Performance Analysis of ERA Using Neuro Fuzzy in wireless sensor network

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Abstract : A remote sensor organize (WSN)is process the spatially scattered sensors for recording and checking the physical state of the earth like sound, temperature, mugginess, wind and contamination level, and so forth. These observing states of the earth are gathered and mastermind information at focal area. As per look into holes we begin in the investigation of remote sensor arrange related vitality issues we found the issue to locate the proper CH (bunch head) utilizing such a methods where by applying least time by utilizing the procedure of fuzzification induction. To think about the different vitality productive steering calculation and grouping procedures for remote sensor organize. To plan and actualize ERA-NF (Energy Aware Routing Algorithm-Neuro Fuzzy) for WSN by utilizing Neural Network for bunch head determination. Neuro fluffy rationale guarantees the efficient determination of bunch Head by taking four phonetic factors that are fixation, centrality, vitality and separation to Base Station to contrast the proposed ERA-NF and a current calculation ERA-FL in view of the parameter wiz. Deferral, parcel drop proportion throughput.

Keywords: Routing Algorithm, ERA-NF, Fuzzification, energy aware, centrality, distance, concentration.

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I. INTRODUCTION

[1]A most recent class of system has showed up in most recent couple of years: called remote sensor arrange (WSN). These systems comprise of individual hubs that are able to connect with their Environment by detecting or controlling physical parameters; these hubs need to participate with each other to satisfy their assignments as, ordinarily, a solitary hub isn't adequately master of doing as such; and they make utilization of remote correspondence to encourage joint effort. In crucial nature, the hubs without such a system control in any event some calculation, remote correspondence, and detecting or control functionalities. Regardless of the reality these systems likewise frequently incorporate actuators; the term remote sensor arrange has turned into the generally acknowledged name.[2] Now and again, other name like "remote sensor and actuator systems" additionally begins. These Wireless Sensor Networks are intense in that they are manageable to support a considerable lot of extremely different genuine applications; they are additionally an intense research and designing issue in view of exceptionally adaptability. As needs be, there isn't single arrangement of necessities that obviously characterize all Wireless Sensor Networks, and there is likewise not single specialized arrangement that include the entire outline space. For instance, in different [3]WSN applications, singular hubs in the system not just be associated with wired power supply but rather tolerably need to depend on installed batteries. Such an application, the vitality effectiveness of any foreseen arrangement is henceforth an extremely basic figure of benefits as a long activity time is typically alluring. In extra applications, control supply won't not be an issue and consequently different measurements, for instance, the precision of the conveyed comes about, can turn out to be more essential. Likewise, the worthy size and expenses of an individual hub can be connected in a few applications. [4]Wardrobe joined the nature of hub's sensors, impact the precision of the outcome that can be get from single hub. The number, cost, and conceivably low exactness of individual hub is connected when look at an appropriated arrangement of different sensor hubs to a more brought together form among less, more costly hubs of lifted precision. [5]Easier yet various sensors that are quit for the day the reality under investigation can detail the engineering of a framework both more straightforward and additional vitality proficient as they make simple disseminated testing distinguishing objects, for instance require a circulated framework.

[6] [7]proposed energy aware mechanism for routing the data for source towards the destination. Fuzzy logic is used for this purpose.

[8], [9]Wireless sensor network is most well-liked service utilize in commercial and industrial applications, because of its technical progression in processor, communication and custom of low power embedded computing devices. Sensor nodes are mostly used to observe environment conditions like temperature, power, pressure, humidity, position sound, vibration etc. [10]The sensor nodes are performing dissimilar tasks like neighbor node discovery, data storage and processing, smart sensing.

Segments of Wireless sensor organize: The most vital parts of the remote sensor arrange are sensor hub, performer hub, depend hub, passage, group head, and base station.

Sensor Node: Capable of information social affair and information preparing, and speaking with additional related hubs in the system. A one of a kind sensor hub ability is around 4 to 8 MHz, having 4KB of RAM, 128 KB streak and totally 916 MHZ of radio recurrence.

