Neighbour Selection Framework For Security Enabled Wireless Networks Networks Using Ant Lion Optimization Approach

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ABSTRACT

Owing to the ability to enable an extensive range of applications, Wireless Networks receives huge research interest and it has major influence on ubiquitous computing. In retaining a useful network lifetime during NS (Neighbour Selection), many research challenges are encountered under constrains imposed by means of the limited energy, which are inherent in the small, locally-powered sensor nodes. The main aim of our research work is to investigate the NS mechanism to solve the base station positioning problem and to balance the energy consumption in Wireless Networks. To extend the existence of the Wireless Networks, an energy efficient method with security is essential. Since, data transmission, data processing and sensing by sensor nodes needs high energy, the sensor node become dead because of the presence of the rechargeable batteries. To overcome this issue, a security constraint NS approach is implemented and it is known as ALOP (Ant Lion Optimization Approach) approach.

This approach is exploited to reach the objectives namely decreasing the energy, delay and distance as well as increasing the security. Further, the experimental analysis states that the proposed ALOP method outperforms the conventional methods.

Keywords: Wireless Networks, Ant Lion Optimization, Neighbour Selection, Security Enhancement, Mobile sink

1. Introduction

In many fields, the Wireless Networks has received a wide range of applications namely battlefield surveillance, environmental monitoring, traffic monitoring, modern agriculture (Chung, et al., 2017), (Li,2014), (Yu, et al., 2017)because of their effective communication. Moreover, the bandwidth, energy and the computational abilities are the small numbers of the resources, which facilitate control against the Wireless Networks. In an exact way, a Wireless Networks has organized for proper sensing, and it symbolizes an integration of wireless communications with multiple nodes. In addition, the sensing, data processing, and communication are the components, which include the sensor nodes. Wireless Networks significances have augmented in up to date times in regions such as area monitoring, environmental sensing, forest fires detection, air pollution monitoring, landslide detection and machine health monitoring. In a certain variety of applications, there is an elevated requirement of protected interaction between the nodes of sensor (Ali, & Ravula 2008). There exists a wide range of various methods to protect the network data transmissions, however owing to power constrictions of Wireless Networks; group key dependent method is the mainly favored one. For this reason, to execute scalable energy proficient protected group of interaction, the most excellent technique would be hierarchical dependent like clustering (Maheshwari 2012). In many of the Wireless Networks models depending on clustering, base station is the indispensable suggestion of contact to the exterior world and in case of its malfunction.

It may direct to entire detachment in the interaction (Wu, & Zhu 2017).With the intention of offering enhanced fault tolerant instant action, a new base station at other physical position will have to acquire the charge (Tawalbeh, et al., 2017). . This may show the way to a whole alteration in the hierarchical topology of network, that in turn show the way to re-clustering the complete network and in turn configuration of novel protection keys (Mohamed et al., 2017). . Consequently, there is a requirement to discover a appropriate algorithm that clusters the nodes of sensor in such a way that while a base station malfunctions and a novel base station takes charge, new key groups gets recognized less consumption of energy and with less performance (Xie, et al., 2017). (Wang, et al., 2017(b). .

Generally, the connectivity, the measures- coverage and the lifetime of a network has been considered for an optimal performance of a network. Besides, the organized clustering method is a reasonable way to achieve optimal performance in the sensor network. The CH can be chosen randomly on the basis of some criteria. The major purpose of the CH is the coordination of the node amid the data transmission and the clusters. Moreover, the remaining energy, centrality, and concentration need to be considered during the CH selection. Here, the centrality indicates to the node centre, whereas the concentration indicates the number of nodes. The different types of approaches are interrelated with the clustering algorithms such as constrained coverage algorithm (Poduri, and Sukhatme, 2004).

LEACH protocol (Hosseinirad, et al., 2014). , SEP protocol (Javaid, et al., 2013). , an adaptive energy optimized clustering algorithm, DEEC Virtual force algorithm (Zou,& Chakrabarty 2003a)., energy balanced deterministic clustering algorithm.

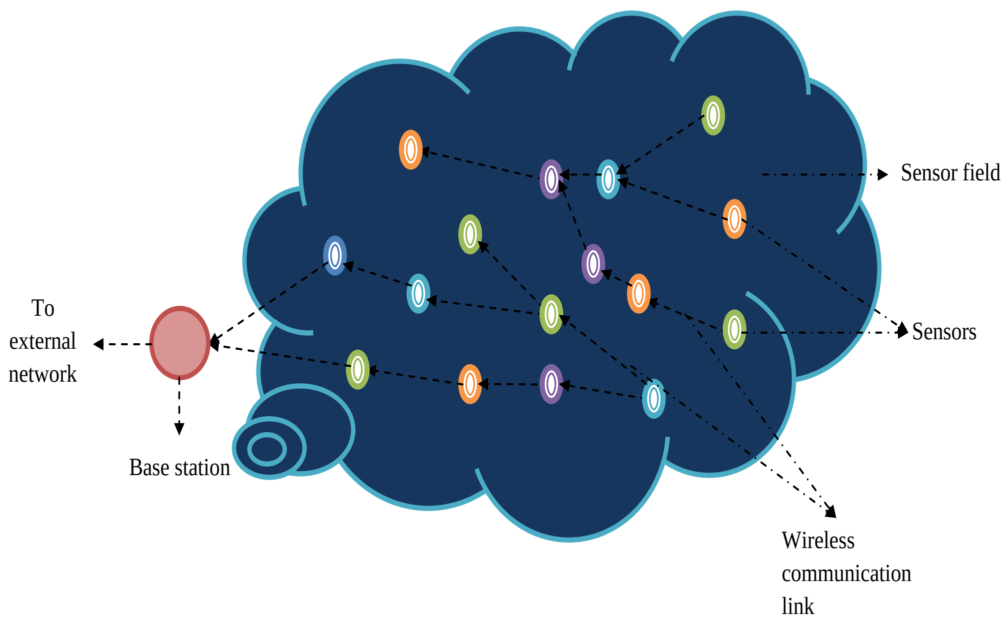


Figure 1.1: Architecture of Wireless Networks in communication system

The conventional clustering approaches have some disadvantages such as additional overhead and low coverage (Poduri, and Sukhatme, 2004). , information transmission delay (Geeta, et al., 2013). , less consideration to residual energy nodes (Javaid, et al., 2013). , large-scale Wireless Networks (Tyagi, & Kumar,N 2013). , less adaptation with the heterogeneous network (Hosseinirad, et al., 2014). , low network lifetime, less use in imbalanced energy nodes

(Hosseinirad, et al., 2014). , poor stability (Fotouhi, et al., 2014). , unbalanced lifetime of nodes (Zou,& Chakrabarty 2003b).

