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An Energy Efficient Clustering based Optimal Routing Mechanism using IBMFO in Wireless Sensor Networks

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Abstract: Recently, the Wireless Sensor Networks (WSNs) are extensively used in many real-time applications due to their scalability, dynamicity, and mobility. Since, optimizing the energy consumption of nodes, and improving the lifetime of network are still remains the challenging tasks. In the conventional works, the different types energy efficient clustering and routing methodologies are developed for improving the networking operations and performance of WSN. However, it limits with the major problems of reduced speed of processing, increased complexity in algorithm design, inefficient QoS, and high average residual energy. Therefore, the proposed work objects to implement an advanced optimization based clustering and routing methodologies for ensuring the better lifetime, energy efficiency and QoS of WSN. Here, an Improved Butterfly Optimization (IBO) technique is deployed to optimally select the CHs based on the parameters of energy, distance, node degree, and centrality. Then, the best and energy efficient routing paths between the source and destination nodes are selected to establish the data transmission by using the Moth Flame Optimization (MFO) technique, which ensures the reliable and valid data routing in the network. During simulation, the performance of the proposed IBMFO technique is validated and compared by using various evaluation metrics.

Keywords*: Improved Butterfly – Moth Flame Optimization (IBMFO), Energy Consumption, Wireless Sensor Network (WSN), Quality of Service (QoS), Clustering, and Optimal Data Routing.*

1. Introduction

In ancient times, the Wireless Sensor Networks (WSNs)is increasingly used[1, 2] in many application systems like military surveillance, real-time monitoring, agriculture and etc, due to their characteristics of heterogeneity, cross-layered design, and node mobility. Generally, the WSN [3, 4]is a kind of wireless network, where the set of sensor nodes are interconnected with each other. Also, the sensor node is considered as an electronic device that comprises the elements of processing unit, sensing element, and power unit. Moreover, it gathers the data based on the ambient conditions, which helps to wirelessly exchange[5, 6] the data between with other sensor nodes and base station. The primary advantages of using WSN are as follows: suitable for all types of environment[7], centralized control and monitoring, flexibility, and reduced maintenance cost. However, improving the lifetime of WSNs is still remains one of the major problem [8-10] owing to the limited energy capacity of the sensor nodes. Normally, the network lifetime is highly depends on the energy level of sensor, since it is a battery-type architecture[11]. So, it is more essential to improve the energy efficiency and lifetime of network[12, 13] for ensuring the better QoS performance of the Networking systems. In the conventional works, the different types of optimization methodologies and routing protocols are implemented to enable the reliable and valid data transmission in WSNs[14, 15]. Still, it faced many challenges[16-19] and problems related to the factors of complex optimization steps, increased energy consumption, high loss of packets, and delay time. Hence, the proposed work objects to implement an advanced optimization based clustering[20] and routing methodologies[21] for optimizing the energy consumption and

Increasing the lifetime of network. The major objectives of this research work are as follows:1.To improve the lifespan of network and minimize the energy consumption, a hybrid technique named as, Improved Butterfly Moth Flame Optimizaton (IBMFO) is deployed.2.To cluster the nodes based on its energy level and distance for enabling the reliable data transmission, an IBO technique is utilized, which provides the optimal for selecting the Cluster Head (CH).3.To identify the reliable and best routing paths between the source and destination nodes, a MFO technique is employed, which helps to minimize the energy of nodes, and increase the lifetime of network.4. To validate the performance and results of the proposed IBMFO, the different types of Quality of Service (QoS) measures such as overhead, residual energy, packet delivery ration, delay, loss of packets, and lifespace of network have been computed during simulation anlaysis. The remaining sections of this papre are structralized as follows: Section II reviews some of the recent energy efficient routing protocols, optimization techniques, and trust computation methodologies used for improving the performance of WSNs. Section III presents the detailed

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description about the proposed methodology with the algorithmic illustrations, and working flow model. Then, the simulation and comparative analysis of the proposed secured optimal routing methodology is validated and compared by using various performance measures in Section IV. Finally, the overall paper is concluded with its future scope in Section V.

2. Related Works

This section investigates the conventional clustering and optimization techniques used for improving the network lifetime and energy conservation in WSN. Also, it examines the pros and cons of each work based on its operating principles.

Biradar, et al [22] conducted a systematic review on various algorithms and techniques used for ensuring the properties of security, energy efficiency, and reliability of network. Here, the different types of routing algorithms used for guaranteeing the security requirements have been surveyed, which includes data integrity, confidentiality, freshness, availability, and localization. Moreover, the advantages and disadvantages of the recent state-of-the-art routing protocols have been investigated[23]. According to this review, it is analyzed that the network energy, delay, throughput, and number of alive nodes were highly depends on the secured routing of networks. Vaiyapuri, et al [24] employed an IoT enabled Cluster Based Routing (CBR) protocol integrated with Black Widow Optimization (BWO) for improving the performance of WSNs. Here, the routing paths were optimally selected based on the best fittest function. Moreover, an inter-cluster intra-cluster communication cost have been computed for evaluating the performance of clustering techniques. In addition to that, some other parameters like residual energy, communication cost, restart number, link quality, and marginality were estimated for enhancing the optimal routing of network. Yet, it limits with the major problems of increased cost consumption, packet drop, and delay time[25].Sankaran, et al [26]suggested a bew data centric routing model, for increasing the energy efficiency and reliability of WSN. Here, the Clear Channel Assessment (CCA) model is employed to verify whether the link established between the nodes are valid or not. Moreover, the Received Signal Strength Indication (RSSI) measure was also used toanalyzing the strength of data transmission. The main drawbacks of this work were increased loss of packets, delay time, high energy consumption, and minimized network lifetime.

