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# Sparkle Effective Scattering and Onward Node Assortment using Linkage Coding Mechanism in Mobile Wireless Sensing Element Network

Balamurugan K[1] , Subramani A[2] , Balamurugan P[3]
[1] Associate Professor, Department of IT, K.S.R. College of Engineering, Tiruchengode, Tamilnadu, India
[2]Assistant Professor, Department of Computer Science, Govt. Arts College, Dharmapuri, Tamilnadu, India
[3] Associate Professor, Department of CSE, K.S.R. College of Engineering, Tiruchengode, Tamilnadu, India
Email: itbalu73@gmail.com; subramani.appavu@gmail.com; pookumbala@gmail.com

**Abstract -** In mobile wireless sensing element networks, scattering and onward node assortment pattern might lead to redundancy, collision, congestion, performance degradation, distribution storm problem and so on. So as to beat these problems, during this paper, we have a tendency to propose sparkle effective scattering and onward node assortment using linkage writing mechanism in mobile wireless sensing element network. During this technique, the amount of nodes concerned in scattering operation is reduced by eliminating the nodes using minimum connected dominating set rule. Then the re scatter redundancy is reduced by choosing the on warders using symbolic logic supported the parameters like delay, residual energy and distance. To reduce re scatter, every node re scatter only its coverage degree is on top of a threshold price. By simulation results, we have a tendency to show that the projected technique minimizes the energy consumption and redundancy.

## I. INTRODUCTION

1.1. Mobile Wireless Sensor Element Networks (MWSEN)
A mobile wireless device network is comprised of little device nodes with 3 basic components: a sensing system to alter knowledge acquisition from the physical surroundings, a process system to alternative processing and storage, a wireless communication system permitting knowledge transmission. The device nodes are either equipped with mobilizers, springs and wheels or connected to transporters like vehicles, animals, robots etc. To confirm mobility of those nodes, the trail breakage happens typically owing to node movement raising the requirement of quality in wireless device network. A mobile node's frequent location updates ends up in excessive drain of device node's battery supply and raises collisions. Additionally the device network life depends on energy supply. Thus sparkle effective steering protocol is needed

1.2. Scattering and Onward Node Assortment in MWSEN
Scattering, a basic communication operation is that the method of sending a message from a node to all other nodes within the network. Many spontaneous network protocols accept scattering as a basic mechanism. Scattering was deployed in several routing protocols as in spontaneous on-demand routing protocols in their route discovery section. Scattering is employed for topology updates, network maintenance, for reliable multicast in fast stepped MANETs or simply to send a control or warning message.

Effective Scattering in a MANET chooses a tiny onward node set by simultaneously guaranteeing scatter coverage. Scattering allows every node to make a decision its on warding status according to given neighborhood data, and the corresponding scatter protocol is named self-pruning. Scattering adopts its easier kind in flooding wherever every node scatters the message on its first time reception of it. With full network coverage guarantee, flooding assures transmitting scatter packet to each node within the network and provide static and connected network. MAC layer of the communication channel is error-free while scattering. Flooding allow every node to receive the message from all its neighbors in a collision-free network. Blind flooding allows every node to onward the packets specifically once [2, 3, 4].

In general, effective scattering needs constructing a network backbone to avoid the scatter storm problem as a result of straightforward blind flooding; during which solely elite nodes particularly on warding nodes forms the virtual backbone, onward data to the whole network. The on warding node set for scattering in MANET area typically chosen a localized manner so as to enable every node to determine its own standing of on warding or non on warding based on local information or the standing of a node is selected by its neighbors. A smaller-sized on warding node set is believed as more efficient due to the restricted transmissions within the network; therefore on alleviate interference and conservation of energy. Thus the full variety of transmission sectors of the on warding nodes within the network is reduce interference and energy consumption [7].

Flooding as well as blind flooding generates several redundant transmissions that increase on increasing average variety of neighbors. Higher scatter leads to high power and information measure consumption within the network. Additionally it raises packet collisions, leading to further transmissions. As a result, severe network congestion or substantial performance degradation, particularly the scatter storm problem happens [2, 3]. Moreover, the present static network scatter schemes have poor performance in terms of delivery quantitative relation while nodes area unit mobile. Message delivery failure is as a result of collision and mobility of nodes [3, 5].

