Energy Optimization Of Heterogeneous WSN System By Using SEP – SEEC Hybrid Protocol

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Abstract— Control of dissimilar of knobs, in positions of their dynamism, in Wireless Sensor systems that are grouped. In these systems certain of the knobs developed collection heads, collective the statistics of their collection associates and communicate it to the descend. We accept that a proportion of the populace of sensor nodes is prepared with added vitality possessions; this is a foundation of heterogeneity which might effect from the original location or as the procedure of the network changes. We also accept that the devices are arbitrarily dispersed and are not movable, organized out of the descend and the extents of the device field are recognised. We demonstrated that the performance of such sensor networks becomes very unbalanced once the first node dies, particularly in the occurrence of node heterogeneity. SEP is grounded on subjective selection chances of each node to become group head rendering to the enduring energy in each node. We show by reproduction that SEP and SEEC always prolongs the solidity period related to the one obtained using current collecting protocols. We accomplish by revising the compassion of our SEP protocol to heterogeneity strictures taking energy imbalance in the network. The thesis grants a technique of WSN enhancement with the shared use of SEP system with the SEEC hybrid. The first segment contains overview to the WSN and a brief about the essentials of the system setup. The second section comprises the review of the earlier work works from various authors. The next section contains the present issue to be resolved and the final section contains the work methodology with reproduction results. The investigational analysis shows the enhancement and superiority of the proposed system SEP-SEEC over the SEEC system of heterogeneity based WSN system.

Keywords— *Wireless Sensor Network; SEP; SEEC protocol; heterogeneous; clusters and Hybrid protocol.*

I. INTRODUCTION

Recent developments in wireless message completed it conceivable to create wireless device networks comprising of little gadgets known as micro-sensors, which gather data by collaborating with one another [1]. These little detecting gadgets are termed as nodes. Nodes essentially have three primary parts, CPU (for information handling), memory (for information stock piling), cordless (for vitality) and for accepting and distribution signs or information starting with one knob then onto the next). The extent of every sensor node differs appropriately with applications. For instance, in some armed or reconnaissance requests it may be little. Its expense relies on upon its limitations like recollection size, processing speed and mobile [1]. The utilization of remote device system is expanding step by step and in the meantime it confronts the issue of vitality imperatives as far as forced battery lifetime. As every hub trusts on upon vitality for its exercises, it has turned into a note worthy problem in wireless sensor systems. The disappointment of unique hub can interfere with the whole framework or request. Each detecting node can be in dynamic, idle or sleep modes. In active mode, vitality is devoured by a node while transmitting or accepting information. In idle mode, energy devoured by a node is just about the same as in vigorous mode. Though in snooze method, the knobs stoppage the receiver to spare the vitality.
The accompanying stages can be occupied to spare vitality brought on by communication in wireless sensor systems.

- To plan the node's condition (i.e. diffusing, reception, workshy or snooze).
- Varying the broadcast reach between the detecting hubs.
- Utilizing productive routing and information gathering techniques.
- Avoiding the handling of undesirable information as on account of overhearing.

In WSNs, battery is the main wellspring [2] of life for the hubs. Speaking with different hubs or detecting actions devours a great deal of vitality in processing the information and spreading the gathered information to the drop. Much of the time (e.g. observation requests), it is unwanted to supplant the series that are exhausted or depleted of vitality. Numerous analysts are in this manner attempting to discover power-aware conventions for remote sensor systems with a specific end goal to overcome such vitality productivity issues as those expressed previously.