Increased energy consumption and death of nodes (Fan & Shuo, 2013). . Hence, many optimization methods have utilized to overcome the problems. Even though a lot of problems are optimized, still, there subsists the issue of maximizing the network's lifetime, energy stabilization and competence, re-division of the monitoring area and this has to be considered for the effectual deployment of nodes in Wireless Networks. Figure. 1 depicts the overall architecture of the Wireless Networks platform.

2. LITERATURE REVIEW

2.1 Energy constraints

In 2016, Jia *et al.* (Jia, et al., 2016a) worked on the Neighbour selection issue which leads to inappropriate coverage and increased energy usage in WSN. Hence, they have developed a clustering algorithm which can maintain balanced energy in the network node. Moreover, they have examined a developed dynamic Neighbour selection technique and employed a Voronoi polygon techniquein order toacquire the redundant nodes and the division of clustering. Subsequently, a new cluster node associated with the residual and average energy with the survival time estimation algorithm corresponding to the nodes was chosen. Finally, the experimental results revealed that the proposed method own the capacity of reducing the energy consumption and increasing the network lifetime while comparing with the suggested method with the previously available LEACH method.

In 2015, Lin *et al.* (Lin, et al., 2015a) worked on asignificant challenge in WSN, specificallyin the sensor nodes to increase the network lifetime with energy constraint. Hence, they have developed a clustering method known as Fan shaped clustering algorithm in large-scale networks with sensor nodes.

Moreover, the fan shaped clustering algorithm has the capability to split the large scale network and convert them into avarious fan shaped clusters. In addition, to find a solution to reduce the increased energy usage this fan shaped clusters were used. Hence, the solutions were Neighbour selection and relay selection. The experimental analysis demonstrates the proposed approach was one of the best methods for energy saving.

2.2 Security constraints

In 2014, S. M. Hosseinirad *et al.*(Yu, et al., 2008a). worked on the combination of LEACH with ICAfor optimum Neighbour selection. Here, the efficiency of the network on the basis of energy consumption, cluster uniformity, and coverage of the network was evaluated using the proposed method. Here, the performance of the proposed method was compared with the normal LEACH algorithm. Moreover, the proposed method exhibits that it has acquired best Neighbour with conserved energy, maintained connectivity of the network and increased network lifespan. However, this approach does not acquire the knowledge about the sensor-density and type of deployment subsists in the network.

In 2016, T. Shankar *et al.*(Shankar, et al., 2016) developed a hybrid algorithm which consists of theHSA and PSOalgorithm to obtain the energy efficient Neighbour selection. The HSA algorithm provided the faster exploration and exploitation with high searching effectiveness, and the PSO provided the dynamic ability. In the residual energy and throughput with enhancement, the proposed approach has imparted the realization about thecount of alive nodes and dead nodes. Nevertheless, the number of iterations of HSA was high to attain the optimum selection of Neighbour.

2.3 Base station positioning

In 2014, Esther M. Arkin *et al.*(Arkina, et al., 2014). worked on shallow tree topologies in order toincrease the lifetime of a network on WSN. The WSN nodes will expand in a conscientious region in order to collect the information. Here, the data was directly transmitted by the sensors to the base station. To identify the problem in transmission and base station positioning, they have developed an efficient method. Moreover, the benefits of the proposed method were low duty cycling. From the experimental results, the proposed method demonstrates the better performance when comparing with the other methods for linear programming.

In 2016, Prasenjit Chanak*et al.*(Chanaka, et al., 2016)addressed a problem in WSN for analyzing the network. Hence, they proposed mobile sink based distributed algorithm in WSN. In general, the mobile sink acts as a mobile robot, and it carried out the base station task. To maintain the high QoS the network functionality and precision was enhanced. Moreover, the tour planning algorithm was employed to save the energy and time.To identify the status of deployed sensors, the status of network information was uploaded. In addition, to notice the faults and scalability in the homogeneous network the proposed method was enhanced. From the experimental analysis, the effectiveness of the proposed method was demonstrated.

2.4 Routing protocol

In 2014, Uthman Baroudi *et al.* (Baroudi, et al., 2014). worked on sensor node deployment distributions of LEACH routing method. The main aim of the WSN is the provisioning of QoS.The various factors namely adopted cluster formation method influence this obligation. Approximately all Wireless Networkss were structured on the basis of the grouping of the sensor nodes into the clusters.

In 2016, Prabhudutta Mohanty and Manas Ranjan Kabat (Mohanty & Kabat 2016). proposed an ESDAD protocol that aggregates the redundant data in the intermediate nodes. At each intermediate node, waiting time for the packets was computed judicially in the proposed protocol. Hence, in the routing path, the data can be aggregated effectually. For data aggregation, the sensed data were transmitted sensibly to the aggregation point. In addition, the proposed method calculates the cost function for the structure free, next hop node chosen and then it performs the near-source data aggregation. Through the extensive simulations, the performance of the protocol was evaluated. Finally, the experimental results demonstrate the proposed method was superior to the conventional methods.

PROBLEM DEFINITION

In Wireless Networks, the practical challenge was the diverse topology. In addition, the cluster based topologies was another challenge for implementation and grouping. In Wireless Networks, to avoid the collision of the network, the multi-objective routing with the multiple sources and destination was needed. However, the security routing was considered as another issue in Wireless Networks (Javaid, et al., 2013). . Generally, the security routing supports to detect and tracks the malicious nodes, protection against sensitive messages, optimal sensor location and management and integration and alerts of messages. On the contrary, apriori information was needed for other approaches from the dynamic network, which was not possible.

Nonetheless, apriori information can be obtained from the networks but it remnants inaccurate. Therefore, the effectiveness of the resultant clustering will not be inconceivable. The routing algorithm for energy well-organized Neighbour was developed by numerous researchers. However, there was no contribution about the security constraints. The security routing remains as an issue for the Neighbour selection process.