1.3 Problem Identification
There are several works on scattering choice supported onward node selection is applied in several works as [2], [6], [7], [8], [9] etc. but there are several drawbacks in these existing works as diminished delivery quantitative relation [2] [7], less on warding quantitative relation [4] [9], reduced re scatter quantitative relation [10], multiplied delay [8] [11] and packet loss [12] etc. Generally scattering and onward node choice scheme faces problems like multiplied redundancy, collision,

congestion, performance degradation, scatter storm problem etc. Hence our objective is to develop a scattering and onward node assortment in mobile wireless sensing element networks with reduced redundancy, higher delivery quantitative relation, and high on warding quantitative relation, high re scatter quantitative relation, reduced delay and packet loss. Additionally the scheme should to be free from collision, congestion, scatter storm problem etc.
To accomplish the above objective, a scattering algorithm was deployed by minimizing re scatter redundancy [10]. Generally the onward nodes re scatters but when hearing this re scatters, neighbor nodes starts to re scatter known as induced on warders. To scale back the induced on warders, we have a tendency to set it as a pair of by selecting solely the close nodes satisfying residual energy. Redundant re scatter can be further reduced by tracking its coverage degree that determines the node's re scatter efficiency. The life time of WSN can be maximized by reducing redundant re scatter and balancing energy consumption by utilizing node's self-delay .However there'll be still redundancy and multiplied energy consumption.

## II. LITERATURE REVIEW

Majid Khabbazian and Vijay K. Bhargava [2] projected a on warding node selection algorithm with fewer scatters within the network and an well-organized receiver-based rule. The constant approximation to the optimal solution (minimum CDS) is assured by 2-hop-based receiver-based algorithm. However the average delivery quantitative relation was decreased. Marimuthu Murugesan and Ammasai Krishnan [4] projected a reliable and efficient scattering algorithm using reduced onward node list algorithm using 2-hop neighborhood information for reducing redundant transmissions in asymmetric Mobile ad hoc networks that assure full delivery. However it has low on warding quantitative relation. Jailani Kadir et al [6] projected a primarily based node choice methodology to observe the intermediate node with optimum stored energy throughout the connection period. Thereby the very best chance node consumes the lowest energy. This could cut back interruption additionally as enhance the network life time due to the bottom potential consumption of energy for a given communication. Anchal Garg and Mohit Garg [7] projected a scheme using a directional antenna to onward chosen domestically need to transmit scatter messages, solely to the restricted sectors, so as to enhance the increased performance on transmit and receive and interference from unwanted sources. The directional antenna usage was combined with network coding based scattering that might support every on warding node to combine some of the messages it receives before transmission. This might minimize the number of transmissions of every on warding node in the message scatter application. However delivery quantitative relation was decreased on increased node movement.

Naixue Xiong et al [8] projected an efficient Minimum CDS algorithm (EMCDS) using an ordered sequence list without considering itself with node energy leading to sometimes failure of scatter operations if relay nodes are out of energy. Then a Minimum Energy-consumption Scatter scheme (MEBS) with a changed version of EMCDS was projected to produce an efficient scheduling scheme with maximized network life time. However there is an opportunity of link failure or delay. M.Murugesan and A.Krishnan [9] projected a localized onward node list selection algorithm with 2-hop neighborhood information in directed graphs with different transmission range for every node. A collection of nodes were solely chosen among the nodes within the sender's transmission range, to retransmit the scatter message. However, onward quantitative relation got decreased with increasing number of nodes. Ruiqin Zhao et al [10] projected a scatter algorithm with least redundancy (BALR) for WSN establishing a weighted sum model with detection of the optimized range of induce on warders as two and by considering re scatter efficiency and residual energy as a new metric for self-delay computing of nodes before re scattering. However re scatter quantitative relation of BALR decreases with increasing node density.

Wei Lou and Jie Wu dialect [11] projected a simple scatter algorithm specifically double-covered scatter (DCS) utilizing scatter redundancy therefore on enhance the delivery quantitative relation in high transmission error rate environment. Few chosen on warding nodes solely retransmit the message among the 1-hop neighbors of the sender. Here on warding nodes were chosen so that it covered the sender's 2-hop neighbors are covered and a minimum of 2 on warding neighbors cover the sender's 1-hop neighbors are either on warding nodes or non on warding nodes. The sender receives the retransmissions of the on warding nodes as the packet reception confirmation. However delay was increased. Basavaraj S.Mathapati and Dr.V.D.Mytri [12] projected an adaptive energy efficient on warding Protocol (AEEOP) to reduce the energy consumption with high reliability. The data on warding probability was adaptively determined according to the measured loss conditions. The network period was maximized by reducing energy consumption. However packet loss was increased.