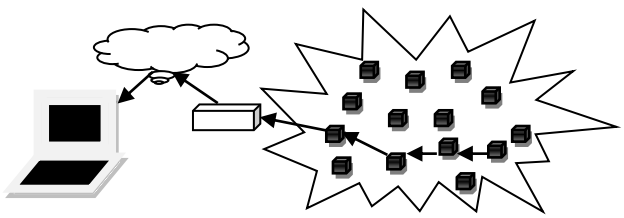


Fig. 1: Wireless Sensor Network

A. Challenges of Wireless Network

Wireless device system guarantees a widespread assortment of uses, and to understand these requests in actual world there is an essential of more effective conventions and algorithms. Planning another convention or algorithm, a few difficulties required to be unmistakably caught on. These difficulties [3] are condensed beneath:

- **Corporeal Resource Restrictions:** The most vital requirement forced on device system is the restricted mobile power of device nodes. The successful lifetime of a sensor hub is reliant on its energy source. Thus generation of a sensor hub system is additionally dictated by the power supply [4]. Consequently the vitality dispersal is principle configuration issue of a convention. Restricted computational control and memory size is additional imperative that influences the measure of information that container be put away in separate sensor hubs. In this way, the convention ought to be basic and light-weighted. Correspondence stay in sensor system can be great because of restricted correspondence channel shared by all hubs inside of one another's transmission range.
- **Ad-hoc Deployment**: Many applications or a large portion of them requires the ad-hoc disposition of device nodes in the area. Sensor hubs are haphazardly conveyed against the area with no foundation which requires the framework to have the capacity to adapt up to arbitrary dissemination and structure association between the hubs. As an illustration, for fire detection in a forest the nodes ordinarily would be dropped into the forest from a plane.
- **Fault-Tolerance:** A sensor node may come up short because of physical harm or absence of vitality (power). On the off chance that a hubs' percentage fall flat, the conventions that are working upon must suit these adjustments in the system. As an illustration, for routing or aggregation convention, they must discover suitable ways or conglomeration point if there should be an occurrence of these sorts of failures.
- **Scalability:** Depending upon the application, the quantity of sensor hubs conveyed could be all together of hundreds, thousands or more. The conventions must sufficiently adaptable to react and work with such extensive number of sensor hubs.
- **Quality of Service:** Some sensor applications are extremely time basic which implies the information ought to be conveyed inside of a sure timeframe from the minute it is detected; generally the information will be pointless. So this could be a QoS parameter for a few applications.

B. Requirements of WSN

Before going into the definite investigation of routing conventions, a brief depiction of the considerable number of variables that influence the working of these conventions are contemplated. Contingent on these variables, a few decisions about the conventions working are drawn. The execution of remote sensor systems depends on the accompanying components.

- Scalability
- Latency
- Energy Awareness
- Network Power Usage
- Node Processing Time
- Transmission Scheme
- Synchronization

C. Applications of WSN

WSNs may comprise of various assorted sorts of sensor hubs to sense distinctive sorts of parameters that empower them to screen a varied assortment of encompassing situations that incorporate the accompanying: flow, disease, weight, moisture, moisture, noise levels, motorized stress, speed, etc. Savvy sensors that can screen numerous physical variables can be utilized with WSN. Numerous new applications are being created on account of this new idea of miniaturized gauge detecting and remote systems management of these brilliant sensors. A potential's portion various utilizations of WSNs are as per the following: habitat monitoring, military, physiological monitoring, precision agriculture, forest fire discovery, nuclear, chemical and organic attack detection and transportation. [5] WSNs can change data gathering in an assortment of circumstances. An applications' portion are talked about beneath in point of interest.

- Habitat Monitoring
- Military Applications
- Physiological Monitoring
- Industrial Application and
- Vehicle Tracking