Table 2.1: Review on Neighbour selection techniques in Wireless Networks based on energy constraints

Author [citation]	**Adopted methodology**	**Features**	**Challenges**
Jia *et al.* (Jia, et al., 2016a)	Dynamic Neighbour selection	❖ To solve the issue of the unreasonable NS ❖ It balances the network node energy in two phases	❖ It is difficult to prolong the lifetime of networks comprise of mobile nodes
Lin *et al.* (Lin, et al., 2015a)	Fan-shaped clustering algorithm	❖ It is exploited to partition the sensor network field into fan-shaped cluster ❖ It minimizes the	❖ It is difficult to attain the parameters in theory on the basis of density and nodes energy

		signaling cost	
Shankar,T*et al.* (Leu, et al., 2015a)	REAC-IN	❖ Increases the energy efficiency of WSN ❖ It prolongs the lifetime ❖ It solves the problem of node isolation	❖ It causes nodes to become isolated from CH
Mohanty 2015a)	PSO and GSA	❖ Finds the fitness value ❖ Finds the next hop	❖ Difficult to eliminate individual node
Hosseinirad et al 2014)	Harmony search algorithm	❖ Fast convergence ❖ Computational time is less	❖ Enhancing the performance of overall networks is difficult.
Poduri and Cheng (Poduri, et al., 2012)	Fuzzy logic-dependent clustering scheme	❖ Prolongs the lifetime of the network ❖ Achieves energy efficiency	❖ To find the optimal fuzzy set is difficult
Javaid (Javaid, et al., 2010).	Distance aware intelligent clustering	❖ Prevents the unnecessary selection of CH	❖ To determine the number of CH is difficult

	protocol	❖ It outperforms classical hierarchical routing protocols	
Zou,Y et al. (14.Zou,Y, et al., 2017).	OCCN method	❖ Increases the lifetime of the network ❖ It perfectly postpones the time	❖ Unreliable communication links ❖ Limited frequency

3. PROPOSED SYSTEM

In Wireless Networks, the efficiency of the cluster can affect by the Neighbour Selection methods. Additionally, this method can influence the lifetime of an energy constrained network. The sensor nodes need more energy for data processing, sensing, and data transmission. Nevertheless, the sensor nodes become dead because of the rechargeable batteries in Wireless Networks. To extent the existence of the Wireless Networks an energy efficient method with security model is needed. Hence, the ALOP algorithm is implemented with security constraint for Neighbour selection methodology in this paper. This method is adoptedin order to reach the objectives such as maximizing the security and minimizing the energy, delay, and distance. Subsequently, the analysis on the basis of the security awareness, network sustainability, trade-off and manner of Neighbour distribution can be obtained by the proposed approach. In addition, the proposed ALOP method is validated and determined by the conventional algorithms namely ABC, FABC, FF and ABC-DS. Finally, the simulation results revealed that the proposed approach provides superior performance for Neighbour selection and balances the network energy with maximum security while comparing with the conventional algorithms.

As shown in Figure.3.1, the Wireless Networks comprises of one base station B_S with N sensor nodes. Here, each sensor nodes are grouped into numerous clusters n_a and each cluster has one Neighbour CH. The wireless links between N sensor nodes represent the direct communication within a radio range.In the network area, the sensor nodes show a random distribution within the dimension of Y_i and Z_i.In the central location the base station is positioned that is $\{0.5Y_i, 0.5Z_i\}$ in order to collect the data from the sensor nodes. Moreover, to measure the position of sensor nodes the coordinate values of Y_p and Z_p are exploited. The location of the base station cannot be defined since the practical network has randomly distributed nodes. The CH routing mechanism is employed to transfer the data from each sensor node to the B_S. To increase the lifetime of a sensor nodes the B_S is a significant factor in Wireless Networks. Here, the lifetime of a network describes the time until the N sensor node uses up its energy. Hence, the data created by each sensor nodes to achieve high network lifetime are allowed to be routed to the B_S through a multipath. Moreover, the distance between CH and the B_S is reduced to minimize the overall energy consumption. Thus, to positioning B_S the Proposed algorithm is developed and it is exploited to minimizes the distance between the B_S and sensor nodes.

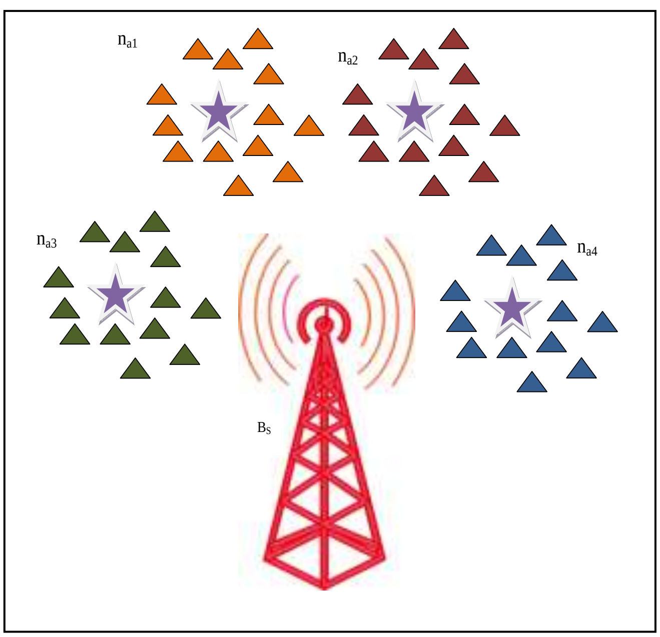


Figure 3.1: A diagrammatic representation of Wireless Networks with sensor nodes

3.1 Network Model

A Wireless Networks consists of N number of sensor nodes with the single base station n_s. In a randomized manner, each sensor is distributed within the dimension of x_m and y_m having its utmost radio range. The N numbers of sensor nodes are grouped into C_H^n number of clusters. Additionally, the Neighbour for n^{th} clusteris denotedas N_H^n. The Neighbour based mechanism is utilized to transfer data to the base station. The d_{pq} represents the distance of the p^{th} normal nodes to the q^{th} Neighbour. On the other hand, b_n represents the distance of the q^{th} Neighbour to the sink node n_s.In Fig 3.2, a simple Wireless Networks with five cluster nodes are depicted. Here, the base station n_s gathers data from the nearer cluster nodes N_H^1, N_H^2, N_H^3, N_H^4 and N_H^5.