## III. PROPOSED SOLUTION

### 3.1 Overview

In this paper, we have a tendency to propose to design a sparkle effective scattering algorithm based on linkage coding mechanism for mobile wireless sensing element networks. Linkage coding permits the intermediate nodes to combine packets before on warding. Thus it can be used for efficient scattering by reducing the whole variety of transmissions. During this algorithm, the amount of nodes involved in scattering operation is reduced by eliminating the nodes using Minimum Connected Dominating Set (MCDS) algorithm program. Then the re scatter redundancy is decreased by choosing the on warders using fuzzy logic. Fuzzy logic takes the input parameters delay, residual energy and distance and provides the onward node selection probability as output. To minimize re scatters, every node re scatter only its coverage degree is higher than a threshold value.

### 3.2 Estimation of Metrics

#### 3.2.1 Node Delay

The node delay is calculable using the subsequent equation (1)

$$\delta(i) = \delta_{\max}\left(w_1 . \frac{d(i,t)}{r} + w_2 \frac{[E_{\max} - e(i,t)]}{E_{\max} - E_{th}}\right) \qquad (1)$$

where, $\delta_{\max}$ = most allowed delay

d (i, t) = distance from node $N_i$ to the nearer ideal location at time t
Emax = initial maximum energy of every node
Eth = threshold worth of energy that helps in preventing node ending with very little energy state
w1 and w2 are the relative weights values of significant location and residual energy of the node respectively.
i.e. w1 + w2 = 1, $0 \leq w_1 \leq 1$, $0 \leq w_2 \leq 1$

### 3.2.2 Residual Energy

The total energy spent by the transmitter for sending x bits message through distance d is given using Eq. (2)

$$E_{tx} = E_e.x + E_a.x.d^2 \quad (2)$$

where $E_e$ = electronics energy
$E_a$ = amplifier energy
The total energy consumed by the receiver is given using Eq. (3)

$$E_{rx} = E_e.x \quad (3)$$

The residual energy of every node (Eres) following one data communication is calculable using Eq. (4) [10]

$$E_{res} = [E_i - (E_{tx} + E_{rx})] \quad (4)$$

where $E_i$ = initial energy of the node

### 3.2.3 Distance

The distance between 2 nodes are often calculable as follows

$$d = \begin{cases} r, & 0 \leq \tau < z^2 \\ z\sqrt{\frac{r^2}{\tau}}, & z^2 \leq \tau \end{cases} \quad (5)$$

where $\tau$ = node density.
r = region
$\sqrt{\frac{r^2}{\tau}}$, = smallest distance between two neighbor nodes.
z = constant
Note: The node density is outlined as the average number of nodes per region of r x r.

### 3.3 Sparkle Effective Scattering Using Linkage Coding Mechanism

Linkage coding permits the intermediate nodes to combine packets before on warding. Hence it can be used for efficient scattering by reducing the whole number of transmissions. During this algorithm, the number of nodes involved in scattering operation is reduced by eliminating the nodes mistreatment Minimum Connected Dominating Set (MCDS) rule. The steps involved in this algorithm are as follows.

Let the C = {V, E} be the wireless sensing element network
where V = set of sensing element nodes,

E = set of edges among the nodes
Let supply S ∈ V

Let L = L0, L1, L2…Ln are layers of the node.
Let X be the layer list for nodes according to their distance to the source.
Let Y be the ordered sequence list.
Let Z be the set for the maximal independent set.
Let M be the list of children for Ni.
Let Hi be the list of parent nodes for Ni.
Let MA be the marked status of the node
Let UM denote the unmarked status i.e. the nodes are initialized with this status in general.
Let IN be the self-governing status of the node where the node is enclosed as a member of the self-governing set
Let CO be the covered status wherever the node is connected to the node within the self-governing set.
Let CD be the connected dominating set
Let CN and UC be the connected and unconnected status

1. Once the nodes are deployed within the network, a breadth first search rule is applied with S as the root.
2. Based on the gap of the node from S, the node layer is obtained.
3. S is found in layer $L_0$ and sequence of nodes in increasing order of the layer is updated in node list X.

4. The nodes from $L_0$ to $L_n$ are verified and order in decreasing order of the node degree and hold on within the list Y. The nodes within the lists are assigned with different standing as follows:
- All the nodes in Y are assigned with UM status.
- S is assigned with IN status and added into list Z.
- All the neighbor nodes of S is set with status CO.

