ENERGY EFFICIENT ROUTING ALGORITHM FOR WSN USING PRIMS AND MODIFIED GENETIC ALGORITHM

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Abstract: *In many applications of wireless sensor networks, a sensor node senses the environment to get data and delivers them to the sink via a single hop or multi-hop path. Many systems use a tree rooted at the sink as the underlying routing structure. Since the sensor node is energy constrained, how to construct a good tree to prolong the lifetime of the network is an important problem. We consider this problem under the scenario where nodes have different initial energy, and they can do in-network aggregation. Several protocols are proposed in performing sub aquatic communication; routing and issues related to efficiency of energy are considered as important for the underwater sensor network. In this article, prims algorithms with genetic optimization algorithm has been proposed to enhance lifetime of nodes of WSN, by employing shortest path strategy and minimum hop length concept. Prims algorithms generates all possible routes between nodes of WSN and genetic algorithms finds shortest distance between source and destination node by employing minimum number of intermediate nodes.*

KEYWORDS: ***WSN, ROUTING ALGORITHM, SHORTEST PATH, LIFETIME, POWER MINIMIZATION.***

1-INTRODUCTION:

The wireless sensor network has played a crucial role in the recent era of the smart grid to improve data transmission performance. In electrical power system communication plays a vital role even smart grid also behaves as a data communication network. In this work, sensors devices are connected to the smart grid in order to transmit the information wirelessly [1]. Advances in microelectronics technology, computer technology and wireless communication technology have led to the development of low-power and low-cost sensor nodes in the past few years. In the recent decade, Wireless Sensor Networks WSNs) including these sensor nodes are becoming a hot research topic and have been applied in many respects including environmental monitoring, health monitoring, military surveillance, and many others as Internet of Thing (IoT). However, power supplies for sensor nodes are limited and hard to replace. In addition, nodes near the base station consume more energy than those elsewhere, since they relay the data collected by sensor nodes far away from the base station [2].

Wireless Sensors networks contain small size, self- configured, distributed and autonomous Sensor Nodes (SNs), that monitor physical or environmental activities like, pressure, temperature or sound in specific area of deployment. A sensor characterized with limited computation capabilities and storage receives the data through analogue to digital converter (ADC). Then, transmit it further for transmission to a central point, known as Base Station (BS) via a wireless connectivity. Generally, with clustering method, the network area is divided into small groups termed as clusters, with a predefined number of leaders known as Cluster Head (CH). All the SNs gathering data and transmit it to their corresponding CH, which finally aggregates it to the BS for additional processing. Clustering has various significant advantages over classical techniques [3].

It is crucial to consider critical parameters such as network lifetime, packet delivery ratio, energy-efficient transmission, and dead node ratio to address the battery constraint issue in WSNs. Energy-efficient routing techniques play a vital role in increasing the network lifetime. The current routing protocols for WSNs are classified into two categories based on their orientation towards either homogeneous or heterogeneous WSNs, further divided into static and mobile protocols. However, it has not been adequately addressed by researchers and practitioners. Despite the efforts to improve energy efficiency in WSNs, some open issues in energy-efficient routing protocol design still need to be addressed. Several energy-efficient routing protocols are available, such as low energy adaptive clustering hierarchy (LEACH), Hybrid Energy Efficiency Protocol (HEEP), threshold-sensitive energy efficient network protocol (TEEN), and power-efficient Gathering in sensor information systems (PEGASIS). Notably, LEACH is considered the father of clustering protocols. It operates in rounds, each consisting of two phases: a setup phase where clusters are formed and a steady-state phase where member nodes send their data to their corresponding cluster heads, which then transfer it to the base station. During setup, nodes exchange messages to form clusters, including cluster head announcements, member node join query messages, and cluster head Time Division Multiple Access (TDMA) schedules [4].

Wireless sensor networks are used due to their many applications in various fields such as agriculture, environmental monitoring, vehicle tracking, healthcare monitoring, smart buildings, security, and animal monitoring and tracking. In fact, due to the various applications mentioned, the lack of energy in the nodes is one of the most critical limitations of wireless sensor networks. Because it is impossible to recharge or replace the nodes in the sensor nodes. Therefore, providing an appropriate protocol that can save energy will increase the network's lifetime. One of the strategies to extend the lifetime of the network is the use of the clustering approach, which, including the hierarchical architecture can be useful in the lifetime and energy consumption of wireless sensor networks. In other words, in this architecture, clustering sensors have other advantages such as saving the power of sensor elements, increasing system adaptability and maintaining data transfer speed [5].

There is a need for energy efficient transmission of data in those areas of usage. Hence routing of data must be energy efficient so as to transmit the data at a faster rate. In this experiment, a distance vector routing algorithm is implemented to make the process of routing an energy efficient one. The main concept of our project is to find the minimum path distance between the routers by finding all the path ways between source node and the destination node. This provides the project with a greater advantage than previous algorithm used by reducing the time taken for the transfer of the data packets with minimum energy used [6].

The necessary approach in this city is to use advanced technology and informatics in order to improve the service level. Smart cities go through four actions to enhance the quality of life and the potential for economic development through a network of devices linked to the Internet and other technologies like data mining for analyzing data in different fields that would help for improving performance like prediction energy consumption and diagnosis of diseases.