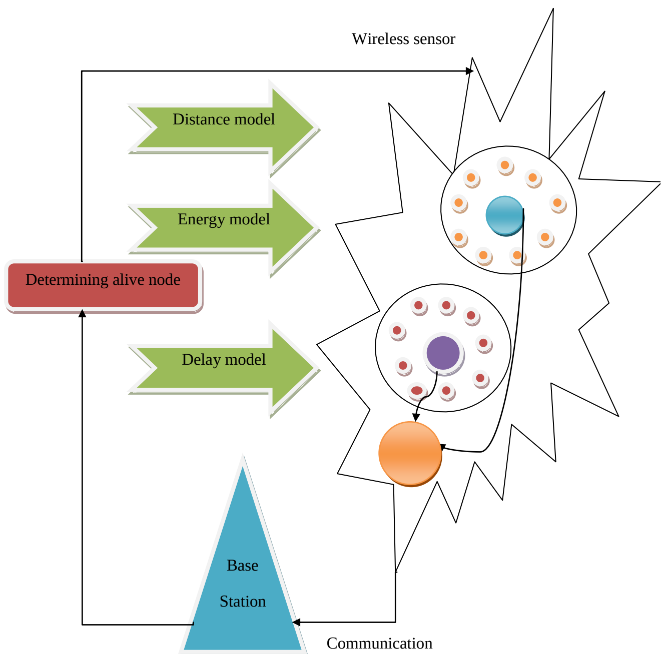


Figure 3.2: Neighbour Selection model

3.2 Energy Model

Assume every sensor node has an initial energy of E_i and it cannot be recharged. The energy loss related to every packet, which sent from p^{th} normalnode, N_{NOR}^P to q^{th} Neighbour, N_H^q in a free space and the multi-path fading model, have a better level of dependency against the distance, which links the transmitter to the receiver. In addition, the network takes on the TDMA protocol in order to carry out the data transmission. At the transmitter end, the Energy dissipation happens, because of the practice of power amplifier and radio electronics. On the contrary, at the receiver end, the radio electronics solely gives the energy dissipation.

On account of distance and the node's nature as a head node or a normal node, the energy dissipation for each packet accepts through two dissimilar models with the intention of the model the dissipated energy.

Neighbour selection framework with security layer

Figure. 3.3 illustrates the framework of Neighbour selection with security layer using AL-OP approach. Here, the network constraints have determined to select the Neighbour. In general, the data transmission related with the Wireless Networks takes place in between the Neighbour and base station and the sensor node and the Neighbour. Hence, the lifetime of a network can be maximized, and the energy can be saved. The Neighbour selection has been proposedon the basis of the overall objectives such as energy, distance, and delay. The distance model is used to disclosing the shortest path during the data transmission. As more data transfer takes place among the Neighbour and the base station the energy related with the Neighbour is required to be maximum. Eventually, the energy model is utilized to evaluate the energy and the delay model is determined to delay, and that delay must be less. Once the cluster is selected, the data transmission takes place between the base station the Neighbour takes place until the nodes become dead node

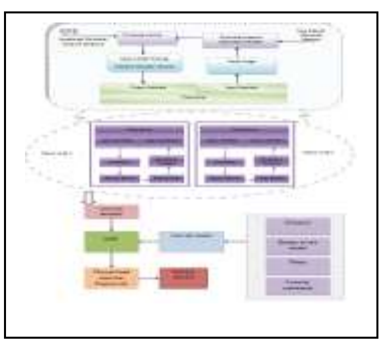


Figure 3.3: Framework of Neighbour selection with security layer using AL-OP

3.3 Security Model

In this section, the security constraints model in Wireless Networks for Neighbour selection is presented. Generally, three modes of security constraints namely secure mode, risky mode and γ-risky mode are exploited and that are defined below.

(i) Secure mode: In Wireless Networks, the secure mode chooses the Neighbour by assigning those Neighbour, which can assure the need for security. If the condition $S_d \leq S_r$ satisfies means, the node will be assigned as the Neighbour.

where,

S_d represents the demand related to security of the selection.

S_r represents the rank related with the security of the Neighbour.

To select the Neighbour from a number of nodes the secure mode is considered as the conservative approach within each cluster.

(ii) Risky Mode: The security-based Neighbour selection is enabled by the risky mode by selecting any of the available Neighbour. Hence, the risky mode takes all the possible risk. In the Neighbour selection process, the risky mode is considered as the aggressive mode.

(iii) γ-Risky mode: The selection process is done by the γ-risky mode. It is performed by assigning the available Neighbour, which can take at most γ-risk.

where,

γ represents the probability measure with $\gamma = 0$ and $\gamma = 1$

Table 5.1: Three Modes of Security Model

Mode	Condition	Cluster Selection Process
Secure Mode	$S_d \leq S_r$	Neighbour selected based on Rank related with the security
Risky Mode	S_d = Any	Selecting Any Of The Available Neighbour
γ-Risky mode	$0 < S_d - S_r \leq 1$t	Risk must be less than 50%.

(i.e., 100%) Analogous to the mode of security and risk. The risky mode and γ-risky mode is employed because the secure mode is considered as challenging mode and expensive. In general, there are five levels of security on the basis on the fuzzy scale and qualitative scale, and they are represented below,

(a) 1 is assured as very Low

(b) 2 is assured as low

(c) 3 is assured as medium

(d) 4 is assured as high

(e) 5 is assured as very high

The Neighbour selection process is considered as secure. Ifthe Neighbour selection is assignedto the safe Neighbour that satisfies the aforementioned condition.

The security constraint model condition is stated below,

If the condition of the Neighbour selection is $S_d > S_r$ then the risk must be less than 50%.

If the condition of Neighbour selection is $0 < S_d - S_r \leq 1$ then the process will be executed.

If the condition of Neighbour selection is $1 < S_d - S_r \leq 2$ then the process will be delayed.

If the deadline has passed (i.e., $2 < S_d - S_r \leq 5$) then the Neighbour selection process cannot be completed, and it must be repeated.

In Equation. (3.1),the risk probability of the security constraint model is represented,

$$f_{risk} = \begin{cases} 0 & if \quad S_d - S_r \le 0 \\ 1 - e^{\frac{(S_d - S_r)}{2}} & if \quad 0 < S_d - S_r \le 1 \\ 1 - e^{\frac{3(S_d - S_r)}{2}} & if \quad 1 < S_d - S_r \le 2 \\ 1 & if \quad 2 < S_d - S_r \le 5 \end{cases} \tag{3.1}$$

3.4 Risk-aware Neighbour selection

The cost function for the security model of the proposed method is implementedon the basis of the delay, distance, risk factor and energy. In Neighbour selection model, the main fact is to reduce the distance between the normal node and Neighbour. In addition, the delay and the risk factor should be minimized while the energy must be maximized for Neighbour selection. On the basis of these constraints, the minimization function of the Neighbour selection can be obtained. In Equation (3.2) the minimization of the objection function is defined

$$F_{objective} = \beta f^{m} + (1-\beta) f^{n}; 0 < \beta < 1 \tag{3.2}$$

In Equation (3.3) the parameters should attain the condition $\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 = 1$

$$f^{m} = \alpha_1 * f_{distance} + \alpha_2 * f_{energy} + \alpha_3 * f_{delay} + \alpha_4 * f_{risk} \tag{3.3}$$

where

α_1 represents the constant parameters of distance,

α_2, represents the constant parameters of energy,

α_3 represents the constant parameters of delay,

α_4 represents the constant parameters of therisk factor,

$$f^{n} = \frac{1}{n} \sum_{p=1}^{n} \left\| M_p^{norm} - B_s \right\| \tag{3.4}$$