Note: The nodes within the network are sequenced with prior information that may be a combination of the layer and node degree.

5. For every node Ni in X and Y,
If status of Ni = UM
Then
UM is modified to IN and added into Z
End if

If the initial value of Ni = UM
Then
Neighbors of Ni is modified to CO
Neighbor nodes are added to M
End if

6. After all nodes within the network are marked, the final maximum self-governing set is obtained as list Z.

7. For every $N_i \in Y$, $N_j \in Y$ is visited as per the prior information of node degree and layer (as per step 4). $N_j$ is added to Hi, if $N_j$ is adjacent to $N_i$ and nearer to S in the similar layer.

8. All the nodes in Z are inserted into CD in the same order as mentioned in previous step. Here,
- S is set as CN
- Remaining nodes are set as UC

9. For every $N_i \in Y$ except S,
If status of $N_i$ = UC
Then
UC is modified to CN and $H_i$ is verified as follows

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If $N_j \in H_i \cap CD$,
Then
$N_j$ is chosen as the connect node Ni
$N_i$ is added into $M_j$
Else
first node $N_{1st}$ in $H_i$ is chosen as the connected node
Ni is added into $M_{1st}$.
End if

10. If state of all nodes in Z is CN, then all the leaf nodes are eliminating from the tree of set CD. Otherwise, repeat step nine. The standing of all nodes in CD is ready as UM.

11. For every $N_i \in$ CD excluding S,
If standing of $N_i$ = UM
Then
UM is modified to MA
If there are some parent node in same layer of $N_j$,
Then
$N_i$ is eliminated from the CD.
$M_i$ is updated.
End if

### 3.4 Fuzzy Based Onward Node Selection

The onward nodes (ON) are selected using fuzzy logic technique. The parameters delay, residual energy and distance are taken as input for the fuzzy membership functions and supported the fuzzy rules, the onward node choice chance (PFN) is calculable as output.

The steps that confirm the fuzzy rule based interference are as follows.

- **Fuzzification:** This involves obtaining the crisp inputs from the selected input variables and estimating the degree to which the inputs belong to every of the acceptable fuzzy set.
- **Rule Evaluation:** The fuzzified inputs are taken and applied to the antecedents of the fuzzy rules. It's then applied to the resultant membership function.
- **Aggregation of the rule outputs**: This involves merging of the output of all rules.
- **Defuzzification:** The incorporated output of the aggregate output fuzzy set is the input for the defuzzification method and single crisp number is obtained as output.

The fuzzy interference system is illustrated using fig 1.

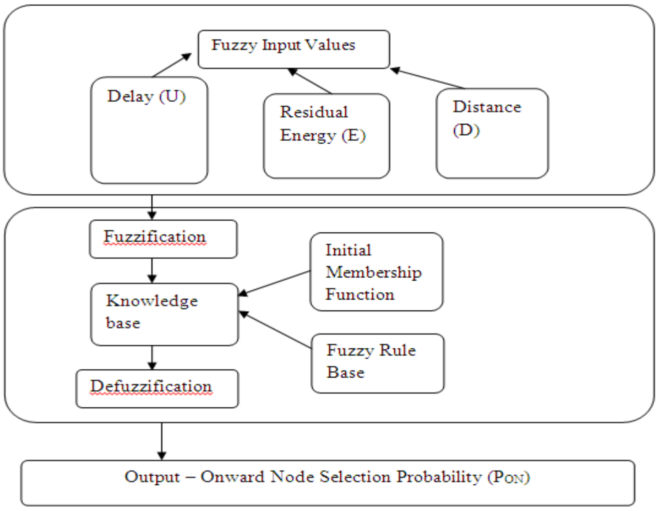


Fig 1 Fuzzy Interference System

**Fuzzification**

This involves fuzzification of input variables like delay (U), residual energy (E) and distance (D) (Estimated in sections 3.2.1-3.2.3) and these inputs are given a degree to applicable fuzzy sets. The crisp inputs are unit combination of U, E and D. we tend to take 2 possibilites, high and low for U, E and D. Figure 2, 3, 4, 5 and 6 shows the membership function for the input and output variables. Due to the computational efficiency and uncomplicated formulas, the triangulation functions are utilized, which are widely utilized in real time applications.