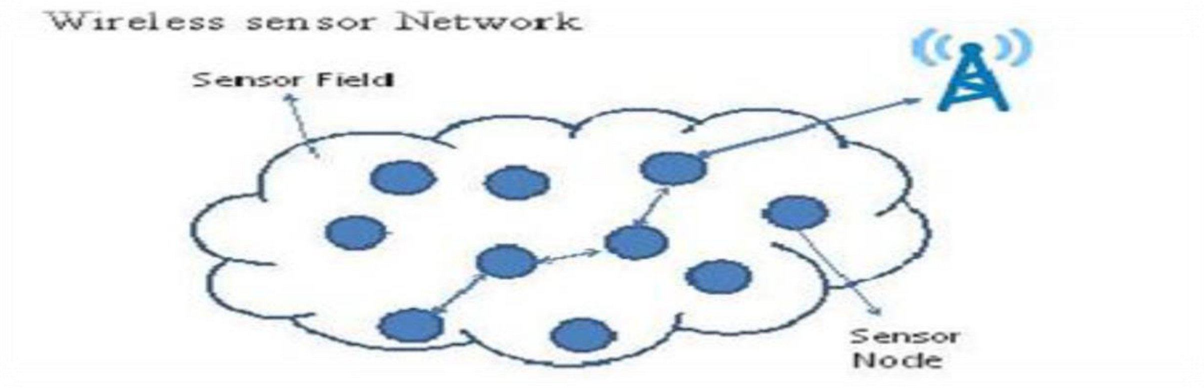


Figure 1.1: Wireless Sensor Network (WSN)

For WSNs with controllable trajectories, most existing approaches focus on how to design the optimal trajectory of the mobile sink to improve the network performance. Consider mobility control and develop the algorithms that generate ferry routes that meet traffic demand and minimize weighted packet delay. The mobile base station starts the cluster organization by broadcasting a beacon message while traversing the network. Introduce a mobile data observer and present a heuristic algorithm for planning the trajectory of the mobile data observer and balancing the traffic load in the network. A distributed and network assisted sink navigation framework to balance energy consumption and collection delay by choosing the appropriate number of multiple hops.

1.2-COMPONENTS OF A WSN: A wireless sensor network consists of three main components: nodes, gateways, and a base station.

The nodes, also known as sensor nodes, are small, low-power, autonomous devices that are deployed in the environment to measure and monitor various parameters. They are typically equipped with sensors, such as temperature, humidity, air pressure, and more, as well as a transmitter and receiver. The nodes communicate with each other through radio waves. The gateways are devices that are used to connect the nodes with the base station. They are typically used to extend the range of the nodes, as well as to provide additional processing power. The gateways also act as a bridge between the nodes and the base station, allowing the nodes to communicate with the base station.

1.3-WIRELESS SENSOR NETWORK ARCHITECTURE: The architecture of a WSN is typically divided into three layers: the physical layer, the data link layer, and the application layer.

The physical layer is responsible for providing the nodes with a physical connection to the base station. It typically consists of radio waves, as well as other technologies such as infrared and Bluetooth. The data link layer is responsible for providing the nodes with a logical connection to the base station. It typically consists of protocols such as the IEEE 802.15.4 protocol. The application layer is responsible for providing the nodes with the ability to communicate with the base station. It typically consists of protocols such as the ZigBee protocol.

1.3.1-TYPES OF WSN: Depending on the environment, there are five distinct types of Wireless Sensor Networks.

1.3.2-TERRESTRIAL WIRELESS SENSOR NETWORKS Terrestrial WSNs are employed to facilitate communication between base stations with great efficiency, and consist of thousands of wireless sensor nodes put in place either in an unstructured (ad hoc) or structured (Pre-planned) manner. The sensor nodes are scattered randomly throughout the designated area when they are released from a set plane in an ad hoc fashion. In this wireless sensor network (WSN), the battery power is very restricted; however, the battery is fitted with solar cells for a supplementary energy source. Energy efficiency of these WSNs is accomplished by employing low duty cycle operations, lowering any delays, and utilizing the most suitable routing, and many others.

1.3.3-UNDERGROUND WIRELESS SENSOR NETWORKS The cost of establishing underground wireless sensor networks is higher than terrestrial WSNs due to the cost of equipment, installation, and upkeep. These networks are composed of several sensor nodes that are buried beneath the ground and keep track of underground conditions. For data transmission from the sensor nodes to the base station, additional sink nodes are put in place above the surface. The battery power of the sensor nodes is constrained and it is hard to recharge them. Furthermore, the underground setting makes wireless communication hard to achieve due to the strong attenuation and signal-loss rate.

1.3.4-UNDERWATER WIRELESS SENSOR NETWORKS Approximately 70% of the planet is covered by water, and this environment comprises numerous sensor nodes and vehicles. To acquire data from the sensors, autonomous underwater vehicles are employed. An issue with underwater communication is its slow transmission, as well as the bandwidth and sensor malfunctions. When they are operating underwater, wireless sensor networks are fitted with a restricted power source that is not able to be recharged or replaced.

1.3.5-MULTIMEDIA WIRELESS SENSOR NETWORKS It has been suggested to use multimedia wireless sensor networks to be able to track and supervise events that can be described as multimedia, including video, audio, and images. These networks are constructed of low-cost nodes that have built-in microphones and cameras. These nodes are interconnected wirelessly so that data can be compressed, retrieved, and associated. The problems associated with multimedia WSNs are heightened power usage, massive bandwidth requirements, data processing, and compressing processes. Furthermore, multimedia content necessitates a great deal of bandwidth in order for it to be transmitted properly and effortlessly.