The distance between the packets traveled from the Neighbour to the Base station and the normal node to the Neighbour is represented in the numerator of Equation (3.5). In addition, the distance between the each node with the other node is represented in the denominator with the range of value between 0 and 1. While the space between the Neighbour and the normal node exceeds the value of $f_{distance}$ becomes large.

$$f_{distance} = \frac{f^{(m)}_{distance}}{f^{(n)}_{(distance)}} \tag{3.5}$$

$$f^{(m)}_{distance} = \sum_{p=1}^{M} \sum_{q=1}^{H_n} \left\| M_p^{norm} - H_c^q \right\| + \left\| H_c^q - B_s \right\| \tag{3.6}$$

$$f^{(n)}_{distance} = \sum_{p=1}^{M} \sum_{q=1}^{M} \left\| M_p^{norm} - M_q^{norm} \right\| \tag{3.7}$$

The fitness function of energy calculation is given in Equation (3.8).

$$f_{energy} = \frac{f^{(m)}_{energy}}{f^{(n)}_{energy}} \tag{3.8}$$

where,

$f^{(m)}_{energy}$ represents the maximum value of energy

$f^{(n)}_{energy}$ represents a maximum count of the Neighbour.

The value of f_{energy} becomes greater than one. In addition, the energy of the node is subtracted from the unit value in order to achieve the minimization criteria.

$$nE(q) = \sum_{\substack{p=1 \\ p \in q}}^{M} \left(1 - E(M_p^{norm}) * E(H_c)\right); 1 \le q < H_c^n \tag{3.9}$$

In Equation. (3.10) the value of $nE(q)$ should be fewer for the enhanced Neighbour selection.

$$f^{(m)}_{energy} = \sum_{q=1}^{H_c^n} nE(q) \tag{3.10}$$

$$f_{(2)}^{Energy} = H_c^n * \underset{p=1}{\overset{H_c^n}{Max}}\left(E(M_p^{norm})\right) * \underset{q=1}{\overset{H_c^n}{Max}}\left(E(M_q^{norm})\right) \tag{3.11}$$

Where,

$E(M_p^{norm})$ indicates the p^{th} normal node energy,

$E(M_q^{norm})$ indicates the q^{th} normal node energy.

The fitness for the delay parameter is given by

$$f_{delay} = \frac{\underset{q=1}{\overset{H_c^n}{Max}}\left(H_c^q\right)}{M} \tag{3.12}$$

In Equation. (3.12) the f_{delay} is directly reliant upon the number of members in the cluster. Therefore, the Neighbour should have a minimum amount of clusters to avoid delay. The maximum amount of Neighbour is denoted by numerator value of Equation. (3.12) and the denominator value of the Equation. (3.12) denotes all the nodes, which the network comprises. In addition, the f_{delay} must be in the range of 0 and 1.

3.5. Adaptive Algorithm

3.5.1 Ant Lion Optimization

The Ant Lion algorithm is a meta-heuristic algorithm. This algorithm is inspired by the flashing activity concerned with the light of fireflies. The primary purpose of the Ant Lion algorithm is to find the optimal positions of the particle, which produce the best evaluation in a given fitness function. The Ant Lion algorithm follows three generalized rules:

(i) All fireflies are contemplated as unisexual. Hence, one Ant Lion can attract other fireflies irrespective of the sex.

(ii)The attractiveness of the Ant Lion algorithm is directly proportional to its brightness. Nevertheless, the brightness decreases as their distance increases.

(iii) The brightness of the Fireflies is influenced by the landscape of the objective function.

On the basis of these rules, the basic steps of the Ant Lion algorithm can be developed as the flowchart shown in Figure. 3.5.1.

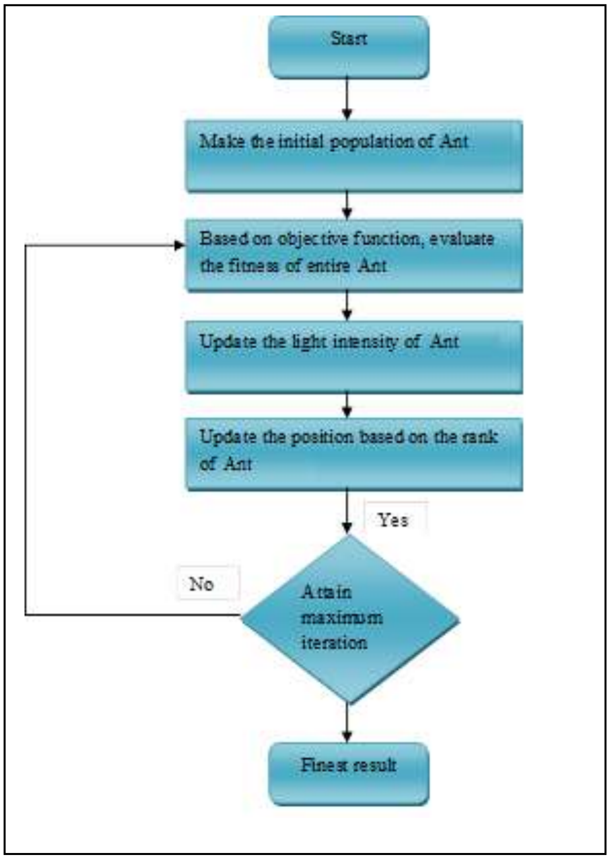


Figure 3.4: Flowchart of Ant Lion algorithm

3.5.2 ALOP

The ALOP method differs from the usual Ant Lion algorithm in terms of frequency of updating the solutions. The proposed ALOP method updates each Ant Lion twice whereas the usual Ant Lion method updates each Ant Lion once. The method standardizes some of the Ant Lion characteristics and that are explained as follows.

(a) Attractiveness and Light intensity: The Equation. (3.13) represents the light function at distance d_a

$$I = I^s \exp(\gamma d_a^2) \qquad (3.1.)$$

where

I^s represents the light intensity at the source

γ represents the absorption coefficient of the medium.

In Equation. (3.14) the Gaussian form of the estimation is contemplated to simulate the singularity prevention at $d = 0$.

$$\beta = \beta_0 \exp(-\gamma d_a^m) \quad (3.14)$$

where

β represents the attractiveness, which is directly proportional to the intensity of light,

β_0 represents the attractiveness at $d = 0$.

(b) Distance: Here, the Ant Lion distance m and n are specified. At x_m and x_n some fireflies are located.

$$d_{a(m,n)} = \sqrt{\sum_{p=1}^{k} (x_{m,p} - x_{n,p})^2} \quad (3.15)$$

The Equation. (3.16) indicates the Cartesian distance.

where

k denotes the number of dimensions and

$x_{m,p}$ denotes the p^{th} constituent of the spatial coordinate x_i which is associated with the m^{th} Ant Lion.