Table 1: Different parameters of ERA-NFL used within simulation[5]

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

In the event that each sensor hubs inside the group are having the comparable properties implies homogenous properties are alluded as disseminated Wireless Sensor Network. Generally if the sensor hubs have different properties called heterogeneous. It is called as various leveled remote sensor organize.
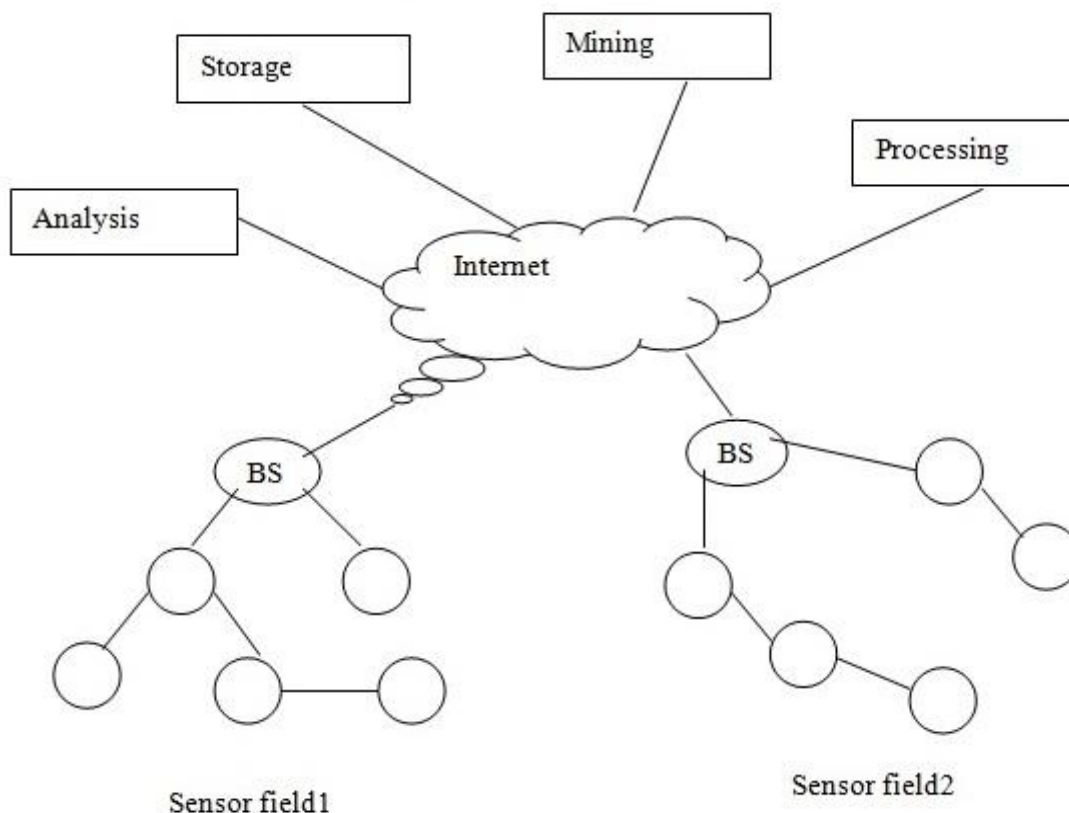

Figure 1: Wireless Sensor Network[5]

I. RELATED WORK

By conduct literature survey it has been initiate that the effect of compression and the special effects of the failures in the most of the energy efficient routing protocols has been overlooked by the most of the researchers.

According to research gaps we originate in the study of Wireless Sensor Network related energy issues we found the following problems and can be defined in such a way as given The problem to locate the appropriate CH (cluster head) using such a technique where by applying least time by using the process of fuzzification inference.

II. ENERGY AWARE ROUTING PROTOCOL

[11], [12]Energy aware Routing protocol is a routing protocol for improving the maximum lifetime of a Wireless sensor network. The protocol is based on brilliant move toward for the selection of cluster head, additional energy of cluster head, and the intra cluster for the cluster configuration. For data routing necessary backbone of cluster head formulate that is from the sink. ERA uses variety of paths from source node to the information sink with an aggressive probability, so the span of whole work is improved. The algorithm is of two types used that are:

Routing:
Energy efficient routing also acting imperative role in the Wireless Sensor Network. For provide the message to the Base Station (BS), Directed Virtual Backbone (DVB) rooted at the Base Station is constructed.[13], [14] The Base Station generate a route demand message in the communication range. The reporting information has its rank (L), ID, and destination data. The rank of the Base Station is set as zero. When a Cluster Head gets the reporting information, then the node increment its stage to the one higher than the sink and sets the sink as its parent node. Ahead of it sends the data packets, node μcalculate the standard residual energy.μ calculates the average residual energy that is referred from (1)[6].

$$\eta(\mu) = (\sum_{i=1}^{p} Er(vi))/p \qquad (1)$$

If the residual energy is elevated or equal to η (μ), then node μ gives incoming data packets and sends these data packets to the correspondent cluster head (CH).