1.3.6-MOBILE WIRELESS SENSOR NETWORKS Commonly known as MWSNs. A Mobile WSNs network contains a collection of sensor nodes that are able to move independently and interact with the surrounding environment. The mobile nodes are also equipped with the capacity to compute sense and communicate. Mobile wireless sensor networks are far more flexible than those that are fixed in one spot. There are many advantages to using MWSNs instead of static wireless sensor networks, such as an enhanced coverage area, higher energy efficiency, and an increased channel capacity.

2-LITRETURE SURVEY

Rekha and Mahadevaswamy [13], Adaptive Zigbee-Aquila communication protocol (AZACP) was used to find the optimal shortest path for transferring data. AZACP finds the shortest optimal path for transmitting the sensed data to base station with low cost and less time consumption. Fault detection was the process of automatically identifying the fault in the transmission line and isolate the faulty nodes to ensure the efficient data transmission in WSN. Here, Enhanced Recurrent Equilibrium Neural Network (ERENN) was introduced to identify the fault in data transmission. It recognized the strength of the signal to transmit the sensed data and checks the quality of the data in transmission line between the nodes. software and compared with existing approaches like Adaptive Error Control (AEC), Gallager Humble Spira (GHS), Genetic Algorithm-Ticket Based Routing (GA-TBR), Improved Grid based Routing and Charging (IGRC) and Emperor Penguin

Optimized Self-healing Strategy (EPOSH). The proposed approach provided better performance in terms of evaluating performance metrics like throughput, delay, reliability, average residual energy, number of total transmission, network lifetime, efficiency and Bit Error Rate (BER).

Xie *et al*. [13], proposed an energy-efficient routing mechanism by introducing intentional mobility to wireless sensor networks (WSNs) with obstacles. In the sensing field, Mobile Data Collectors (MDCs) can freely move for collecting data from sensors. An MDC begined its periodical movement from the base station and finally returns and transports the data to the base station. In physical environments, the sensing field may contain various obstacles. A research challenge was how to find an obstacle-avoiding shortest tour for the MDC. Firstly, author's obtained the same size grid cells by dividing the network region. Secondly, according to the line sweep technique, the spanning graph was easily constructed. The spanning graph composed of some grid cells usually includes the shortest search path for the MDC. Then, based on the spanning graph, a complete graph by Warshall-Floyd algorithm was constructed.

KHEDIRI *et al.* [15], proposed and evaluate a new centralized energy-efficient clustering protocol for homogenous WSNs, which was called Distance energy evaluated DEE. In DEE, the cluster-heads (CHs), were elected by a probability based on the ratio between distance and residual energy of each node. The probability of being CH according to their initial and residual energy, finally, the simulation results seemed that DEE achieved more effective messages and longer lifetime than current important clustering protocols in homogeneous environments.

Verma [16] , analyzed key parameters for sensor network applications, including network lifetime, packet delivery ratio, energy-efficient transmission, and dead node ratio. Author examined the effectiveness of clustering in wireless sensor networks for achieving efficiency. The research focused on the Low-Energy Adaptive Clustering Hierarchy (LEACH) protocol and proposed an enhanced algorithm that improves network lifetime, throughput, and the number of alive nodes. Article evaluated the performance of the improved LEACH protocol and compared it to other protocols currently in use. The results indicated that the proposed method significantly improved the protocol's performance, making it a promising method for efficient routing in wireless sensor networks.

ARAFAT *et. al* [17],developed an analytical model to determine the optimal number of clusters by considering intra- and inter-cluster transmission distances to reduce the overall transmission distance and number of transmissions. Finally, a routing algorithm to ensure energy-efficient packet delivery from CH to sink was proposed. Simulation outcomes revealed that the proposed DECR significantly outperforms the existing clustering and routing protocols in various performance metrics.

3-RESEARCH METHODOLOGY:

3.1-PROBLEM STATEMENT

One of the most important issues in such networks is high possibility of failure in nodes. These failures can be occurred because of various reasons, for example when sensor nodes run out of energy. So energy is regarded as a crucial factor for network. One of the most considerable topics in these networks is energy maintenance to increase network lifetime.

The most important issue in sensor networks is routing and the most important issue in routing is optimal energy consumption in sensors to increase network lifetime, because sensors have limited energy and are not rechargeable. These networks typically have static nodes or with limited mobility and a central node which collects sensed data from nodes directly (one-step method) or indirectly (multi-steps). In directly transmission, each sensor sends information directly to central node, because of distance between sensors and base station, a lot of energy consumed in each transmission. In contrast designs which make communication distance smaller could extend network lifetime. Clustering protocols are appropriate methods for extending WSNs lifetime. In clustering, network is divided to clusters, in each cluster a node will be selected as cluster head. Member clusters send processed data to cluster head (either directly or indirectly and by multisteps method). After that data are aggregated and be sent to base station using one-step or multisteps transmission. In the proposed technique, minimum number of numbers will be utilized between source and destination nodes to propagate the information to save energy of other nodes.

3.2-MOTIVATION

Wireless sensor networks are used due to their many applications in various fields such as agriculture, environmental monitoring, vehicle tracking, healthcare monitoring, smart buildings, security, and animal monitoring and tracking. In fact, due to the various applications mentioned, the lack of energy in the nodes is one of the most critical limitations of wireless sensor networks. Because, it is impossible to recharge or replace the nodes in the sensor nodes. Therefore, providing an appropriate protocol that can save energy will increase the network's lifetime. One of the strategies to extend the lifetime of the network is the use of the clustering approach, which, including the hierarchical architecture can be useful in the lifetime and energy consumption of wireless sensor networks.

