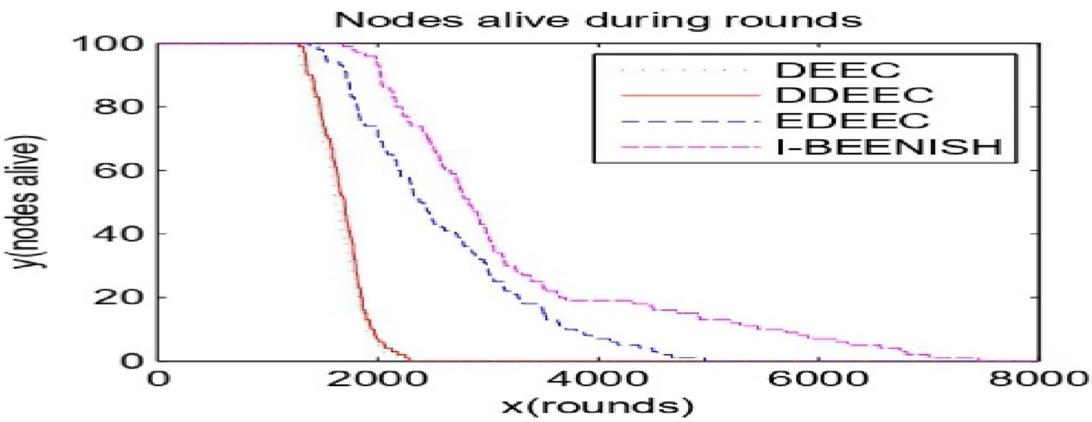

Figure 5: Alive nodes

Tenth node of I-BEENISH dies in 2046 rounds. All nodes of I-BEENISH DEEC perished in 7687 rounds. So we discovered that in terms of network longevity when we compared the dead and living nodes of all four protocols during each round. We discovered that in terms of network lifespan I-BEENISH performs considerably better that the other three protocols.

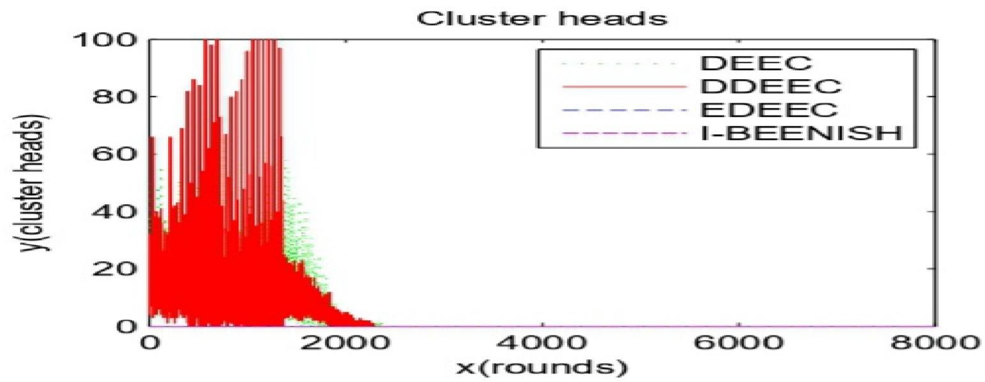

Figure 6: Number of cluster heads selection during rounds

Above given figure 6 we reached on the conclusion that I-BEENISH perform much better then other protocols due to small cluster size.

Table 2: Comparing Performance of DEEC, Developed-DEEC, Enhanced-DEEC and I-BEENISH

$m = 0.5$, $m_o = 0.4$, $a = 0.5$ and $b = 1$

Protocols	First node zero energy	Tenth node zero energy	All nodes zero energy	Data-Packets sent to BS
DEEC	1281	1345	2215	$0.4x10^5$
Developed-DEEC	1331	1410	2482	$0.55x10^5$
Enhanced-DEEC	1515	1626	5035	$2.6x10^5$
I-BEENISH	1690	2046	7687	$3.25x10^5$

Heterogeneous protocol performed considerably batter then Homogeneous protocol. Efficiency improves with the rising amount of variability. In this thesis we compared third level and multi level heterogeneity model procedures. After that we integrate advanced fuzzy logic ideas in I-BEENISH protocol which is a multi level heterogeneity protocol. After that we simulate DEEC, Enhanced-DEEC, Developed-DEEC and fuzzy logic based I-BEENISH protocols in MATLAB programme. After simulation we compare the outcomes.[17] [18] [19] [20] We found that advanced fuzzy logic based multi level heterogeneity I-BEENISH protocol performed much better compared to low levels heterogeneous protocol in terms of network lifetime, number of packets send to the base station, number of dead nodes and number of alive nodes which shows network lifetime and count of Cluster Heads per round. From the simulation result of MATLAB it is apparent that sophisticated fuzzy logic based I-BEENISH protocol sends maximum packets to the base station. Last node of sophisticated fuzzy logic based I-BEENISH protocol die at 7687 round. These displays maximum lifespan of the sophisticated fuzzy logic based I-BEENISH protocol compared to all other three protocols. With the increasing of heterogeneity level of WSNs protocols performs significantly batter compared to other WSNs protocols. Stable period of advanced fuzzy logic based I-BEENISH protocol is higher compared to all other three protocols like DEEC, Developed-DEEC and Enhanced-DEEC WSNs protocols. So we clear that in terms of network lifespan, clustering hierarchy, packets supplied to the base station and stability period advanced fuzzy logic based I-BEENISH protocol is batter that DEEC, Developed-DEEC and Enhanced-DEEC WSNs protocols.

V. CONCLUSION

We tested DEEC, Developed-DEEC, advanced fuzzy logic based I-BEENISH and Enhanced-DEEC to find HWSNs that have different levels of heterogeneity. Imitation proves that DEEC and Developed-DEEC work well on networks that contain significant energy differences between normal, advance and ultrasuper nodes. Although, we reached on the conclusion yhat the Enhanced-DEEC and I-BEENISH do better in the all cases. I-BEENISH has excellent performance in terms of life and stability expectancy but the instability of Enhanced-DEEC and I-BEENISH is very high. Therefore, Enhanced-DEEC and I-BEENISH are developed over a period of stability while endangering lifetime. Further research work can be done on the above concern.

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