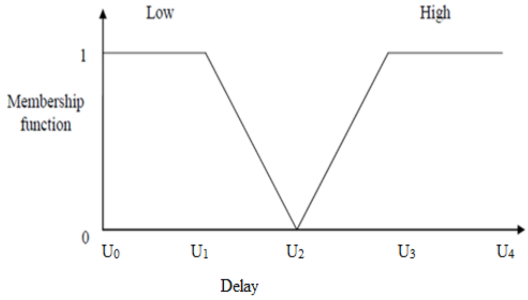


Figure 2 Membership Function of Delay

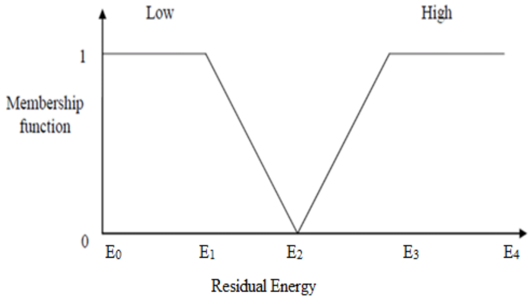


Figure 3 Membership Function of Residual Energy

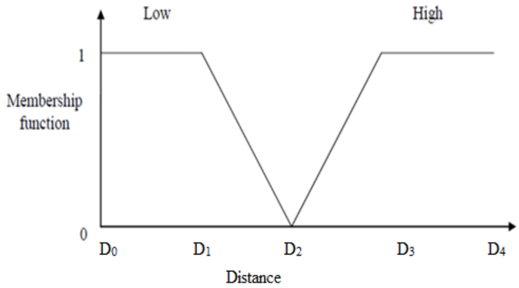


Figure 4 Membership Function of Distance

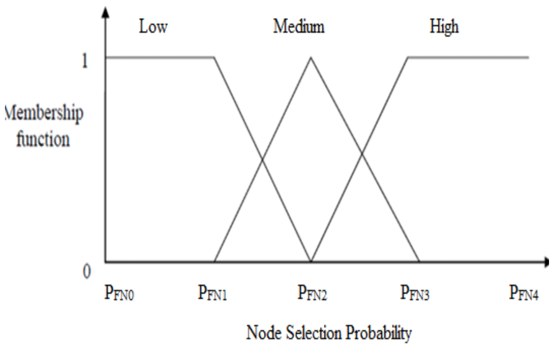


Figure 5 Membership Function of Onward Node Selection Probability

In table 1, U, E and D are given as inputs and the output represents the onward node selection probability. The fuzzy sets are defined with the combinations presented in table 2.

| **S.No** | Delay (U) | Residual Energy (E) | Distance (D) | Onward Node Selection Probability ($P_{ON}$) |
|---|---|---|---|---|
| 1 | Low | Low | Low | Low |
| 2 | Low | Low | High | Low |
| 3 | Low | High | Low | High |
| 4 | Low | High | High | Medium |
| 5 | High | Low | Low | Low |
| 6 | High | Low | High | Low |
| 7 | High | High | Low | Medium |
| 8 | High | High | High | Low |

Table 2 demonstrates the designed fuzzy interference system. This illustrates the function of the interference engine and technique by that the outputs of every rule are combined to generate the fuzzy decision.

For example
Let us think about Rule 15.
If (U&D = low, E = High)
Then
$P_{ON}$ = high
End if
i.e To reduce re scatters, every node re scatter only its coverage degree is higher than a threshold value.

**Defuzzification:**

Defuzzification is employed for extracting a crisp value from a fuzzy set as a illustration value. we tend to think about centroid of area strategy for defuzzification.

$$F_{QoS} = \frac{\int_f \eta_{agg}(F)\, f df}{\eta_{agg}(F)\, df} \qquad (3)$$

Where $\eta_{agg}(F)$ = aggregated output of membership function

## IV. SIMULATION RESULTS

### 4.1 Simulation Model and Parameters

The Network machine (NS2) [13], is employed to simulate the planned design. In the simulation, the mobile nodes move in a 900 meter x 900 meter region for 50 seconds of simulation time. All nodes have an equivalent transmission vary of 250 meters. The simulated traffic is Constant Bit Rate (CBR). The simulation settings and parameters are summarized in the following table.

| | |
|---|---|
| No. of Nodes | 20,40,60,80 and 100 |
| Area Size | 900 m X 900 m |
| MAC | IEEE 802.11 |
| Transmission Range | 250 m |
| Simulation Time | 50 sec |
| Traffic Source | CBR |
| Packet Size | 512 bytes |
| Rate | 250 kbps |
| Initial Energy | 10.1 J |
| Transmission Power | 0.660 J |
| Receiving Power | 0.395 J |
| Speed | 10,20,30,40 and 50 m/s |

### 4.2 Performance Metrics

The projected Sparkle Effective Scattering and Onward Node Assortment using Linkage coding Mechanism (SESONA) is compared with the BALR technique [ ]. The performance is evaluated principally, in keeping with the subsequent metrics.