(c) Movement: Here, a Ant Lion m towards gradually attracts the Ant Lion n and it is represented in Equation. (3.16)

$$S_2 = S_1 + \beta_0 e^{-\gamma d_{a(m,n)}^2} (x_n - x_m) + \alpha\varepsilon \quad (3.16)$$

where

The second term represents the inclusion using the attractiveness

The third term represents the randomization parameter.

Pseudo code for proposed ALOP is given in below.

ALGORITHM 3.1: PSEUDO CODE OF ALOP

Input: $x = (x_1 .... x_d)$

Output: Optimal Neighbour selection $x = (x_1 .... x_d)^*$

Begin

Step 1: Start the initialization of the population $x = (x_1 .... x_d)$ and Generate the initial Ant Lion population, $x_m (m = 1,2.....k)$

Step 2: Using the objective function $F_n(x_m)$, search out the light intensity I at x_m and Define the absorption coefficient γ of light

Step 3: While (Maximum production exceeds t), do the following process

Step 4: for every m and n, and for i varies from 1 to N times, If $(I_{mi} > G(I_{n1}^{+}, I_{n2}^{+})$, then make the Ant Lion n^* to travel in the direction of m^* in d-dimension;

Step 5: Calculate the new solutions using Equation. (3.16) to update the light intensity

Step 6: Formulate a ranking of the fireflies to place the present best

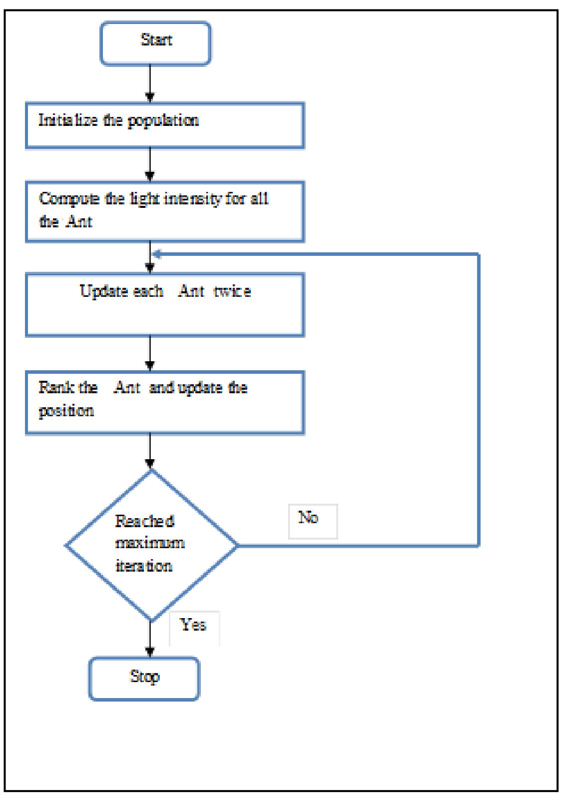


Figure 3.5: Process of Proposed ALOP algorithm

The description of the process and pseudo code of the proposed ALOP algorithm is demonstrated below.

(i) Generate the initial population of the fireflies

(ii) Calculates the light intensity of each Ant Lion with the objective function.

(iii) The light absorption coefficient γ is determined.

(iv) The precise fitness is obtained by updating each Ant Lion, and the updating process is performed for two times. Here, each Ant Lion is updated by Equation. (3.17).

$$I_n^* = G(I_{n1} + I_{n2}) \quad (3.17)$$

where

$G(I_{n1} + I_{n2})$ indicates the greedy selection process.

If the light intensity of one Ant Lion is better than the other, subsequently the equivalent fewer light intensity Ant Lion goes towards the other one.

(v) The update of light intensity is employed to update the solution, and it is done by using Equation. (3.17).

(vi) Each Ant Lionis updated with suitable rank through a ranking process.

(vii) If a termination criterionis fulfilled, means the process will terminate else the process will repeat until it reaches the maximum iteration.

4. Results and Discussion

This section presents the simulation of Neighbour selection in WIRELESS NETWORKS Network and performance comparison of conventional methods such as ABC, FABC, FF and ABC-DS with proposed ALOP algorithm. The comparison of proposed and conventional method was implemented using Network Simulator Tool. Here, the proposed method was performedon the basis of two scenarios. In the first scenario, the security constraints have been considered. In the second scenario, both the security constraints and energy awareness have been considered. In a simulated network, the experimentation was carried out with the following network configuration and parameters.

Table 4.1: Parameters used in Simulation

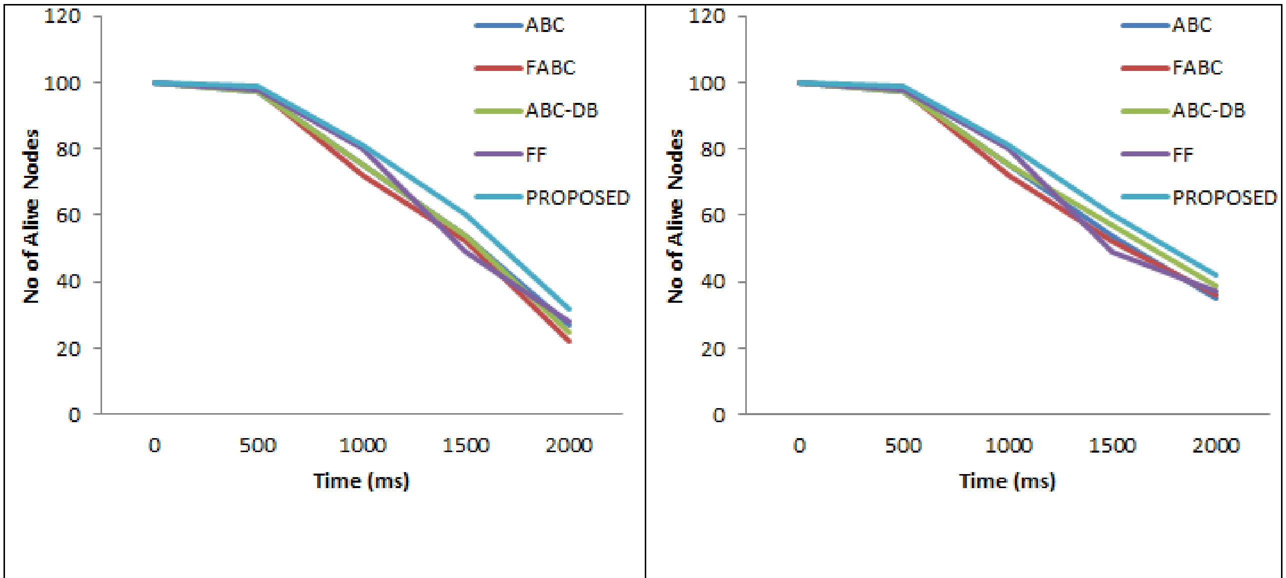
Parameters	**Values**
Network size	$100m \times 100m$
Initial energy E_I	0.5
Energy for free space model E_F	$10\, pJ / bit / m^2$
Energy of power amplifier E_P	$0.0013\, pJ / bit / m^2$
Transmitter Energy E_T	$50nJ / bit / m^2$
Data aggregation E_D	$5nJ / bit / signal$
Number of rounds	2000