WSN are mostly preferable at the remote location to provide connectivity with the outer world, in such case battery life is concerned. In this article, we are employing an algorithm to find the shortest path between source and destination node and make minimum number nodes involved for data transmission.

3.2.1- OBJECTIVES:

- The primary objective of the proposed methodology is the increase the lifetime of node by efficient utilization of nodes as intermediate or routing node.
- To enhance the lifetime of network shortest path optimization algorithm has been proposed to minimize the number of nodes as hop.
- To enhance the lifetime of network by finding shortest path between source and destination node.

In this article Prims algorithm with modified genetic algorithm for energy efficient shortest-path detection between WSN has been proposed. Flow diagram of the proposed system has been depicted in figure 3.1 below.

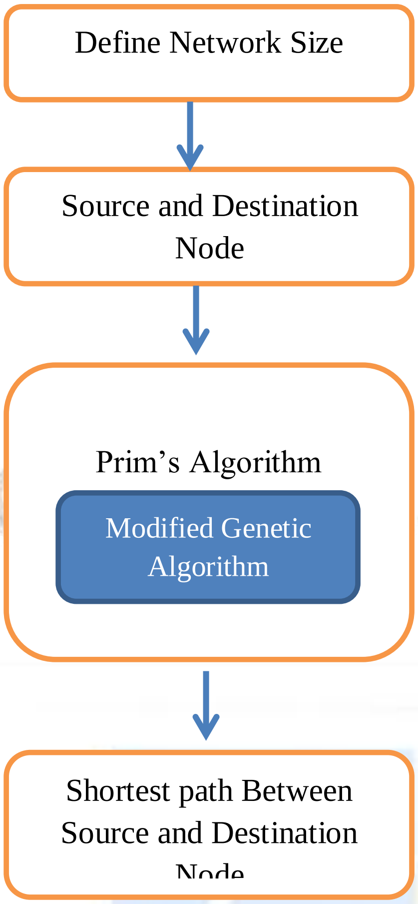


Figure 3.1: Implementation flow diagram

3.3.1-WSN NETWORK: A Wireless Sensor Network (WSN) is a distributed network and it comprises a large number of distributed, self-directed, and tiny, low powered devices called sensor nodes alias motes [1]. WSN naturally encompasses a large number of spatially dispersed, petite, battery-operated, embedded devices that are networked to supportively collect, process, and convey data to the users, and it has restricted computing and processing capabilities. Motes are the small computers, which work collectively to form the networks. Motes are energy efficient, multi-functional wireless device [7].

Table 3.1-Differences between WSN and Ad hoc Networks

Parameters	Wireless Sensor Networks	Ad Hoc Networks
Number of nodes	Large	Medium
Deployment	Densely deployed	Scattered
Failure rate	Prone to failures	Very rare
Topology	Changes very quickly	Very rare
Communication paradigm	Broadcast communication	Point to point communication
Battery	Not replaceable	Replaceable
Identifiers	No unique identifier	Unique identifier
Centric	Data centric	Address centric
Fusion	Possible	Not possible
Computational capacities and memory	Limited	Not limited

Data rate	Low	High
Redundancy	High	Low

Wireless sensor nodes are equipped with sensing unit, a processing unit, communication unit and power unit [5]. Each and every node is capable to perform data gathering, sensing, processing and communicating with other nodes. The sensing unit senses the environment, the processing unit computes the confined permutations of the sensed data, and the communication unit performs exchange of processed information among neighboring sensor nodes. The basic building block of a sensor node is shown in Figure 3.1 below.

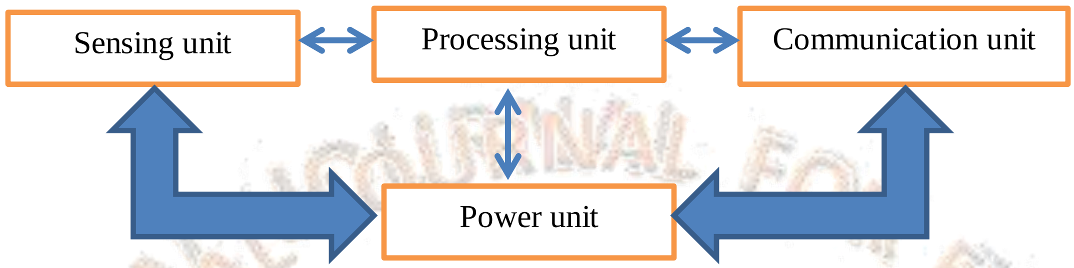


Figure 3.1: Basic building Blocks of Sensor Nodes

3.5-PRIM ALGORITHM:

The algorithm starts with a tree consisting of a single vertex, and continuously in-creases its size one edge at a time. It halts when all the vertices have been reached.

- **Input**: A non-empty connected weighted graph with vertices V and edges E (the weights can be negative).

-- **Initialize**: $V_{new} = \{x\}$, where x is an arbitrary node (starting point) from V, $E_{new} = \{\}$ and Repeat until $V_{new} = V$. Then, choose an edge $\{u, v\}$ with minimal weight such that u is in V_{new} and V is not (if there are multiple edges with the same weight, any of them may be picked). Finally, add V to V_{new}, and $\{u, v\}$ to E_{new}.