Mehta, et al [27] employed a Multi-Objective Cluster Head (MCH) based Energy Aware Optimized (EAO) routing algorithm for increasing processing power and energy efficiency of WSNs. Here, the sailfish optimization algorithm was implemented for optimally selecting the routing path to transmit the information across the nodes. Also, the route alternation methodology was implemented to avoid the route failures in the network. In addition to that, the multi-objective clustering mechanism was utilized to cluster the nodes based on the parameters of residual energy, node coverage, cost and proximity. However, it also faced the problems of reduced network throughput, increased number of untrusted nodes, and minimized node mortality. Mittal, et al [28] utilized a Moth Flame Optimization (MFO) technique for ensuring the scalability and reliability of networks. It also intends to use the clustered routing approach for forwarding the data packets with reduced cost links. The MFO was one of the recent optimization technique mainly used for solving the binary coded problem. Still, it has the following drawbacks: lack of data security, increased energy utilization for long distancing nodes, and delay in processing. Sahoo, et al [29] developed a hybridized optimization technique by integrating the functionalities of GA and PSO for optimally routing the data packets. Here, the different types of measures such as energy consumption rate, node degree, distance, and residual energy were considered for selecting the CH. Based on the best optimal solution, the CH was elected before enabling the data transmission across the networks.

3. Proposed Methodology

This section presents the detailed description about the proposed optimization based clustering and route selection methodologies for ensuring the reliable data communication in WSN. The main contribution of this work is to optimally reduce the energy consumption and increase the lifetime of network by implementing an advanced optimization methodologies. Here, an Improved Butterfly Optimization (IBO) technique is deployed for selecting the CH to minimize the energy consumption of the network. Then, the Moth Flame Optimization (MFO) technique is utilized to select the best routing paths for enabling the data transmission. The overall working flow of the proposed IBO-MFO based energy efficient data transmission methodology is shown in Fig 1. Initially, the network is constructed with the set of sensor nodes, where the cluster formation is performed for simplifying the data communication. After forming the clusters, the CH is elected from each group to ensure the reliable data transmission by using an Improved Butterfly Optimization (IBO) technique. Then, the data transmission is enabled between the source and destination nodes by selecting the shortest and optimal routing paths using an advanced Moth Flame Optimization (MFO) technique. The primary advantages of this work are increased convergence rate of optimization, increased speed, ensured network lifetime, reduced energy consumption, and improved QoS. The modules involved in the proposed systems are as follows:

- Network formation
- Cluster formation
- Cluster Head (CH) selection using IBO
- Routing path selection using MFO
- Data transmission

The novel contribution of this work is, it considered the parameters of both distance and energy for creating an energy efficient network, where the energy level of sensors are optimized by selecting the CH using IBO technique. Then, the best suitable routing paths are selected to enable the data transmission between the sensor nodes by using MFO technique. Moreover, the energy conservation helps to improve the overall performance of network with ensured QoS.

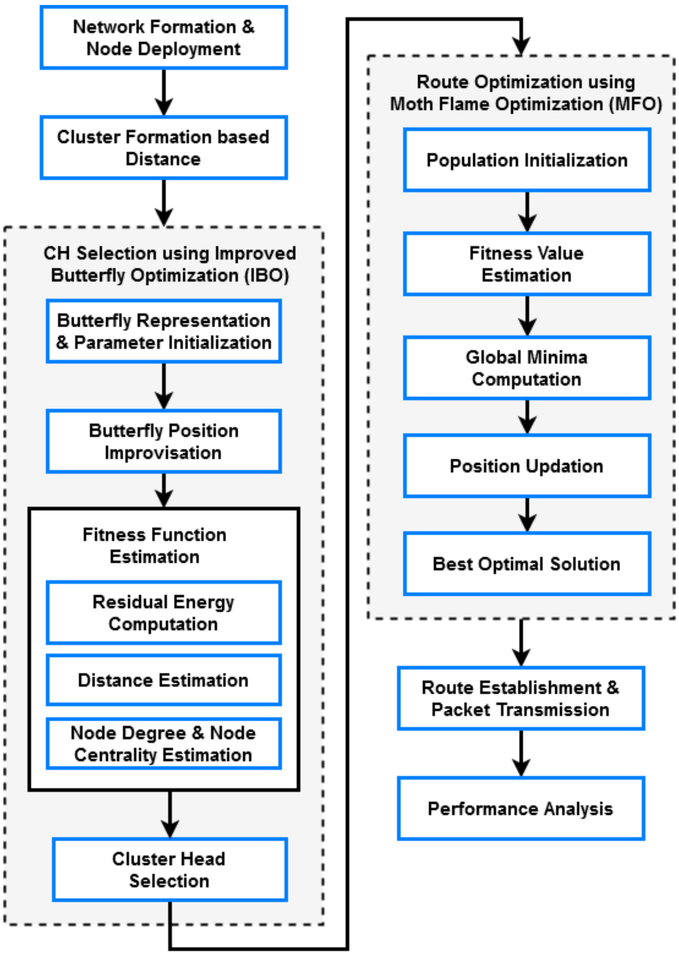

Figure 1. Working flow of the proposed system

3.1 Cluster Formation and CH Selection

In WSN, the sensor nodes deployed in the network are similar to each other with respect to its processing time, and initial energy. Here, the nodes are randomly organized and its positions are constant after deployment. The initial network formation and node deployment are depicted in Fig 2. After constructing the network, the clusters are formed by grouping the nodes having minimum distance, which is estimated by using Euclidean distance value. Consequently, the CHs are selected from the each cluster for simplifying the data transmission and routing as shown in Fig 3. In this system, an IBO technique is employed to select the CH from each cluster based on its energy and distance. Moreover, the IBO is a kind of nature-inspired meta-heuristics optimization technique mainly used for solving the complex multi-objective optimization problems. It imitates the behavior of butterflies for food searching and mating. The main objective function of this technique is computed based on the stimulus intensity of butterflies. In the proposed work, the optimal CHs are selected among the other sensor nodes based on the parameters of node centrality, distance, energy, and node degree. Also, it includes the following stages of operations:

- Butterfly representation and initialization
- Position improvisation
- Fitness function computation
- Residual energy estimation
- Distance, node degree, and centrality computation