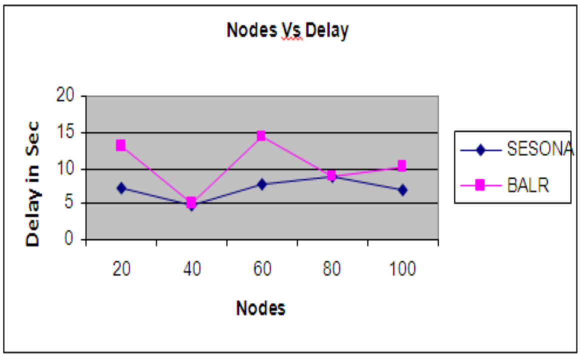


Fig 6: Nodes Vs Delay

♣ **Packet Delivery Ratio:** It's the quantitative relation between numbers of packets received and the number of packets sent.
♣ **Packet Drop**: It refers the average number of packets dropped throughout the transmission
♣ **Energy Consumption:** It's the amount of energy consumed by the nodes to transmit the information packets to the receiver.
♣ **Delay:** It's the amount of time taken by the nodes to transmit the information packets.

### 4.3 Results

**Based on Nodes**

In our 1st experiment we tend to vary the quantity of nodes as 20,40,60,80 and 100

Figure 6 shows the delay of SESONA and BALR techniques for various range of nodes state of affairs. We can conclude that the delay of our planned SESONA approach has 26 % of less than BALR approach.

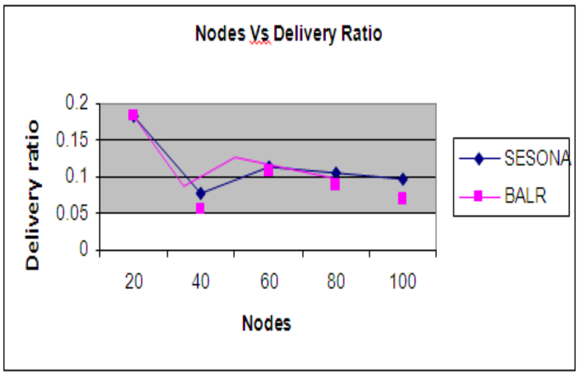


Fig 7: Nodes Vs Delivery Ratio

Figure 7 shows the delivery quantitative relation of SESONA and BALR techniques for various range of nodes state of affairs. We can conclude that the delivery quantitative relation of our planned SESONA approach has 16 % upper than BALR approach.

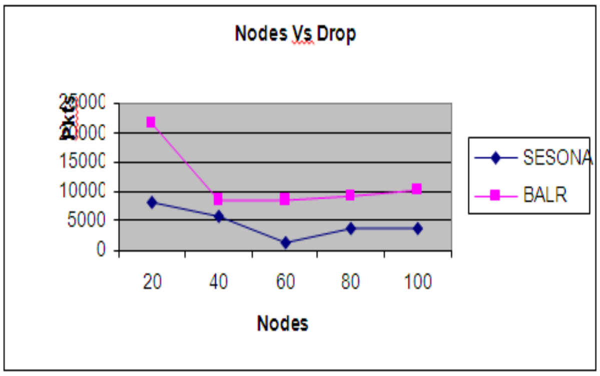


Fig 8: Nodes Vs Drop

Figure 8 shows the drop of SESONA and BALR techniques for various range of nodes state of affairs. We can conclude that the drop of our planned SESONA approach has 59 % of less than BALR approach.

Figure 9 shows the residual energy of SESONA and BALR techniques for various range of nodes state of affairs. We can conclude that the residual energy of our planned SESONA approach has 3 % upper than BALR approach.

Figure 10 shows the overhead of SESONA and BALR techniques for various range of nodes state of affairs. We can conclude that the overhead of our planned SESONA approach has 54 % less than BALR approach.