4.1 Network Sustainability

If the number of alive nodes increases the sustainability of the network remains high.Figure. 5.3 demonstrate the network sustainability of the proposed ALOP method and conventional ABC, FABC, FF and ABC-DS. The number of alive nodes subsists for risk awareness condition as well as energy with risk awareness condition until the completion of 2000 round is shown in Figure.4.1 (a) and 4.1 (b).

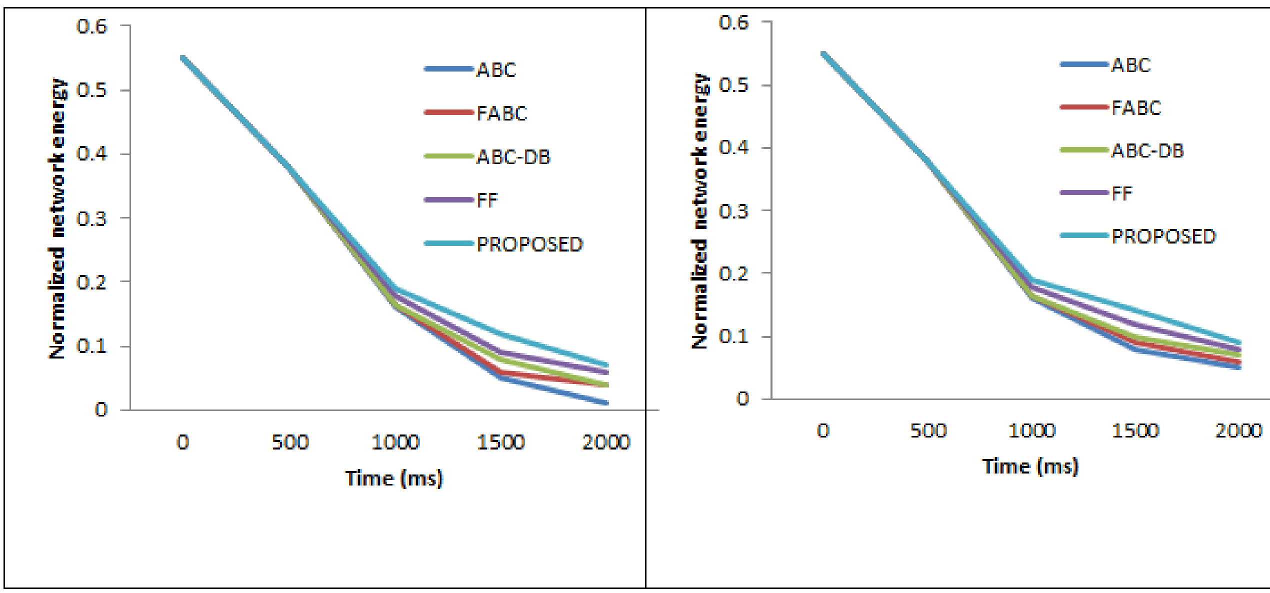
Figure. 4.1 illustrates the network sustainability of the proposed ALOP method and the conventional methods. Figure.4.1 (a) depicts the number of alive nodes exists for risk awareness condition and energy until the completion of total rounds.

Here, 35 numbers of alive nodes are subsisted for the proposed ALOP method, which is better performance than the conventional methods. Figure.4.1 (b) illustrates the number of alive nodes exists for risk awareness condition until the completion of total rounds. In proposed ALOP method, 32 numbers of alive nodes are subsisted, when considering only the risk awareness condition. From Figure. 4.1 (b), we can see that the proposed method provides better performance than the conventional methods.



(a) (b)

Figure 4.1: Graphical representations of network sustainability (a) Alive nodes of risk awareness condition (b) Alive nodes of energy and risk awareness condition



(a)	(b)

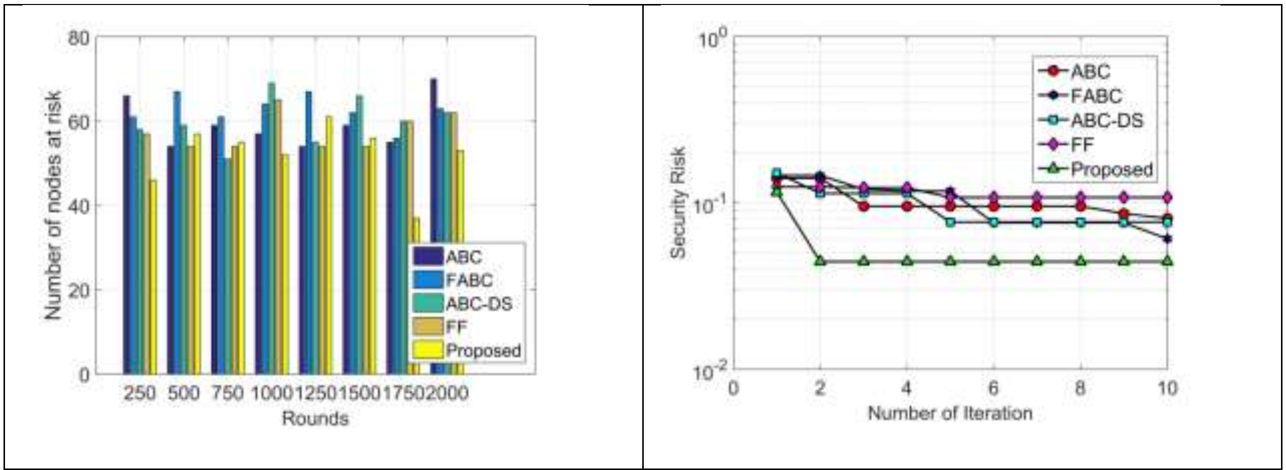
Figure 4.2:(a) Normalized network energy Vs number of rounds of risk awareness condition (b) Normalized network energy Vs number of rounds of energy and risk awareness condition

Figure. 4.2 (a) and (b) shows the normalized network energy for the risk awareness condition and energy, risk awareness condition with the number of rounds. From Figure.4.2 (a) and 4.2 (b),the proposed ALOP method achieves high network energy until 2000 roundswhile comparing with the conventionalABC, FABC, FF and ABC-DS methods.