Let, consider that the butterflies indicate the set of sensor nodes, where the CHs are elected based on the position updation of butterflies. At first, the position of each butterfly is determined with its random ID ranging from $1,2 \dots n$, where n indicates the total number of nodes in the network. The set of butterflies G_i are initialized as follows:

$$G_i = (G_{i,1}(x), G_{i,2}(x) \dots G_{i,m}(x)) \quad (1)$$

Where, iindicates the butterfly, m represents the number of CHs in the network. Then, the position is updated as $G_{i,k}, 1 \leq k \leq m$ with respect to the node ID. During position improvisation, the position of all butterflies are updated in local or global searching space, which is in the range of 0 to 1. Consequently, the set of new butterflies are improvised and its move can be updated in the global searching space as represented below:

$$s_i^{p+1} = s_i^p + (a^2 \times h^* - s_i^p) \times bf_i \quad (2)$$

Where, s_i indicates the solution vector of ith butterfly, a is the random number in the range of [0, 1], h^* is the current iteration, and bf_i denotes the butterfly fragrance. Similarly, its position is updated in the local searching space as illustrated below:

$$s_i^{p+1} = s_i^p + (a^2 \times s_j^p - s_d^p) \times bf_i \quad (3)$$

Where, s_j^p and s_d^p are the jthand dthbutterflies. Then, its fragrance bf is generated by using the following model:

$$bf = SML^b \quad (4)$$

Where, SM represents the sensory mobility, L indicates the stimulus intensity, and b denote the power exponent. After that, the fitness is computed for optimally selecting the CH based on the parameters of residual energy, distance, node degree and centrality. In which, the residual energy is estimated for determining the energy level of selected CH as represented below:

$$fit1 = \sum_{i=1}^{m} \frac{1}{R_E SCH_i} \quad (5)$$

Where, $R_E CH_i$ indicates the residual energy of the ithSCH. Consequently, the distance between the SCH and other sensor nodes is estimated based on the energy level of nodes, where the energy dissipation is entirely depends on the transmission distance between the source and destination nodes. It is computed as shown in below:

$$fit2 = \sum_{j=1}^{m}\left(\sum_{i=1}^{NS_j} dis(sen_i, SCH_j)/NS_j\right) \quad (6)$$

Where, NS_j indicates the number of sensors belongs to the CH, sen_i denotes the sensor, and $dis(.)$ is the distance between the SCH and sensor node. Sequentially, the distance between the CH and base station is estimated as shown in below:

$$fit3 = \sum_{i=1}^{m} dis(CH_j, base\ station) \quad (7)$$

In addition to that, the node degree and centrality parameters are computed by using the following equations:

$$Nd = \sum_{i=1}^{m} NS_i \quad (8)$$

Where, ND is the node degree, and NS_i is the number of sensor nodes in the cluster.

$$Nc = \sum_{i=1}^{m} \frac{\sqrt{\left(\sum_{j\epsilon k} dis^2(i,j)/k(i)\right)}}{N_{Di}} \quad (9)$$

Where, Nc defines the node centrality, and $k(i)$ is the number of sensor nodes in the cluster. Based on these functions, the objective function is formulated as shown in below:

$$obj = \omega_1 fit1 + \omega_2 fit2 + \omega_3 fit3 + \omega_4 Nd + \omega_5 Nc \quad (10)$$

Where, ω_1, ω_2, ω_3, ω_4 and ω_5 are the weight values, and $\omega_i \in (0,1)$. By using this objective function, the CH is selected from each group, which is used to enable the reliable and valid data transmission in the network.

Algorithm I – CH Selection using IBO

Step 1: Initialize the set of population of butterflies, stimulus intensity$L$, sensor modality, switching probability, and power exponent;
Step 2: for each j to M_{itr} //M_{itr} – Maximum number of iterations;
Step 3: for each BF in population //BF – butterfly
Step 4: Estimate fragrance by using equ (4);
Step 5: end for;
Step 6: Identify the optimal butterfly population;
Step 7: for each BF in population
Step 8: Generate the random number a in [0, 1];
Step 9: if $a < p$
Step 10: Estimate the optimal solution using equ (2);
Step 11: else
Step 12: Randomly generate the solution using equ (3);
Step 13: end if;
Step 14: end for;
Step 15: Update the value of$b$;
Step 16: end for;
Step 17: Based on the optimal solution, select the CH from each cluster;

3.2 Routing Path Selection using MFO

After selecting CH from each group, the data transmission is enabled between the source and destination nodes by identifying the best and energy efficient routing paths with the help of MFO technique. Typically, the entire performance of network is highly depends on the reliable data transmission among the sensor nodes. Hence, it is most essential to select the optimal and energy efficient routing paths for establishing the data communication. For this purpose, an intelligent MFO technique is deployed in this proposed system, which provides the optimal solution for selecting the suitable routing paths for data transmission. Typically, the MFO technique is one of the efficient and modern population based optimization algorithm, which is mainly used for solving the complex problems with the best optimal solution. Moreover, it is inspired by the flight behaving or moth flames, where the moths are determined as the point particles in the searching space. Then, the position and velocity of these particles are adjusted for discovering the best candidate solutions. It comprises the stages of population initialization, searching space selection, updating rules generation, and mutation. In this technique, the candidate solutions are organized as the moths, which are as represented as follows:

$$S = \begin{bmatrix} s_{1,1} & s_{1,2} & \cdots & s_{1,d} \\ s_{2,1} & s_{2,2} & \cdots & s_{2,d} \\ \vdots & \vdots & \vdots & \vdots \\ s_{n,1} & s_{n,2} & \dots & s_{n,d} \end{bmatrix} \quad (11)$$

Where, n is the total number of moths, and d indicates dimension. Then, the separate array has been maintained in this technique for storing the all fitness values as shown in below:

$$X = \begin{bmatrix} X_1 \\ X_2 \\ \cdots \\ X_n \end{bmatrix} \quad (12)$$

In this model, the fitness value is considered as the return value of objective function, and the flames in other components are also represented as follows:

$$P = \begin{bmatrix} p_{1,1} & p_{1,2} & \cdots & p_{1,d} \\ p_{2,1} & p_{2,2} & \cdots & p_{2,d} \\ \vdots & \vdots & \vdots & \vdots \\ p_{n,1} & p_{n,2} & \dots & p_{n,d} \end{bmatrix} \quad (13)$$