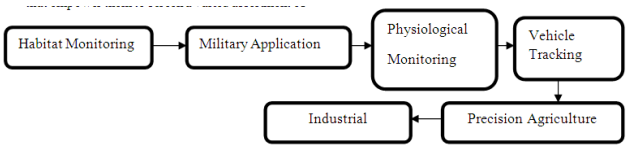


Fig. 2: Application of WSN

II. RELATED WORK

For instance, at the system layer, it is very attractive to discover routines for vitality effective course disclosure and handing-off of information after the instrument hubs to the Base Station so that the system's generation is augmented. Yun Li et. al. (2011), examined the modification over LEACH

convention. LEACH convention is unique of the collecting steering conventions in remote sensor systems. The upside of LEACH is that every hub has the equivalent likelihood to be a collection head, which types the vitality scattering of every hub be generally adjusted. In LEACH convention, time is separated into numerous bands, in every round, every one of the hubs battle to be cluster head as per a pre-defined basis. This paper disclosed how to set the period measurement of every round, to drag out the system's lifetime and expand throughput, which was meant as the measure of information packs sent to the descend hub. The elements of generation and quantity identified with the time distance of every overweight were derived. These capacities can be utilized to upgrade the execution of collection based remote sensor systems regarding lifetime and throughput [6]. Weiyi Zhang [2011] authors talked about LEACH convention and have set the time and extent of every round to drag out generation and to build information throughput. In [7] authors presented NEAP, this convention is effective for homogeneous yet not streamlined for heterogeneous. In [3] creators presented new convention which is scope mindful. In this paper creators clarified deficiency of utilizing remaining vitality or scope excess as the main criteria for the choice about the hub's part in bunch based remote sensor systems. In [9] creators introduced a general structural engineering for utilizing message passing algorithms for inference in sensor systems, utilizing reweighted conviction spread. They demonstrated hypothetically that any graphical model can be mapped to bits without requiring directing, by and by, some long-extend connections may present extra variables[6]. Mehdi Golsorkhtabaret. al. (2010), presented the new vitality versatile convention to diminish general power utilization, augment the system lifetime in a heterogeneous remote sensor system. Collecting sensor nodes is a successful topology control approach, however these procedures are not enhanced aimed at the attributes of mixed remote sensor systems In this paper, NEAP (the Novel Dynamism Adaptive Protocol for heterogeneous remote sensor organizes) the bunch head was chosen by a likelihood, in light of limit per round and bunch development in light of hubs current battery power and quantities [8]of individuals right now under a bunch head are occupied, separation between group heads and gestures. Finally, the reproduction consequences demonstrated that NEAP accomplishes longer lifespan and diminish vitality utilization in remote sensor networks [7]. Te-Li Wang et. al. [2014] calculated for battery-powered wireless device systems generally empower nodes to function in low responsibility cycle. Though, deprived of disconnected alteration in system strictures, present etiquettes any save liveliness at a cost of long in expression or work well only for a slender range of circulation load. To medicine these difficulties, this paper offerings CBA-EVT, an energy-efficient MAC procedure that is self-organizing in the attendance of different working regimes. To be self-organizing, CBA-EVT leverages two methods—charge benefit examination and extreme-value theory. CBA-EVT usages the cost advantage analysis that considers both delay and vigour consumption to regulate the snooze agenda from a macroscopic view; while it adventures extreme value theory to regulate duty cycle at a minute aspect[9].

III. ROUTING PROTOCOLS

Routing protocols in WSNs have a typical target of proficiently using the restricted assets of sensor hubs possession in concentration the end goal to broaden the system's lifetime. Distinctive steering systems can be received for diverse applications taking into account their necessities. Applications can be time basic or requiring intermittent upgrades, they may require exact information or enduring, less exact system, they may require persistent stream of information or occasion driven yield. Steering systems can even be upgraded and adjusted for particular application. By and large, the directing conventions in WSNs can be arranged into data-centric, ranked, location based direction-finding depending with respect to the system structure as appeared in figure. In data-centric, every one of the hubs is practically proportional and partner in directing a question got from the base station to the occasion. In hierarchical approach, a few hubs have added obligations possession in mind the end area to diminish the heap on different hubs in the system. In position based, the learning of places of sensor hubs is misused to course the question from the base station to the event [10].