- Output: V_{new} and E_{new} describe a minimal spanning Tree.

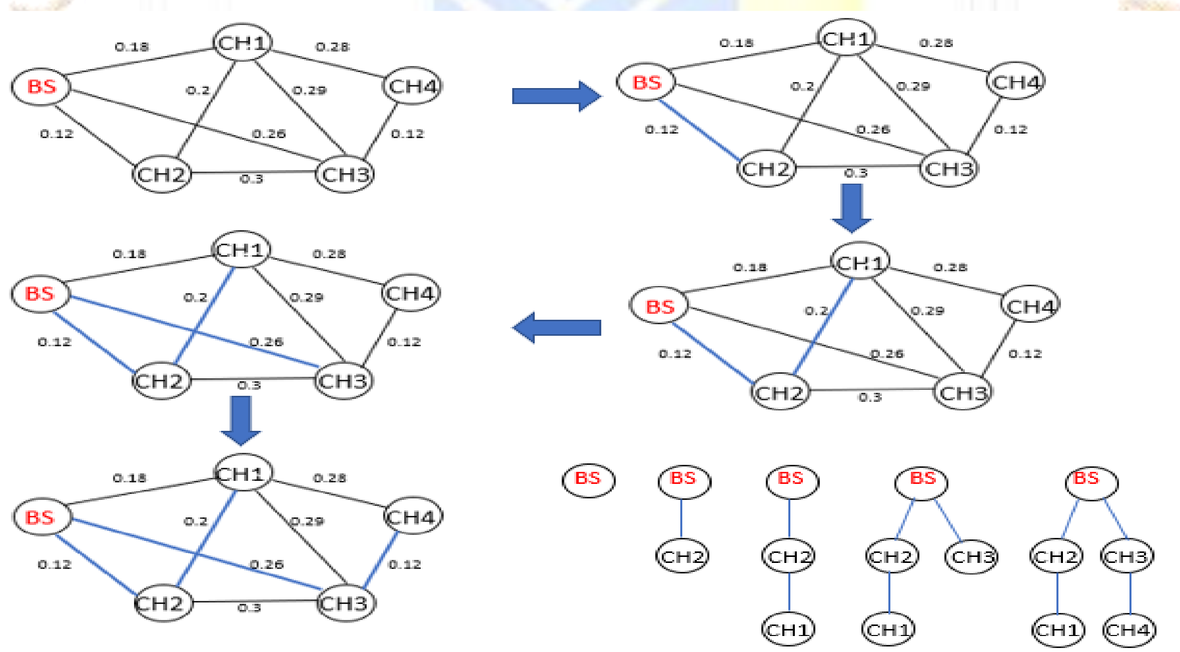


Figure 3.2: Steps of the algorithm

3.6- MODIFIED GENETIC ALGORITHM

Genetic Algorithms(GAs) are adaptive heuristic search algorithms that belong to the larger part of evolutionary algorithms. Genetic algorithms are based on the ideas of natural selection and genetics. These are intelligent exploitation of random search provided with historical data to direct the search into the region of better performance in solution space. They are commonly used to generate high-quality solutions for optimization problems and search problems.

Genetic algorithms simulate the process of natural selection which means those species who can adapt to changes in their environment are able to survive and reproduce and go to next generation. In simple words, they simulate "survival of the fittest" among individual of consecutive generation for solving a problem. Each generation consist of a population of individuals and each individual represents a point in search space and possible solution. Each individual is represented as a string of character/integer/float/bits. This string is analogous to the Chromosome.

3.6.1- Foundation of Genetic Algorithms: Genetic algorithms are based on an analogy with genetic structure and behaviour of chromosomes of the population. Following is the foundation of GAs based on this analogy –

- **Individual in population compete for resources and mate:** Those individuals who are successful (fittest) then mate to create more offspring than others Genes from "fittest" parent propagate throughout the generation, that is sometimes parents create offspring which is better than either parent. Thus each successive generation is more suited for their environment.
- **Search space:** The population of individuals are maintained within search space. Each individual represents a solution in search space for given problem. Each individual is coded as a finite length vector (analogous to chromosome) of components. These variable components are analogous to Genes. Thus a chromosome (individual) is composed of several genes (variable components).
- **Fitness Score:** A Fitness Score is given to each individual which shows the ability of an individual to "compete". The individual having optimal fitness score (or near optimal) are sought.

The GAs maintains the population of n individuals (chromosome/solutions) along with their fitness scores. The individuals having better fitness scores are given more chance to reproduce than others. The individuals with better fitness scores are selected who mate and produce better offspring by combining chromosomes of parents. The population size is static so the room has to be created for new arrivals. So, some individuals die and get replaced by new arrivals eventually creating new generation when all the mating opportunity of the old population is exhausted. It is hoped that over successive generations better solutions will arrive while least fit die.