Consequently, the flame matrix is also constructed for maintaining the fitness values of all flames as shown in below:

$$Y = \begin{bmatrix} Y_1 \\ Y_2 \\ \cdots \\ Y_n \end{bmatrix} \quad (14)$$

Moreover, the moths are treated as the searching agents in the space, and flames are considered as the best positions identified by the moths. So, the moths could around the flames for obtaining the best solutions, and the global optimal solution for the given problem is constructed as follows:

$$M_{FO} = (Q, H, Z) \tag{15}$$

Where, $Q, H,$ and Z are the objective functions, in which the function $Q\{S, X\}$ indicates the random initial population of moths, and its corresponding fitness values are estimated as follows:

$$S(i,j) = (U_B(i) - L_B(i))^2 rand(\,) + L_B(i) \tag{16}$$

$$X = Obj\ function\ (S) \tag{17}$$

Where, U_B and L_B are the upper and lower bounds respectively. Then, the function H is estimated when the moths are moved around the searching space, and its updated value of S is computed as follows:

$$S_i = dis_i^* e^{cr*} \cos(2\pi r) + flame_j \tag{18}$$

Where, c indicates the constant, r is the random number lies between [-1, 1], $flame_j$ denotes the jth flame, and dis_i is the distance. Consequently, the distance is further updated as follows:

$$dis_i = |flame_j - S_i| \tag{19}$$

When, the termination condition is reached, the function Z returns the true value; otherwise, it returns the false value. Based on this model, the best optimal solution is obtained by integrating these objective functions, which helps to optimally select the routing paths for establishing the data transmission. Moreover, the data routing between the source to destination nodes is enabled by using the optimally selected routing paths according to the obtained solution as shown in Fig 4. The major advantages of using this technique are as follows:

- Increased convergence rate
- Reduced loss of packets and delay time
- Improved network lifetime
- Optimized energy consumption
- Efficient system performance