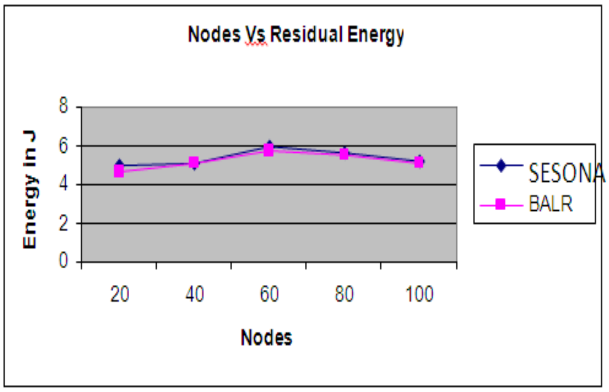


Fig 9: Nodes VS Residual Energy

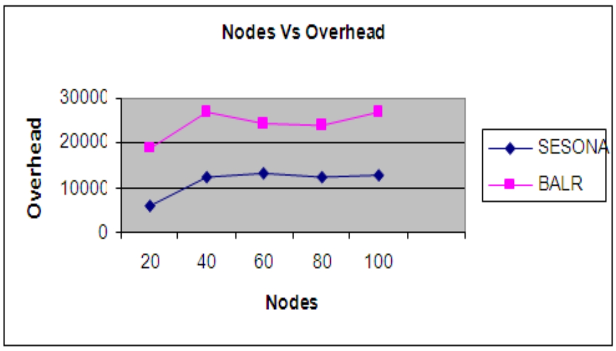


Fig 10: Nodes Vs Overhead

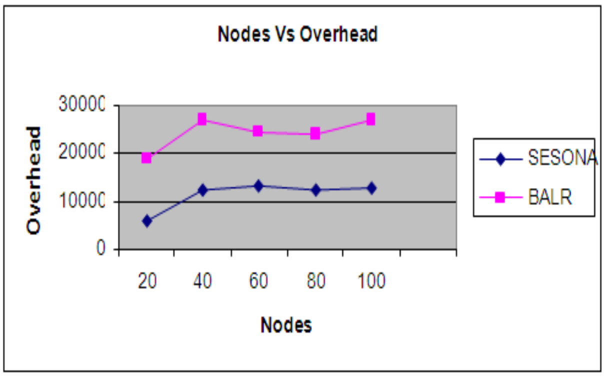


Fig 11: Nodes Vs Onward Ratio

**Based on Speed**

In our second experiment we have a tendency to vary the node mobility speed as 10, 20, 30, 40 and 50 m/s.

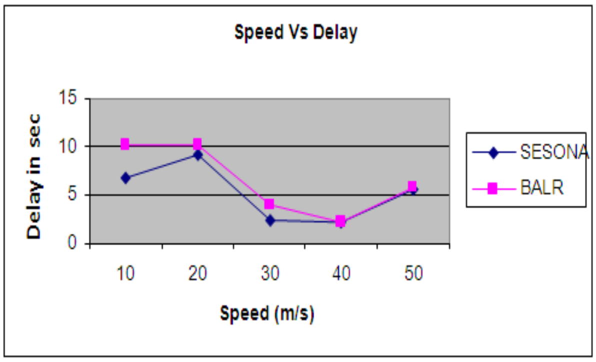


Fig 12: Speed Vs Delay

Figure 11 shows the on warding quantitative relation of SESONA and BALR techniques for various range of nodes state of affairs. We will conclude that the on warding quantitative relation of our planned SESONA approach has 29 % less than BALR approach.

Figure 12 shows the delay of SESONA and BALR techniques for different speed scenario. We are able to conclude that the delay of our projected SESONA approach has 19 % less than the BALR approach.

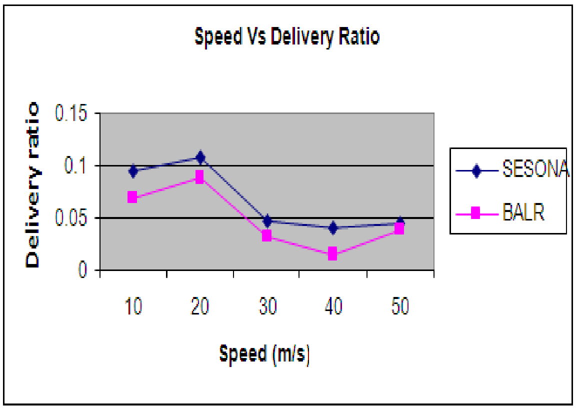


Fig 13: Speed Vs Delivery Ratio

Figure 13 shows the delivery magnitude relation of SESONA and BALR techniques for various speed scenarios. We are able

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to conclude that the delivery magnitude relation of our projected SESONA approach has 32 % upper than BALR approach.