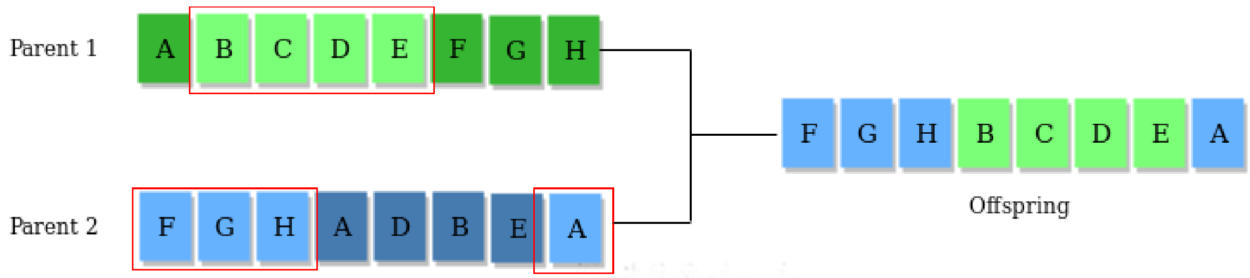
Each new generation has on average more "better genes" than the individual (solution) of previous generations. Thus each new generations have better "partial solutions" than previous generations. Once the offspring produced having no significant difference from offspring produced by previous populations, the population is converged. The algorithm is said to be converged to a set of solutions for the problem.

- **Operators of Genetic Algorithms:**

Once the initial generation is created, the algorithm evolves the generation using following operators –

- Selection Operator: The idea is to give preference to the individuals with good fitness scores and allow them to pass their genes to successive generations.

- Crossover Operator: This represents mating between individuals. Two individuals are selected using selection operator and crossover sites are chosen randomly. Then the genes at these crossover sites are exchanged thus creating a completely new individual (offspring).



- Mutation Operator: The key idea is to insert random genes in offspring to maintain the diversity in the population to avoid premature convergence. For example-

In Artificial Intelligence, Genetic Algorithm is one of the heuristic algorithms. They are used to solve optimization problems. They are inspired by Darwin's Theory of Evolution. They are an intelligent exploitation of a random search. Although randomized, Genetic Algorithms are by no means random.

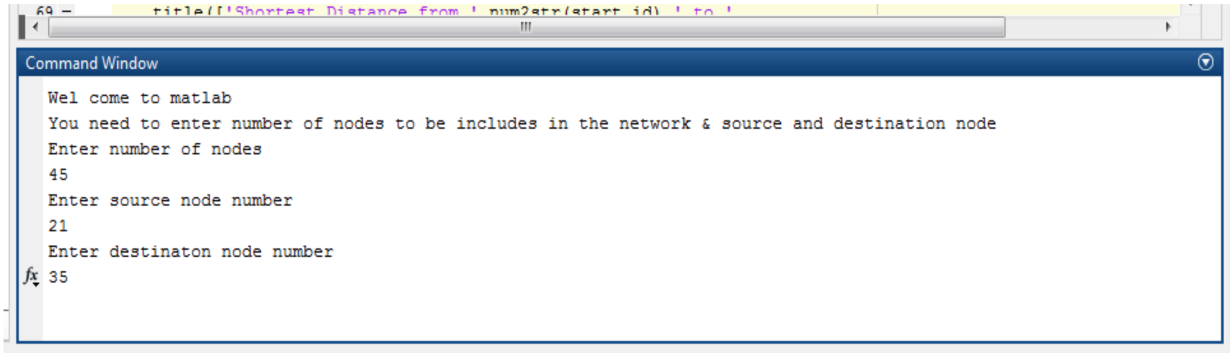
Levy Flights from Coockoo search Algorithm, On the other hand, various studies have shown that flight behaviour of many animals and insects has demonstrated the typical characteristics of L´evy flights. A recent study by Reynolds and Frye shows that fruit flies or Drosophila melanogaster, explore their landscape using a series of straight flight paths punctuated by a sudden 90 degree turn, leading to a L´evy-flight-style intermittent scale free search pattern. Studies on human behaviour such as the hunter-gatherer foraging patterns also show the typical feature of L´evy flights.

4-RESULTS AND DISCUSSION

4.1 SIMUATION RESULTS

As indicated in Implementation flow diagram, in the proposed technique WSN network is created by different number of nodes each time. In run time number of nodes in network to be included, source and destination node numbers are entered from key board. We can check running time of code and optimization performance of Modified Genetic Algorithm. We are going to evaluate the performance of proposed system using different case study.

Case 1: Total number of nodes in WSN-45, Source node 21 and destination node 35.



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Wel come to matlab
You need to enter number of nodes to be includes in the network & source and destination node
Enter number of nodes
45
Enter source node number
21
Enter destinaton node number
35
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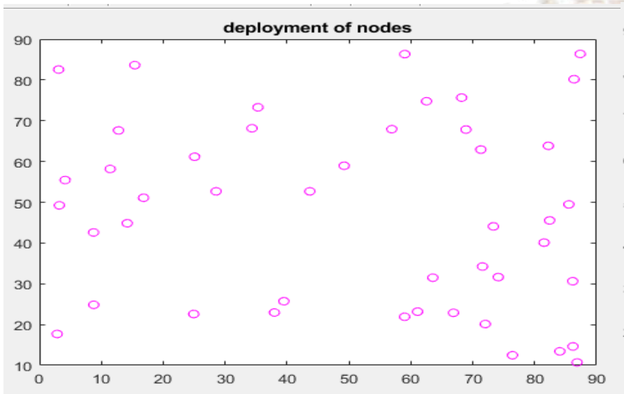