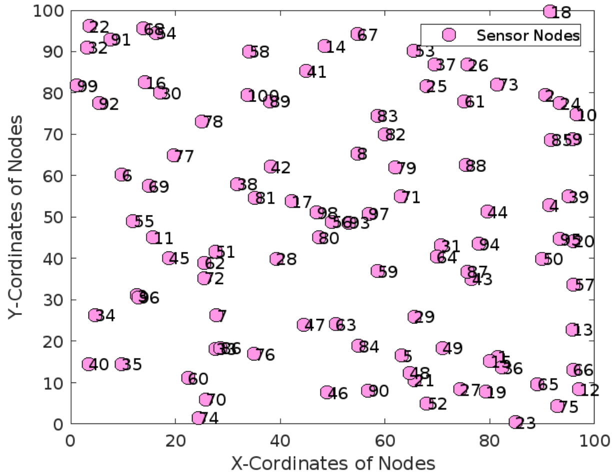

Figure 2. Network formation

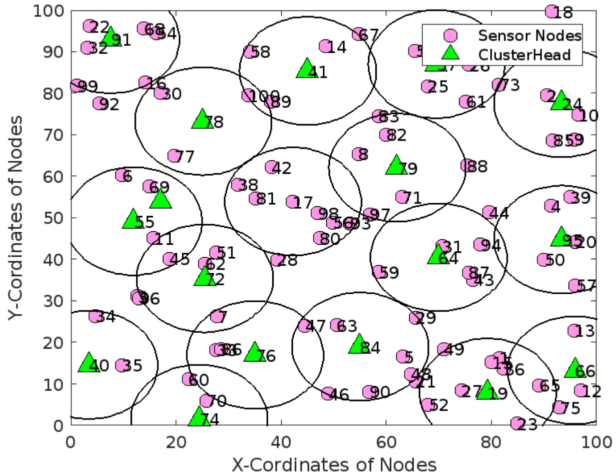

Figure 3. CH selection

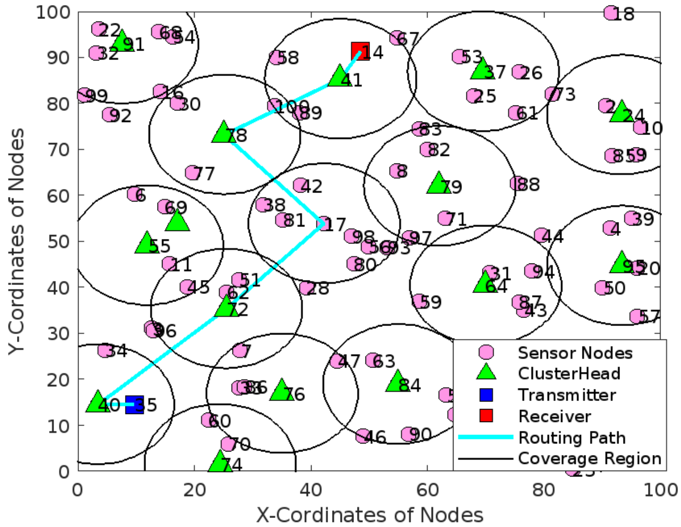

Figure 4 (a). Data transmission scenario – 1

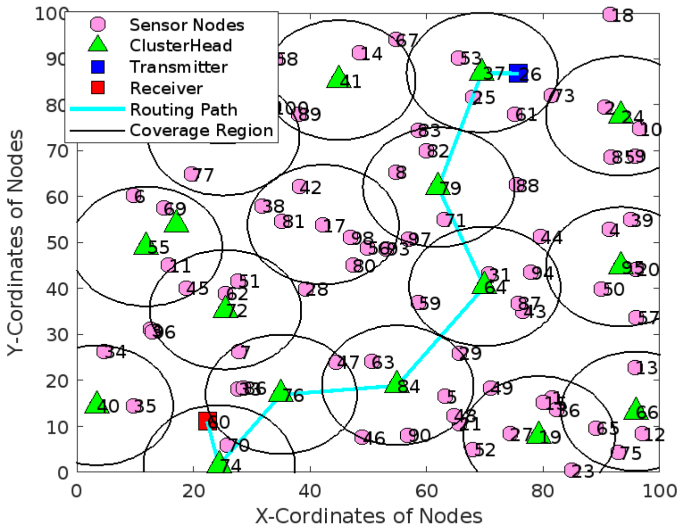

Figure 4 (b). Data transmission scenario - 2

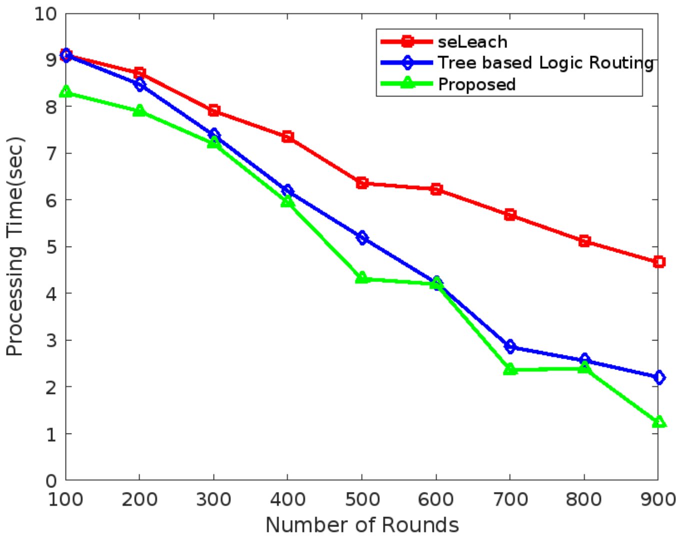

Figure 5. Processing time Vs Simulation round

4. Results and Discussion

This section validates the simulation results of proposed IBMFO technique for analyzing the performance and efficiency of the proposed system. Also, the obtained results are compared with other optimization based routing methodologies for proving the betterment of proposed system. The simulation parameter settings used in this analysis are listed in Table 1.

Table 1. Simulation setup

Simulation Parameters	Values
Network area	$1000 \times 1000\ m^2$
Base station location	$500 \times 500\ m^2$
Count of nodes	1000
Size of packets	4000 bits
Deployment of nodes	Random
Initial energy level	1J
Bandwidth	20 kbps

Fig 5 validates the processing time of existing [30] and proposed routing techniques with respect to varying simulation rounds. Typically, the processing time is defined as the amount of time taken by the routing schemes for establishing the reliable and successful data transmission. The increased processing time could degrade the performance of entire networking system with high delay and loss of information. In the proposed work, an energy efficient clustering and optimized data routing methodologies help to obtain the reduced processing time. When compared to the other methodologies, the processing time of the proposed system is efficiently reduced for all rounds of operations.

Similar to that, the amount of network overhead produced by the existing and proposed routing techniques are validated and compared as shown in Fig 6. The network overhead is generally defined by the amount of resources that are consumed by each and every sensor node participated in the communication, which includes the resources of bandwidth, energy, time, and memory. The network overhead must be reduced for ensuring the better performance of the system. Based on this analysis, it is identified that the proposed IBMFO technique could efficinetly minimize the network overhead, when compared to the other routing methodologies.

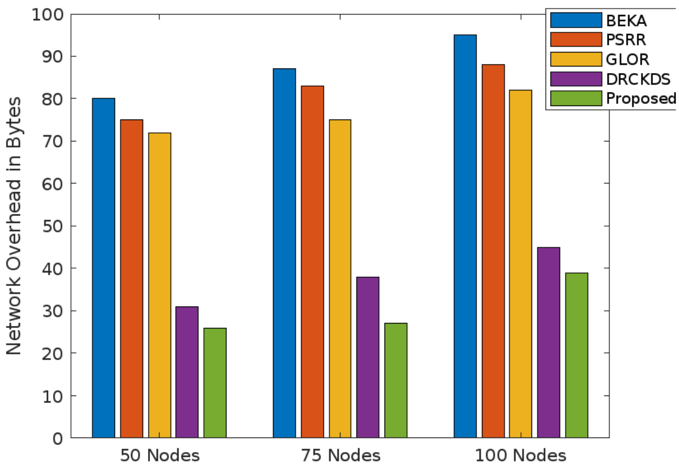

Figure 6. Network overhead Vs No of nodes

The energy consumption of various existing and proposed routing methodologies are validated and compared with respect to varying network sizes as shown in Fig 7 (a) to (d). For this analysis, the network is constructed with different sizes such as 1000×1000, 800×800, 600×600, 400×400, and 200×200. Typically, the sensor nodes consume an increased amount of energy for processing the networking operations like data transmission, reception, forwarding, and etc. The increased energy consumption of nodes reduce the lifetime of entire network, hence the energy efficiency of the network should be improved by proper optimization and routing. In the proposed system, an energy efficient optimized data routing is performed by using an integrated IBMFO, where the trust score and energy estimation could help to increase the energy efficiency of network. According to these evaluations, it is analyzed that the proposed IBMFO technique efficiently reduced the energy consumption of network for all sizes of networking environments.