Clustering:
[15], [16]The procedure of clustering consists of nodes that are consistent into specific groups called clusters, and every specific group has its controller associated which is known as CH, and the enduring nodes in a cluster take action as Cluster members (CM). All sensor nodes should be linked to one cluster in the network. All sensor nodes sets its individual timer separately. Let t(i) sensor node timer which is equated from (2) [7].

$$t(i) = \frac{E_m(i) - E_r(i)}{E_m(i)} x T_{CH} \qquad (2)$$

TCH is the utmost given time for selection of CH, Em(i) is the primary maximum energy, and Er(i) is the sensor node's residual energy. Nodes which have extra residual energy are well thought-out as Closter Head. Later than the termination of timer, node i elect itself as Cluster Head and ahead Cluster Headexposure information in the communication range. When node j receive information, it loses the anticipation of becoming CH, thus it leaves its contention with cancelling its timer and acts as the non-CH node for the upcoming communication round. Later than that, node j keeps on tracking of sensor node by in receipt of Cluster Head reporting information by taking into consideration a neighbor Cluster Head (CH) set denote by NCH(i). For the configuration of the cluster network, all candidate Cluster Head node sets its cluster membership by locale node j which requests the connection with Cluster Head that belongs to the set NCH(j).Node j connect to the closet Cluster Head which has residual energy which is equivalent to μ.

III. METHODOLOGY

According to do the research gaps originate in the study, it has been determined to apply Neuro-Fuzzy logic instead of only Fuzzy for the ERA protocol where the above two given problems and gaps can be privileged easily.
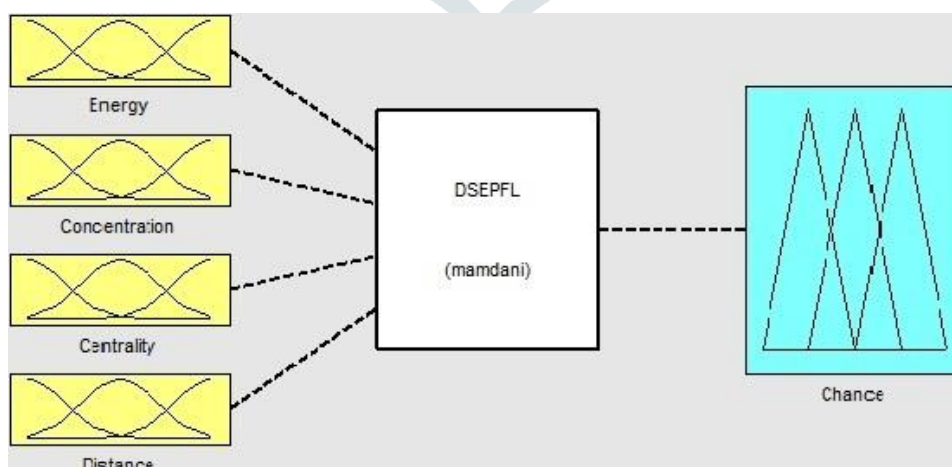

Figure 2: Working of ERA-FL[7]

Instead of using single membership function we can prefer top three membership function for fuzzification method and can realize or implement and run equivalent as the neural network technique has its interior benefit..The accepted objectives of

dissertation are: [17]To study the different Energy efficient routing algorithms and Compression techniques for Wireless Sensor Network. Analyze and Design Fault Tolerant Compression based Energy Aware Routing Algorithm for Wireless Sensor Network and evaluate the planned Fault Tolerant Compression based Energy Aware Routing Algorithm with an existing algorithm based on the parameters , Throughput, Remaining energy, Packets sent to cluster head, , Number of alive nodes Number of dead nodes etc

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

Energy: The remaining energy of the node in the network proportion or fraction to entire energy of the network. Energy is divided into three values that are Low, Medium and High values.

Distance: Distance of the node from the core location. Distance is also divided into the three values are Near, Medium and far values.