In this segment, we overview the state-of-the-art routing procedures for WSNs. When all is said in done, directing in WSNs container is partitioned into flat founded routing, classified founded routing, and location-based routing depending with respect to the system construction. In level based routing, all hubs are ordinarily doled out equivalent parts or usefulness. In hierarchical-based steering, however, centres will assume diverse parts in the system. In position based routing, instrument hubs positions are misused to course information in the system.

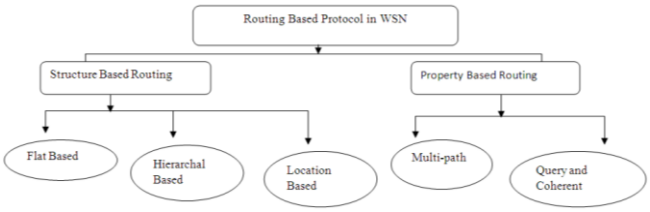


Fig. 3: Routing based Protocols in WSN

These conventions can be further arranged into query-based, multiple path-based, negotiation-based, coherent-based, QoS-based, or routing procedures depending in light of the convention process. Notwithstanding the overhead, directing conventions can be characterized into three classes, specifically, proactive, reactive, and mixture protocols relying upon how the basis discovers a course to the terminus. In proactive conventions, all courses are figured previously they are truly required, while in responsive conventions, courses

are registered on interest. Mixture conventions utilize a blend of these two thoughts. At the point when sensor hubs are static, it is desirable over have table determined directing conventions instead of utilizing reactive conventions. A lot of vitality is utilized as a part of course disclosure and setup of reactive protocols.

A. Hybrid (SEC AND SEEC) Routing Protocol

We define energy effectiveness as extreme work completed by saving less energy. Specially, in wireless sensor network energy effectiveness means extreme system lifetime with less energy uses of the wireless sensor network sensor knobs. Initially, we category the network [11] area into dissimilar regions of similar size. Then, sensor knobs are organized arbitrarily in the network area. The location of sensor knobs is dynamic, due to atmosphere. A static sink is plotted at the high peak centre of the network area and binary mobile destinations vary its location after both round and move within the edges of the network. While, mobile destination [2] remains in a single region, until the death of both sensor knobs of those regions.

We define SEP, which enhances the unchanging of the gathering grading procedure using the features of heterogeneity, specifically the segment of innovative knobs and the included energy parameter between normal and improved knobs. To prolong the stable region, SEP efforts to preserve the restraint of well equally vigour consumed. In enhanced nodes have to convert cluster heads more often than the simple nodes, which is equal to equality restraint on energy consumed [12].

IV. SIMULATION MODEL

The research replicated different clustering protocols in varied WSN using MATLAB and for imitations he used 100 nodes randomly positioned in a field of dimension $100m \times 100m$. For simplicity, he measured all nodes are either fixed or micro-mobile and disregard energy loss due to signal collision and meddling between signals of different nodes that are due to active random channel situations. In this situation, he considered that, BS is placed at centre of the system field. We simulate SEEC and SEP-SEEC for two-level heterogeneous WSNs. Simulation Model Steps:

[1] Design wireless network area to work i.e (100x100) m
[2] Apply the spread of the nodes in the area of communication
[3] Apply mobility parameters to source and sink for dynamic communication
[4] Arrange the communication using SEEC [**base system**]
[5] Arrange the communication using SEP-SEEC enhanced system [**proposed system**]
[6] Performance analysis for different number of nodes and area concentration
[7] Calculate the efficiency of both the system using the objective described parameters

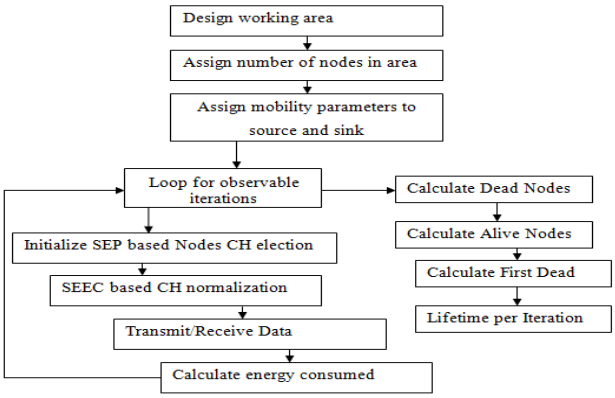


Fig. 4: Proposed Block Diagram

Scenarios describe values for number of nodes dead in leading, tenth and last bands as well as values for the packets sent to BS by CH at dissimilar values of limits m and a. These values are examined for SEEC and SEP-SEEC.