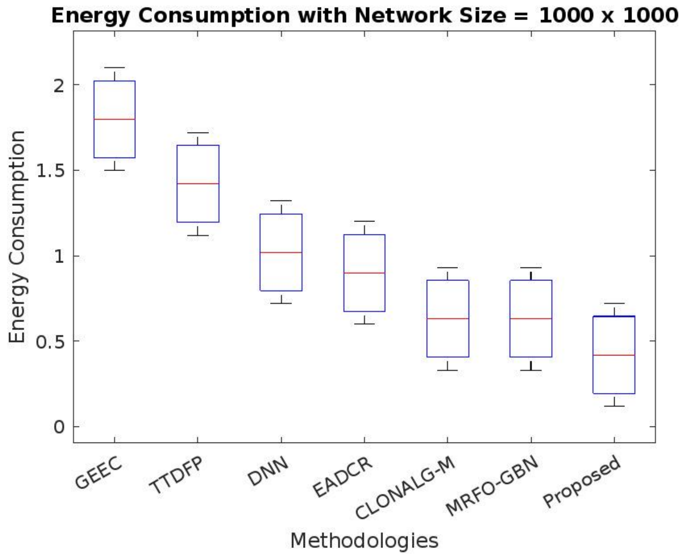

Figure 7 (a). Energy consumption with network size of 1000 ✕ 1000

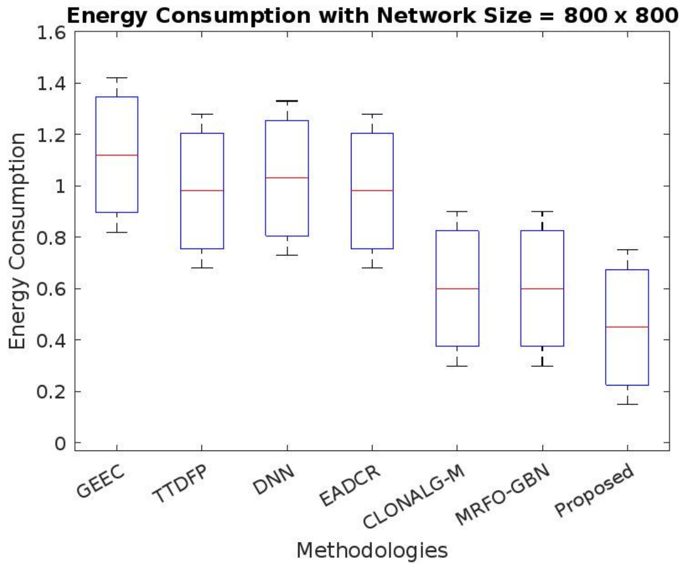

Figure 7 (b). Energy consumption with network size of 800 ✕ 800

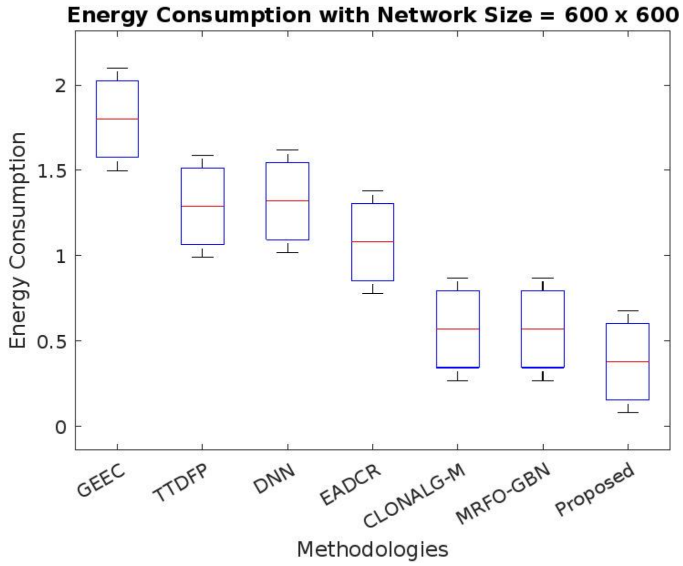

Figure 7 (c). Energy consumption with network size of 600 ✕ 600

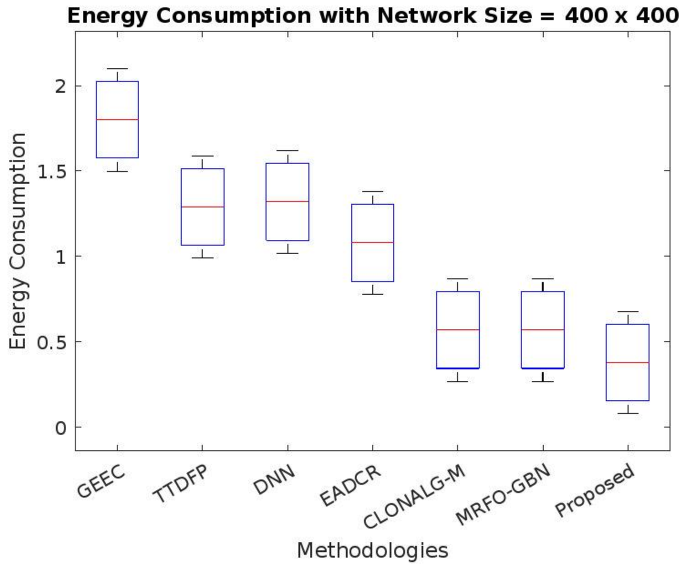

Figure 7 (d). Energy consumption with network size of 400 ✕ 40

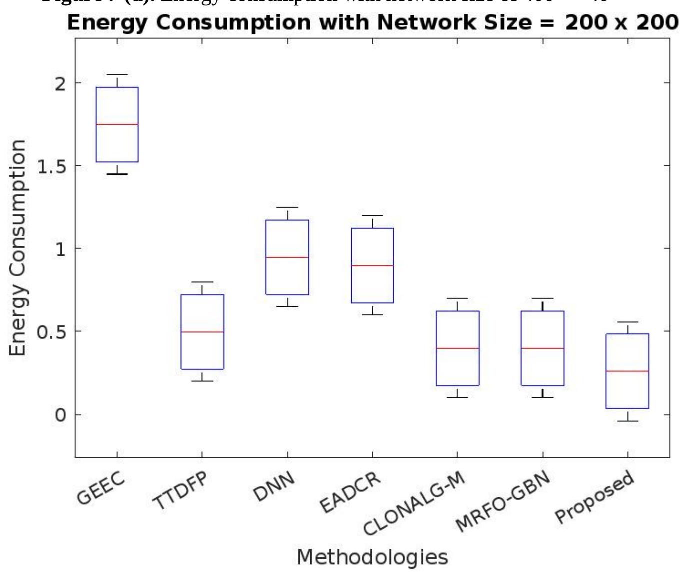

Figure 7 (e). Energy consumption with network size of 200 ✕ 200

Fig 8 validates the number of alive nodes exist in the network among the total number of nodes, where the alive nodes are estimated for both existing [31] and proposed techniques. The results show that the proposed IBMFO system has the increased number of alive nodes, when compared to the other approaches, which shows the effectiveness and improved performance of the proposed work.

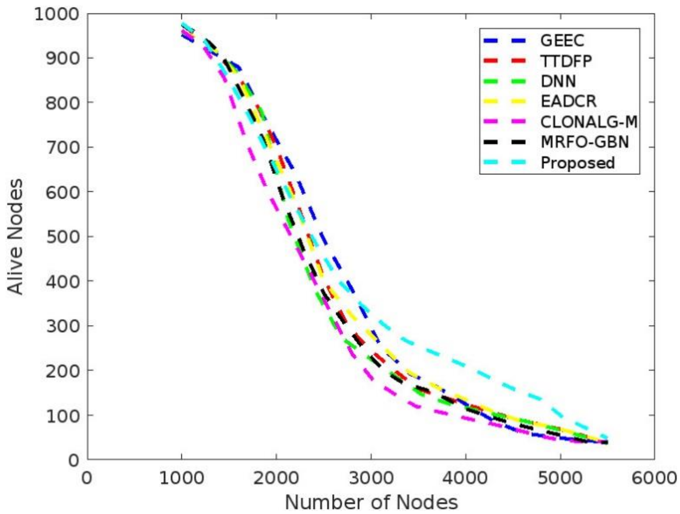

Figure 8. Total number of nodes Vs Alive nodes

Fig 9 compares the throughput of existing and proposed techniques with respect to varying number of nodes in the network. Generally, the throughput is defined based on the amount of data that is successfully transmitted from the source to the corresponding destination without any loss of information. Fig 10 validates the average delay analysis of existing and proposed techniques with respect to varying number of nodes in the network. From the results, it is analyzed that the proposed IBMFO technique overwhelmes the other approaches with increased network throughput and reduced delay.