Centrality: This demonstrates the closeness from node to cluster head. Centrality is divided into close, adequate and far values.

Concentration: The number of nodes in cluster with node linked to cluster head. Concentration value is divided into Low value, medium and high values

Neuro fuzzy Interface: The new method presents to get better or enhance the network lifetime energy efficiency of the previuous protocol with neuro fuzzy logic in it.. Neuro fuzzy logic is development of crisp logic which restrain transitional values between extremely true and extremelt false. The lifetime of nertwork is based on the efficient selection of cluster head. This realizeor implemented schema improved the lifetime of the network by improving ERA cluster head selection using neuro fuzzy logic.

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        ┌─────────────┐
        │    START    │
        └─────────────┘
              │
  ┌────────────────────────────────────────┐
  │   Network Design and Initialize Design  │
  └────────────────────────────────────────┘
              │
  ┌────────────────────────────────────────┐
  │ Define sensor field and selection of    │
  │ primary node                            │
  └────────────────────────────────────────┘
              │
  ┌────────────────────────────────────────┐
  │              Cluster Head               │
  └────────────────────────────────────────┘
              │
  ┌────────────────────────────────────────┐
  │ Selection of Cluster Head using Neuro   │
  │ Fuzzy                                   │
  └────────────────────────────────────────┘
              │
  ┌────────────────────────────────────────┐
  │ Associate Number of nodes with cluster  │
  │ head                                    │
  └────────────────────────────────────────┘
              │
  ┌────────────────────────────────────────┐
  │ Replace Nodes with Secondary nodes and  │
  │ data transmission                       │
  └────────────────────────────────────────┘
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        ┌─────────────┐
        │     End     │
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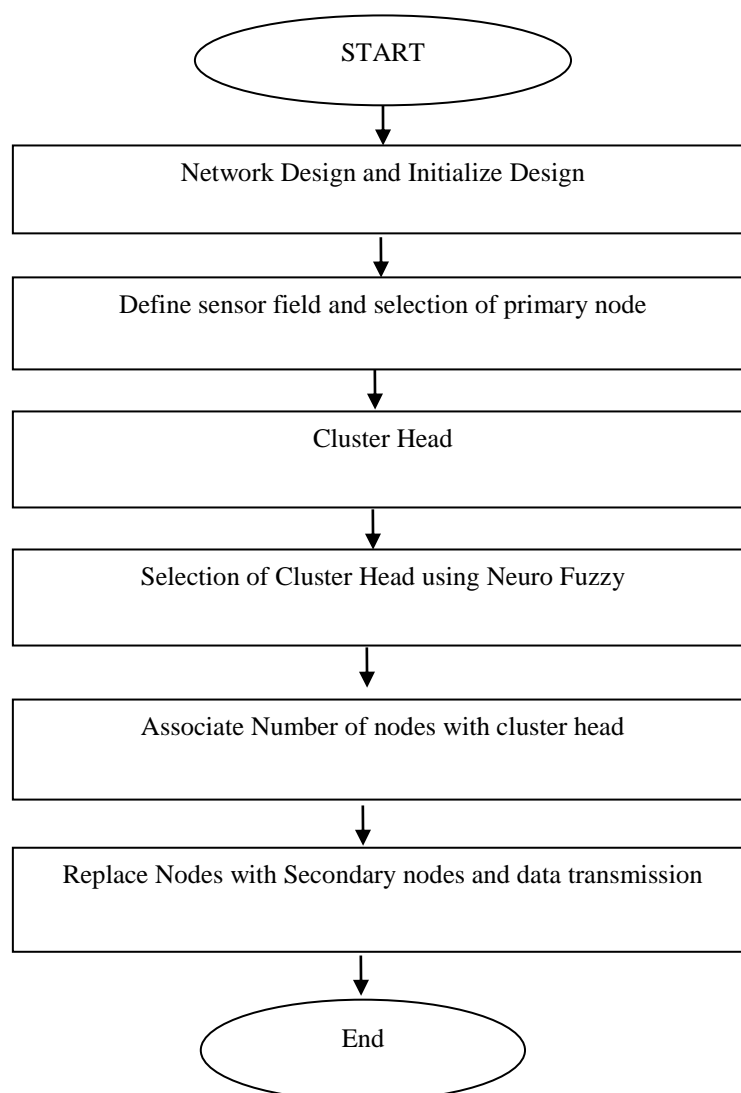
Figure 3: Methodology of performance analysis of ERA using neuro fuzzy network