Table 2: Values of Parameters

Parameters	Values
System field	100 m,100 m
Numeral of nodes	100
Eo(original energy of normal nodes)	0.5J
Communication size	4000 bits
$Eelec$	50nJ/bit
Efs	10nJ/bit/m2
$Eamp$	0.0013pJ/bit/m4
EDA	5nJ/bit/signal
do(threshold distance)	70m
$Popt$	0.1

A. Energy Parameters

Energy ingesting minimization is an imperative when scheming the corporeal layer for WSN in totaling to the usual properties such as scattering or shadowing:

$$E_T(m,d) = E_{TC}(m) + E_{TA}(m,d)$$

$$E_T(m,d) = m\left(e_{TC} + e_{TA}d^{\alpha}\right)$$

Where;

E_{TC} = liveliness used by the spreader circuitry;
E_{TA} = energy required by the transmitter amplifier to achieve an adequate signal to noise ratio or at the earpiece

And; e_{TC}, e_{TA}, and e_{RC} are hardware dependent strictures.
To avert the unruly of node isolation, the area average energy and the reserves between sensors and the sink are planned to determine whether the isolated node should send its data to a CH node in the preceding round or to the sink [17].

B. Radio Dissipation Model

$$E_R(m) = me_{RC}$$

The wireless energy classical defines that l bit message is communicated over a distance $d$as in energy exhausted is then given by [18]:

$$E_{Tx}(l,d) = \begin{cases} lE_{elec} + l\varepsilon_{fs}d^2, & d < d_0 \\ lE_{elec} + l\varepsilon_{amp}d^4, & d \geq d_0 \end{cases} \quad (1)$$

Where, $Eelec$is the liveliness immoral per bit to run the transmitter or the earpiece circuit. d is the distance between sender and headset. If this distance is less than threshold, free space(fs) model is used else multi path(*amp*) model is used. Now, total energy dissipated in the network during a round is given by [18]:

$$E_{round} = L(2NE_{elec} + NE_{DA} + k\varepsilon_{amp}d_{toBS}^4 + N\epsilon_{fs}d_{toCH}^2) \quad \text{………………} \quad (2)$$

Where, K= number of clusters
E_{DA} = Data aggregation cost expended in CH
d_{toBS} = Average distance between the CH and BS
d_{toCH} = Average distance between the cluster members and the CH

,

$$E_{round} = L(2NE_{elec} + NE_{DA} + k\varepsilon_{amp}d_{toBS}^4 + N\epsilon_{fs}d_{toCH}^2) \quad \text{………………} \quad (2)$$

Where, K= number of clusters

E_{DA} = Data aggregation cost expended in CH

d_{toBS} = Average distance between the CH and BS

d_{toCH} = Average distance between the cluster members and the CH

$$d_{toCH} = \frac{M}{\sqrt{2\pi k}}, \qquad d_{toBS} = 0.765\,\frac{M}{2} \quad \text{……………………………………} (3)$$

$$k_{opt} = \frac{\sqrt{N}}{\sqrt{2\pi}}\sqrt{\frac{\varepsilon_{fs}}{\varepsilon_{amp}}}\frac{M}{d_{toBS}^2} \quad \text{……………………………………………………}(4)$$