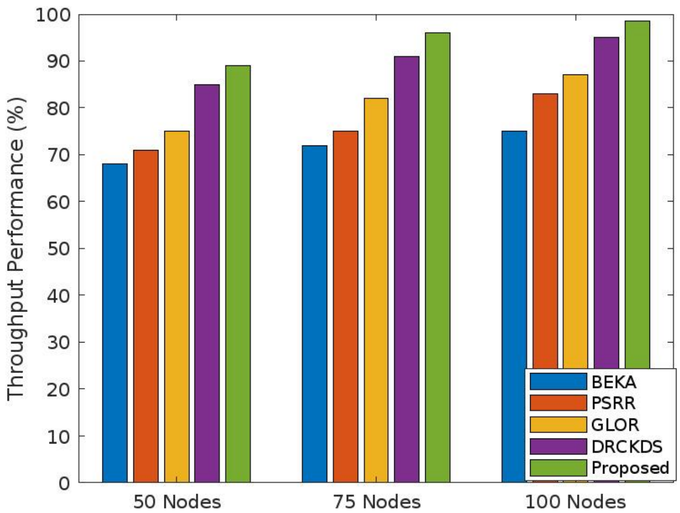

Figure 9. Throughput

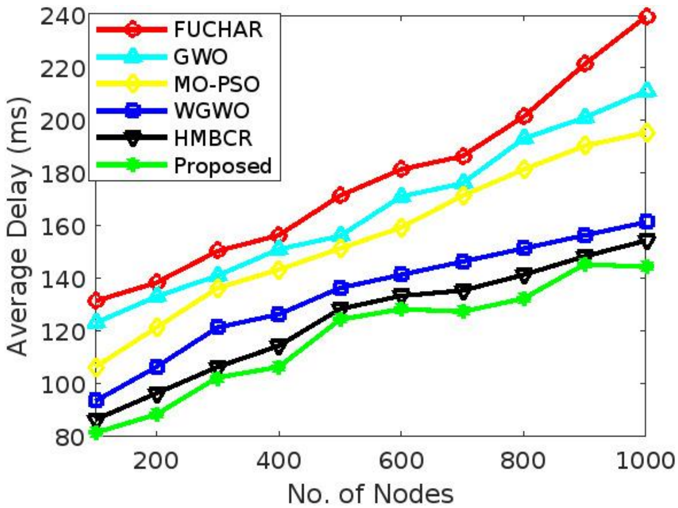

Figure 10. Average delay analysis

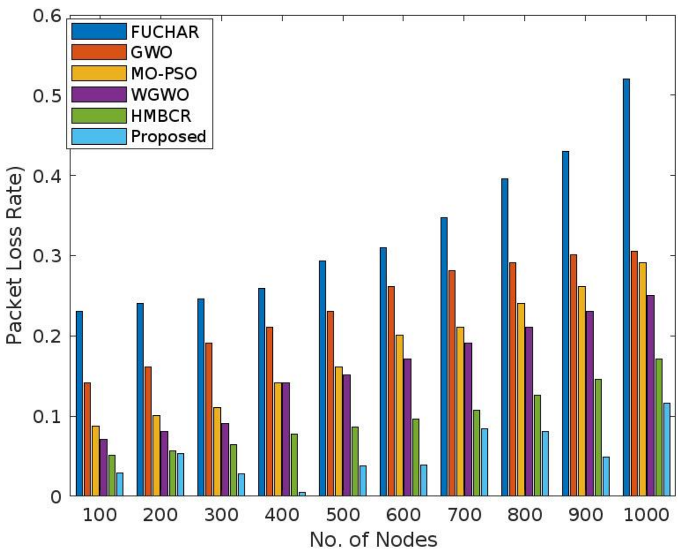

Figure 11. Packet loss rate Vs No of nodes

Fig 11 and Fig 12 validates the packet loss rate and packet delivery ratio of the routing methodologies with respect to varying number of nodes exist in the network respectively. The packet loss rate is defined as the ratio of amount of data packets that are not exactly received by the destination, and the total number of packets that are actually transmitted by the source. The network reliability is highly depends on this measure, hence the loss of packets should be reduced for ensuring the successful data transmission. Moreover, the packet delivery rate is highly correlated to the loss rate, but which must be improved for the reliable and valid data communication. According to these results, it is evaluated that the proposed IBMFO technique outperforms the other approaches with increased packet delivery ratio, and reduced packet loss rate.

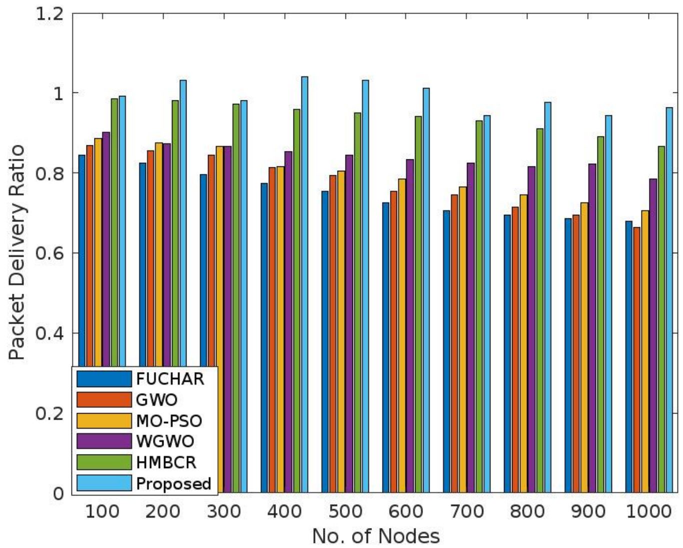

Figure 12. Packet delivery ratio Vs No of nodes

Table 2 compares the network lifetime of optimization based existing and proposed routing schemes based on the factors of First Node Die (FND), Half Node Die (HND), and Last Node Die (LND). Then, its corresponding graphical illustrations are shown in Fig 13 (a) to (c). Due to an energy efficient routing path selection, and clustering processes, the network lifetime of the proposed IBMFO technique is highly improved, when compared to the other approaches.