The neuro fuzzy signify combination of neural network and fuzzy logic. The memory, available power, processing speed is the most useful linguistic input variable. The outrput variable is observed coefficient. It also works in more dense environment.
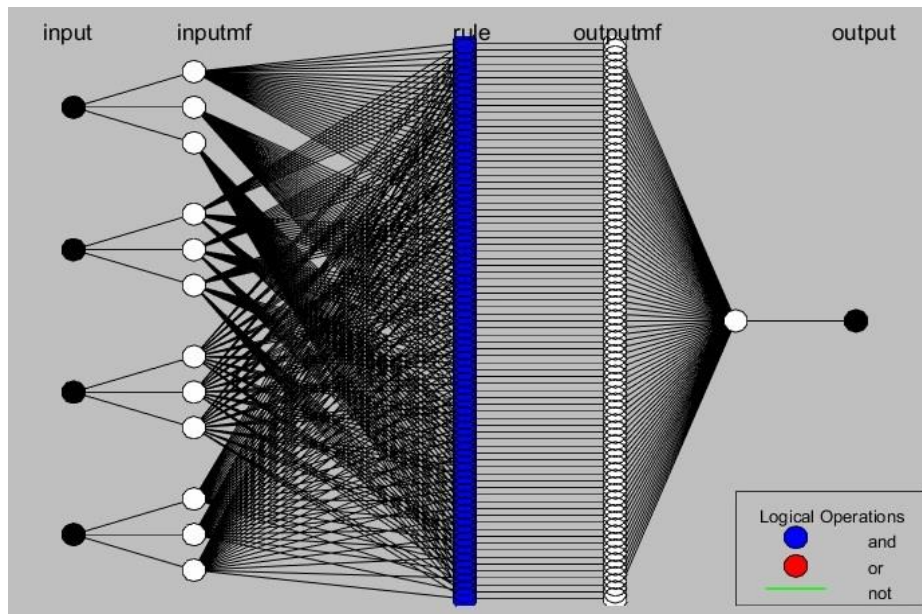
Figure 4: Neuro Fuzzy Network

Algorithm:
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);
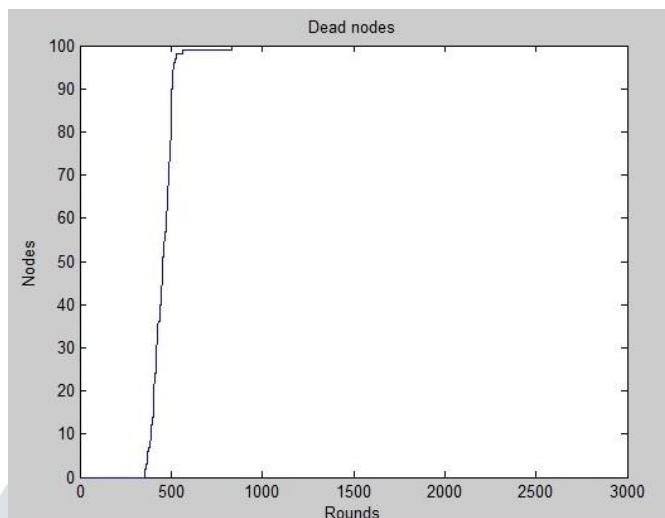**End for**