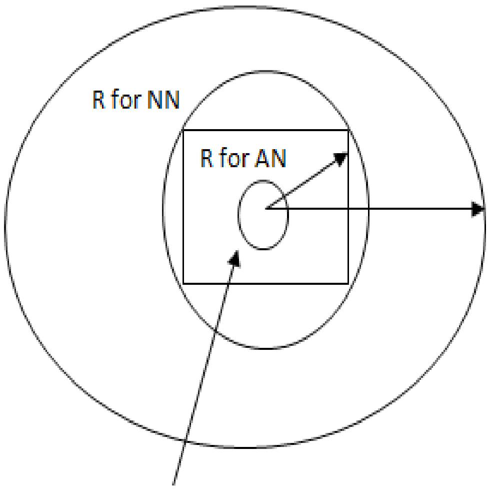
C. Periodic Listen and Sleep

Both node in the system turns off (sleeps) its transceiver and wakes up to snoop to the medium sometimes. The parameter to amount the percentage between wake-up retro to sleep period is called *duty cycle* and is given by:

Duty Cycle= listen time/cycle time

SEP based Energy Model
Mean = Sum of energy of AN network / Total number of nodes
Mean is reserved energy.

$$s = \sqrt{\frac{\sum(X-M)^2}{n-1}}$$



Area for deployment of the MN or Mobile nodes
The total number of nodes will be

$T_{mobile} = 0.7668$

$$T_{mobile} = 0.7668\sqrt{n}\ x\ number\ of\ \Delta$$

Where triangle is the number of loops between two advance nodes and BS base station .

D. SEP based Cluster Energy

EENERGY = k(bit)*(Eelec + εamp* r1^2+ Eelec + εamp* r2^2 + ERx)

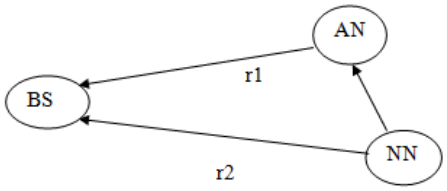
EDIRECT = k(bit)*(Eelec + εamp* r^2)

EENERGY < EDIRECT

E. Elected node with Amp energy

⇔ (Eelec + εamp* r1^2+ Eelec + εamp* r2^2 + ERx) < (Eelec + εamp* r^2) (1)
Tx = 50 mw (i.e)
Because Eelec = ERx = 50 µJ, εamp = 0.1 µJ. So:
⇔ 100+0.1(r1^2 + r2^2) < 0.1*r^2
⇔ 1000 + (r1^2 + r2^2) < r^2

The given formula is used for forwarding the data of nodes to BS and from nodes to neighboring nodes
r1, r2, and r are 3 edges of a triangle



Here the advance node is selected by using the SEP based polling and every time the stability of the network is preserved while communication

=> r2^2 = r1^2 + r^2 - 2*r1*r*cos(β).

Hence: 1000 + (r1^2 + r1^2 + r^2 - 2*r1*r*cos(β)) < r^2

V. RESULT ANALYSIS

The following section shows the results for the proposed and base system with 50 joules of energy and 100x100 areas with 700 nodes.

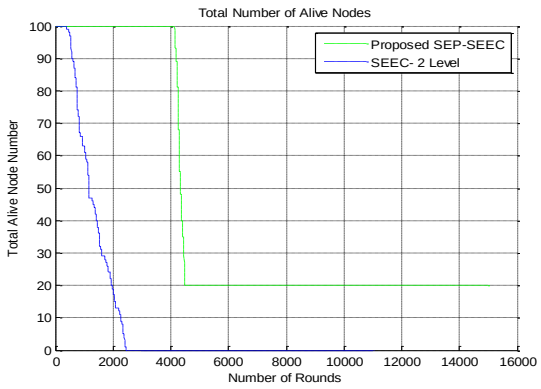


Fig. 5: shows number of alive node for Base and proposed system

The above figure shows the comparison of the base and proposed system on the basis of total number of alive nodes for longest time. It can be seen from the output that the proposed system shows the increment in node life by a gap of 1000+ iteration as the number of alive nodes in the proposed system are converging at 4000+ iteration and the base at 2300 iteration.