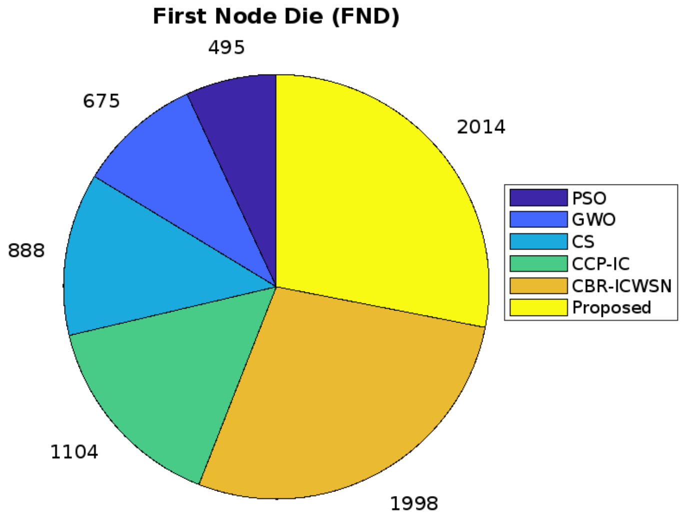

Figure 13 (a). Network lifetime – First Node Die

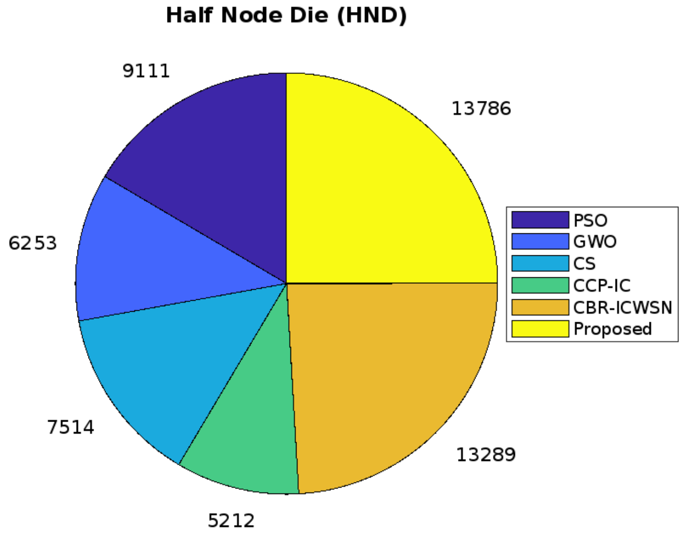

Figure 13 (b). Network lifetime – Half Node Die

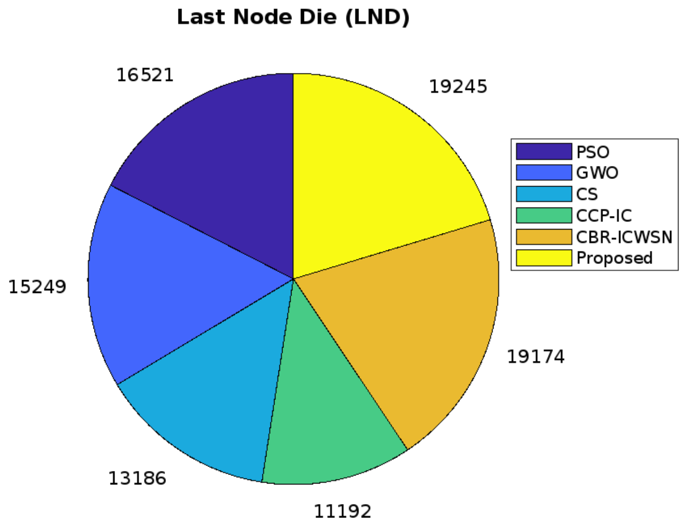

Figure 13 (c). Network lifetime – Last Node Die

Table 2. Analysis of network lifetime

Network life time	PSO	GWO	CS	CCP-IC	CBR-ICWSN	Proposed
FND	495	675	888	1104	1998	2014
HND	9111	6253	7514	5212	13289	13786
LND	16521	15249	13186	11192	19174	19245

5. Conclusion

The paper presents an intelligent optimization based energy efficient clustering and routing path selection methodologies for improving the network lifetime of WSN. The main contribution of this work is to minimize the energy consumption of networks with better lifespan by establishing an energy efficient and reliable data transmission between the sensor nodes. This framework includes the stages of network formation, clustering, CH selection, best routing path selection, and data transmission. Here, the sensor nodes are grouped into the form of clusters for simplifying the networking operations and improving the energy efficiency of nodes. Consequently, the CHs are selected from the each cluster based on its energy level and distance value by using IBO mechanism. In the proposed work, the optimal CHs are selected among the other sensor nodes based on the parameters of node centrality, distance, energy, and node degree. After selecting

CH from each group, the data transmission is enabled between the source and destination nodes by identifying the best and energy efficient routing paths with the help of MFO technique. It provides the best optimal solution for selecting the suitable routing paths for data transmission. The primary advantages of the proposed IBMFO technique are increased convergence speed, maximized network lifespan, reduced loss of packets, minimal delay time, and ensured QoS. During simulation, the performance and efficiency of the proposed IBMFO technique is validated and compared by using various evaluation metrics. From the evaluations, it is analyzed that the proposed IBMFO overwhelms the other techniques with improved performance outcomes. In future, this work can be extended by implementing a new security mechanism for detecting the harmful attacks against the network.

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Author contributions

Seelam Srinivasa Rao: Investigation, Conceptualization, Methodology, Software, Field study **K.Chenna Keshava Reddy:** Data curation, Writing-Original draft preparation, Software, Validation. Field study.

Conflicts of interest

The all authors there is no Conflict of Interest to publish this article.

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