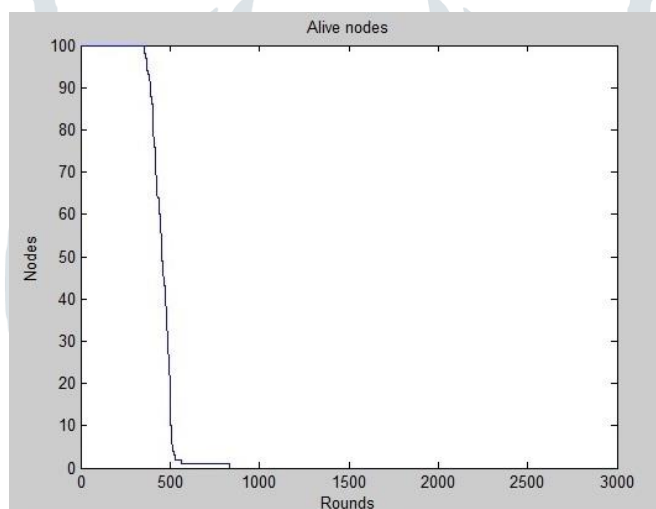Figure 5: Number of dead node for Eo=0.2J
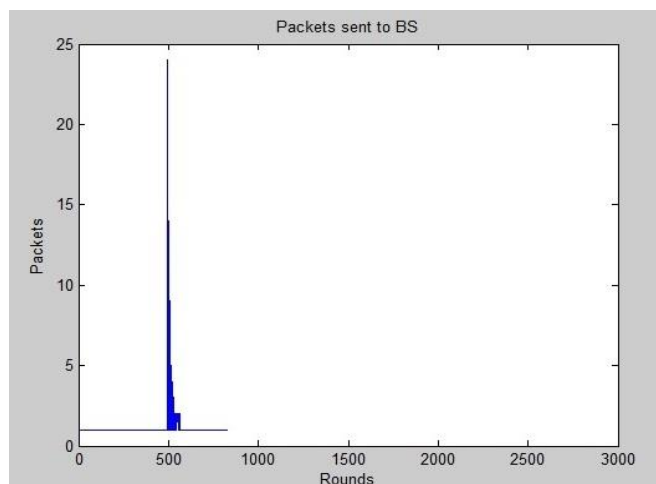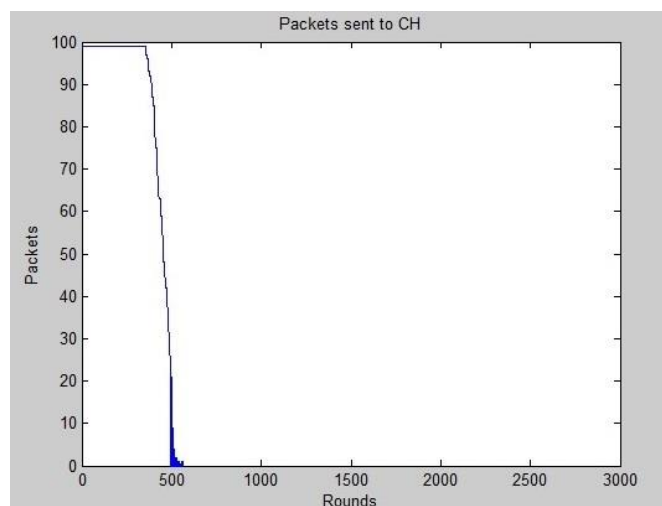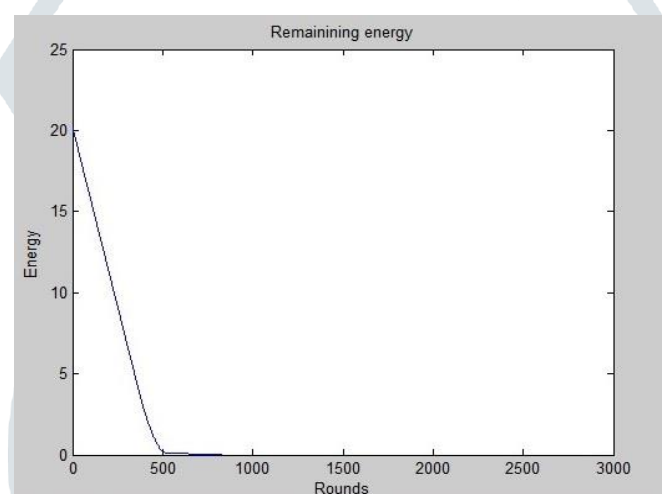

Figure 6: Number of dead node for Eo=0.2J

Figure 7: Throughput of the network for Eo=0.2J

Figure 8: Packet sent to Cluster Head (CH) for Eo=0.2J

Figure 9: Remaining energy for Eo=0.2 J

CONCLUSION

Wireless Sensor Network have minute nodes with sensing, declaration and utilization capabilities. All sensor nodes gather data from monitor's area and routes it back to the BS. In the proposed work enhance the stability of sensor networks using neuro fuzzy logic. In MATLAB   simulation results increase the performance by comparing the existing protocol with planned protocols with the metrics, raise in network lifespan as initial energy changes. It is concluded that increase the energy level of the network, more stable and more increase the lifetime.

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