4.3 Security awareness

In Figure. 4.3, the awareness associated with the security constraint over the Neighbour selection for the proposed ALOP and conventional methods such as ABC, FABC, ABC-DS and FF is presented.

In addition, the count of nodes for each round at risk is estimated in Figure. 4.4. The number of nodes at risk achieved by the existing methods is superior to 45 for each round, and it is represented in Figure. 4.3.The number of risk nodes nearly differs from 42 for 250 rounds, 58 for 500 rounds, 55 for 750 rounds, 51 for 1000 rounds, 61 for 1250 rounds, 56 for 1500 rounds, 37 for 1750 rounds and 55 for 2000 rounds for proposed method. In the Neighbour selection process, the proposed ALOP method gives minimum risk to all nodes.



(a) (b)

Figure 4.3:(a) Analysis of security awareness for prediction of number of nodes at risk (b) Analysis of security awareness and security risk of each iteration

Figure. 4.3 illustrates the security risk for the Neighbour selection for each iteration.

Figure. 4.3, it is clear that the proposed ALOP method attainsminimum security risks while comparing with the conventional ABC, FABC, ABC-DS and FF methods.

4.4 Trade-off

In this section, the graphical representation of trade-off between the parameters obtained during the process of Neighbour selection, and it is depicted in Figure 4.4.

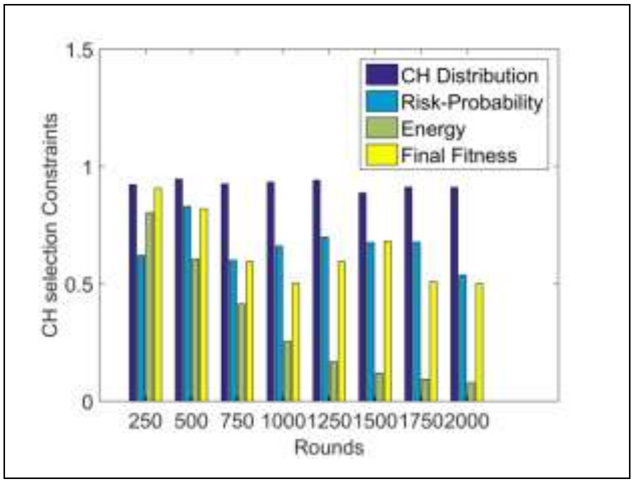


Figure 4.4 : Analysis of trade- off constraints of Neighbour selection for each round

Figure. 4.4 illustrates the distribution of Neighbour, theprobability of risk and energy for all rounds with total fitness. Figure. 4.4 proves that the energy consumption is maximum for starting nodes in contrast the energy consumption of final rounds is minimum. Further, Figure. 4.4 illustrates the total final fitness for each round represents minimum total fitness, when the number of round increases.

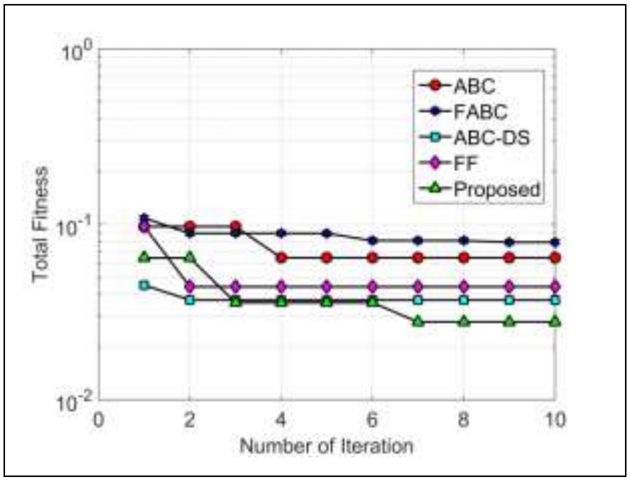


Figure 4.5: Performance analysis of total fitness for each iteration

Figure. 4.5 illustrates the comparative analysis of proposed ALOP method and conventional ABC, FABC, ABC-DS and FF methods with respect to the total fitness for each iteration. From the Figure.4.5, the FF method and proposed method behaved similarly until 6^{th} iteration. From iteration 2 to 10 the proposed method proposed provides minimum fitness than the conventional methods.

5. Conclusion

Wireless Networks is a resource constraint network, in which all sensor nodes have inadequate resources. Data must be aggregated to save resources and energy as well as to reduce the amount of traffic in the network. In addition, to prolong the lifetime of the Wireless Networks, the clustering approach is an effective way.

The clustering methods are exploited to select the CH with high residual energy, as well as the Neighbours periodically, to distribute the energy consumption among nodes in each cluster and maximizes the lifetime of the network. The NS approaches for Wireless Networks were put forward to solve the problem of the unreasonable NS, which may lead to the base station positioning problem and energy consumption of the sensor nodes. The energy conservation, distance, and delay were the drawbacks of the CH due to the different transmission distance from each CH to the base station. To decrease the energy consumption and maximize the lifetime of the network and to solve the base station positioning different optimization methods were proposed in this paper.

The ALOP method was proposed to solve the base station positioning problem by minimizing the distance between the Neighbour and the base station. Hence, the lifetime of the network was enhanced, and the energy consumption was reduced. In experimental results, the network energy and the number of alive nodes were calculated based on the optimized positioning of the base station. In spite of the fact, the base station positioning is a traditional technique; less number of methods has been deployed for solving the problem. Moreover, the approved algorithms are traditional evolutionary algorithms such as GA and Ant Lion algorithm. Henceforth, the proposed method was compared with the GA, ABC and PSO for comparative study along with the base algorithm. The result showed that the proposed method is 80% better than the conventional methods.

The ALOP algorithm differs from the conventional Ant Lion algorithm with respect to the frequency of updating the solutions. Here, it consists of two scenarios such as security constraints and both the security constraints and energy awareness. A security constraint approach AL-OP method was implemented to reach the objectives namely energy, delay, energy, and distance among the sensor nodes and increase the security in Wireless Networks.

If the number of alive nodes increases, the sustainability of the network remains high. In addition, the risky nodes with and without energy constraints were also computed. To find the efficiency of the network, the number of alive nodes for both the proposed and conventional methods was computed.

For Future scope, we can utilize different constraints such as delay and sensing capabilities in different applications. An advanced optimization algorithm has the ability to solve the problem, hence we focussed to carry out an extensive study over the performance of several advanced optimization algorithms.

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