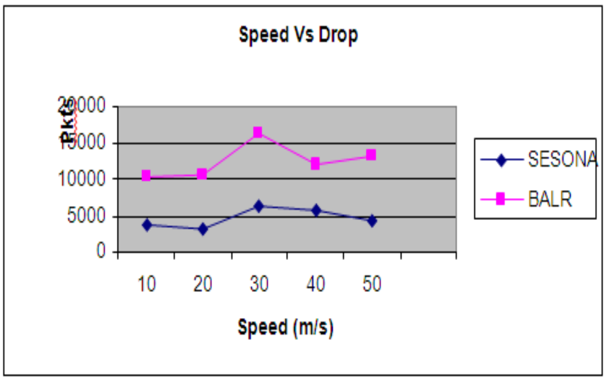


Fig 14: Speed Vs Drop

Figure 14 shows the packet drop of SESONA and BALR techniques for various speed scenarios. We are able to conclude that the packet drop of our projected SESONA approach has 63 % less than the BALR approach.

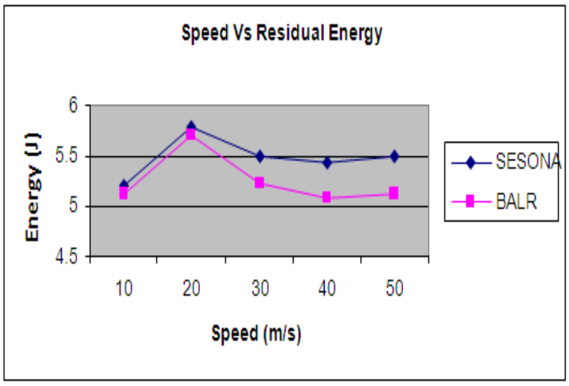


Fig 15: Speed Vs Residual Energy

Figure 15 shows the residual energy of SESONA and BALR techniques for various speed states. We are able to conclude that the residual energy of our projected SESONA approach has 4 % upper than BALR approach.

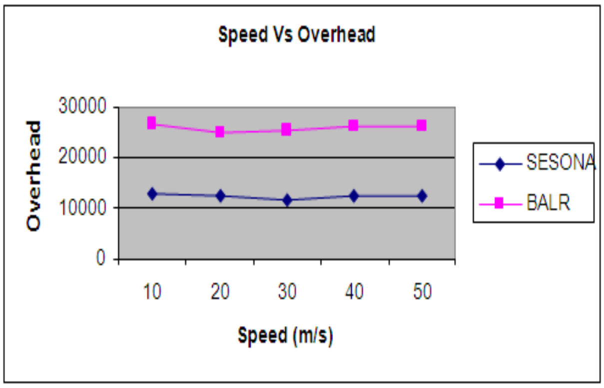


Fig 16: Speed Vs Overhead

Figure 16 shows the overhead of SESONA and BALR techniques for various speed states. We are able to conclude that the overhead of our projected SESONA approach has 52 % less than the BALR approach.

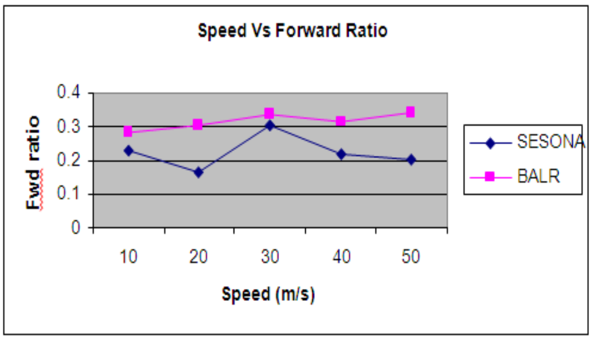


Fig 17: Speed Vs On warding Ratio

Figure 17 shows the on warding magnitude relation of SESONA and BALR techniques for various speed states. We are able to conclude that the on warding magnitude relation of our projected SESONA approach has 29 % less than the BALR approach.

## V. CONCLUSION

In this paper, we have proposed Sparkle effective Scattering and onward node Assortment using Linkage coding mechanism in Mobile Wireless sensing element networks. During this technique, the number of nodes concerned in scattering operation is reduced by eliminating the nodes using minimum connected dominating set algorithm. Then the re scatter redundancy is decreased by choosing the on warders using fuzzy logic based on the parameters like delay, residual energy and distance. To reduce re scatter, every node re scatter, only if its coverage degree is higher than the threshold worth. By simulation results, we have shown that the planned technique minimizes the energy consumption and redundancy.

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