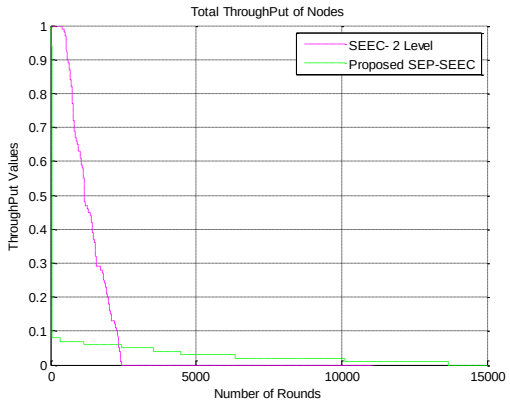


Fig. 6: shows the throughput of nodes for Base and proposed system

It can be seen from the output that the proposed system shows the increment in node life by a gap of 8000+ iteration as the throughput in the proposed system is converging at 10000th iteration and the base at 2400 iteration.

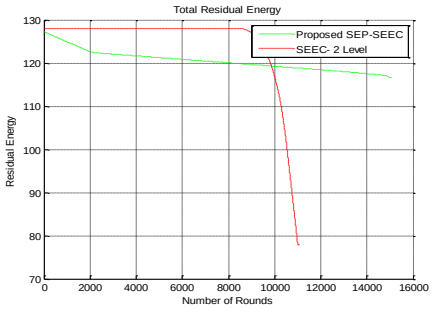


Fig. 7: shows residual energy of nodes for Base and proposed system

It can be seen from the output that the proposed system shows the increment in node life by a gap of 70 joules as the proposed system is at 110 joules at 10000+ iteration and the base at 85 joules at 10000 iteration.

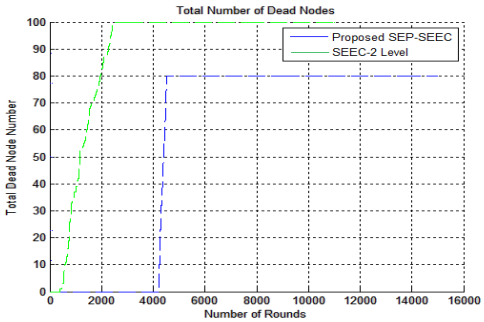


Fig. 8: Total number of Dead Nodes

It can be seen from the output that the proposed system shows the increment in node life by a gap of 1000+ iteration as the number of alive nodes in the proposed

system are converging at 4000+ iteration and the base at 2300 iteration

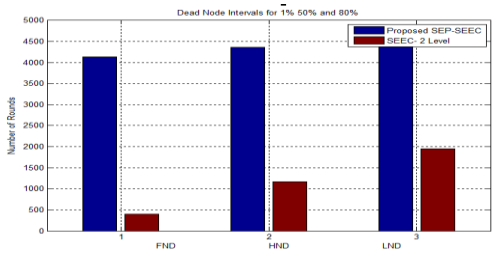


Fig. 9: shows FND HND and LND for Base and proposed system

It can be seen from the output that the proposed system for FND shows 4000 iteration and the base at 500 iteration, for HND shows 4400+ iteration and the base at 1100 iteration and for LND shows the 4500+ iteration and the base at 2200 iteration.

VI. CONCLUSION AND FUTURE SCOPE

One of the many issues inside layout connected with direction-finding protocols regarding WSNs will be vitality efficiency a result of the hard to find vitality sources connected with sensors. Therefore, direction-finding protocols designed for WSNs needs to be because vitality successful as is possible to help stretch the actual use of individual sensors, and therefore the actual network life. Although numerous direction-finding approaches seem promising, it is possible to numerous issues in which must be resolved inside sensor webs. We decorated those recurrent issues and also located foreseeable forthcoming research recommendations with this respect.

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