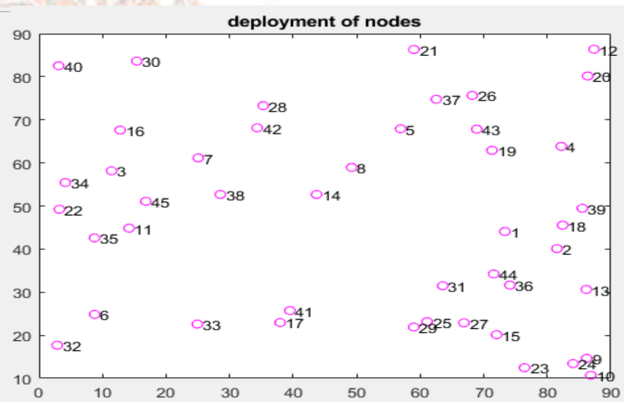

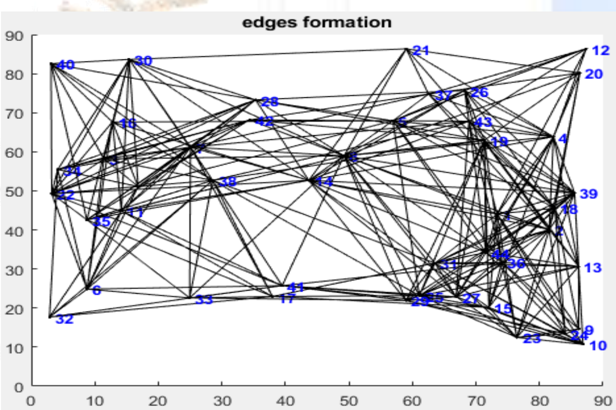

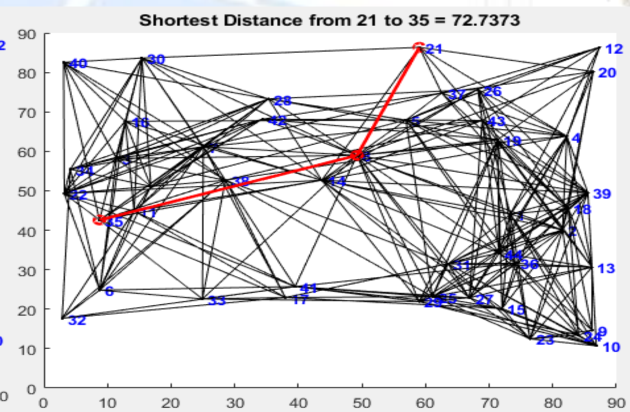

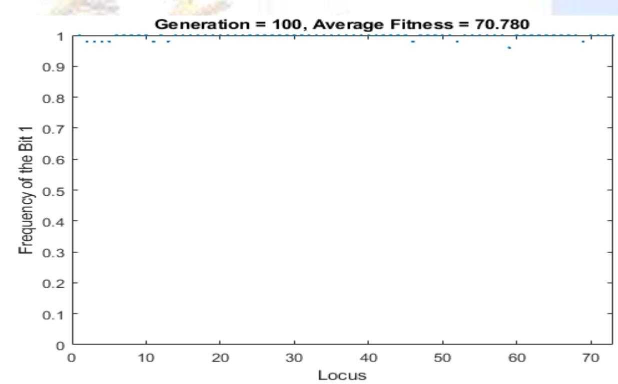

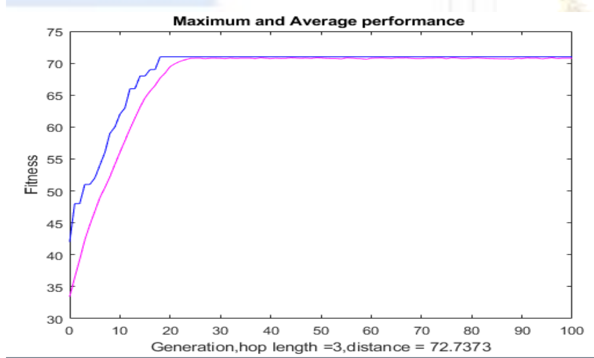

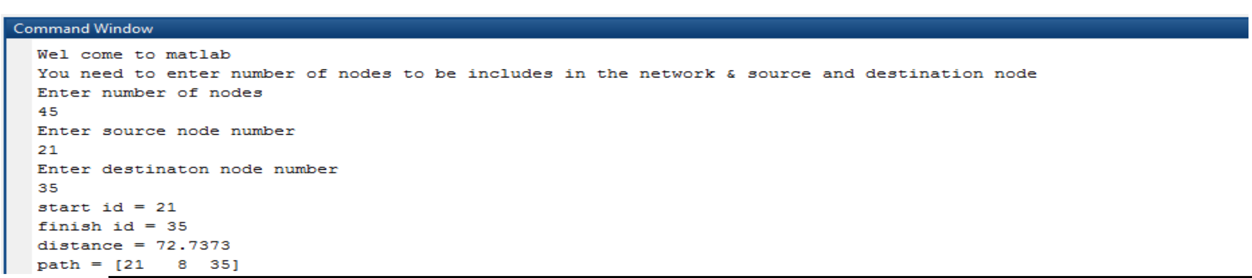

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Wel come to matlab
You need to enter number of nodes to be includes in the network & source and destination node
Enter number of nodes
45
Enter source node number
21
Enter destinaton node number
35
start id = 21
finish id = 35
distance = 72.7373
path = [21    8   35]
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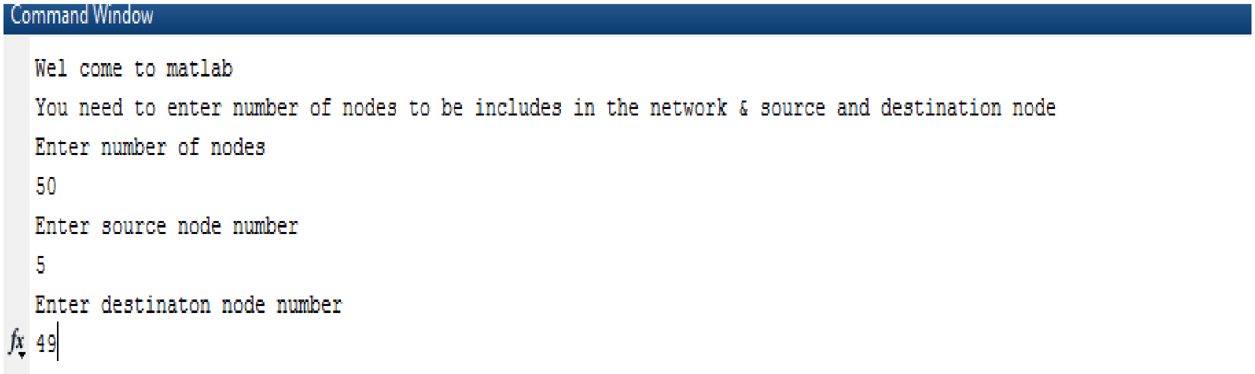
Figure 4.1 (a)-Input network size, source and destination node, (b) deployment of nodes, (c) numbering of nodes, (d) possible routes between nodes, (e) shortest path and (f) MGA fitness curve for case 1.

Case 2: Total number of nodes in WSN-50, Source node 5 and destination node 49.



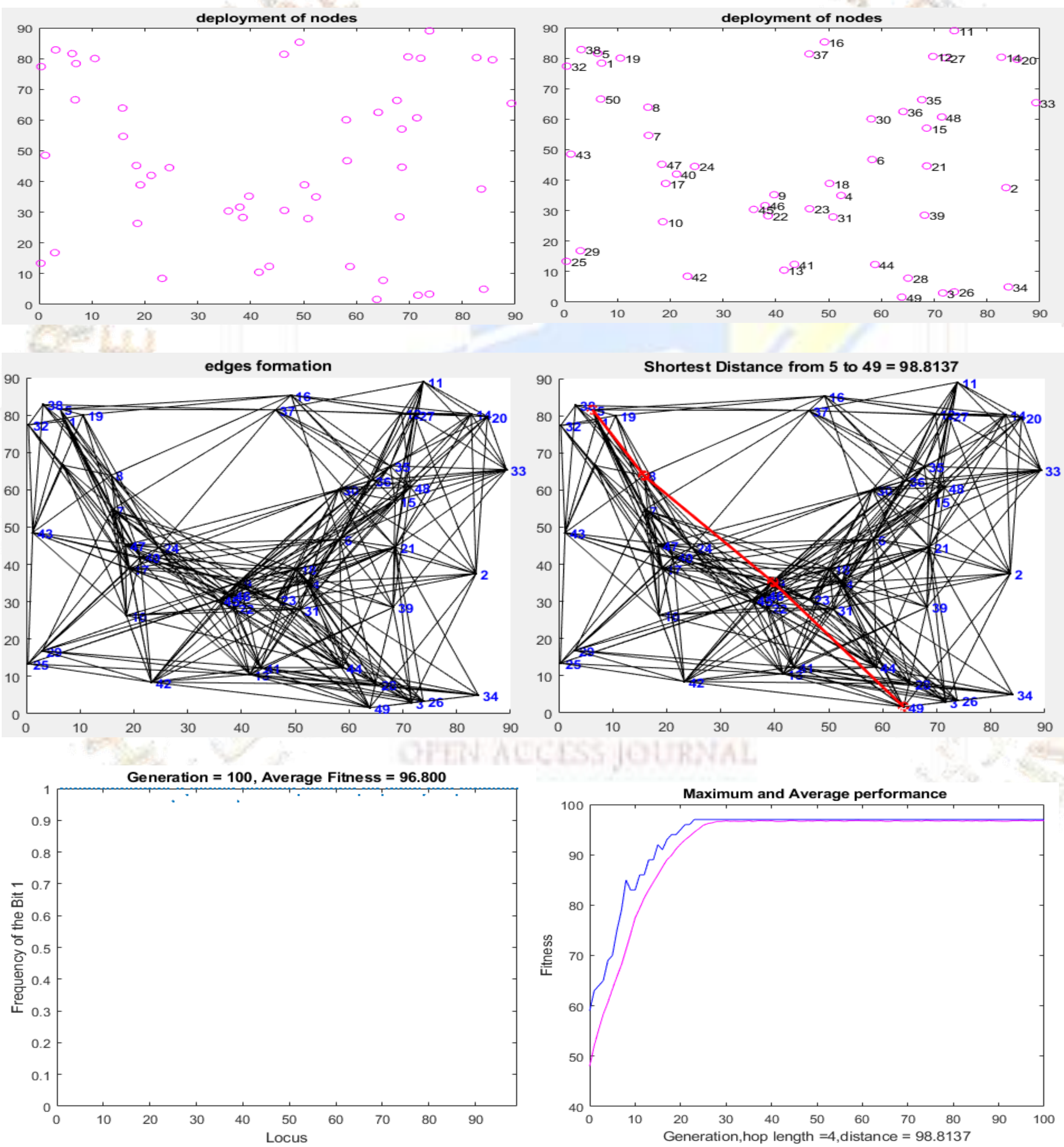
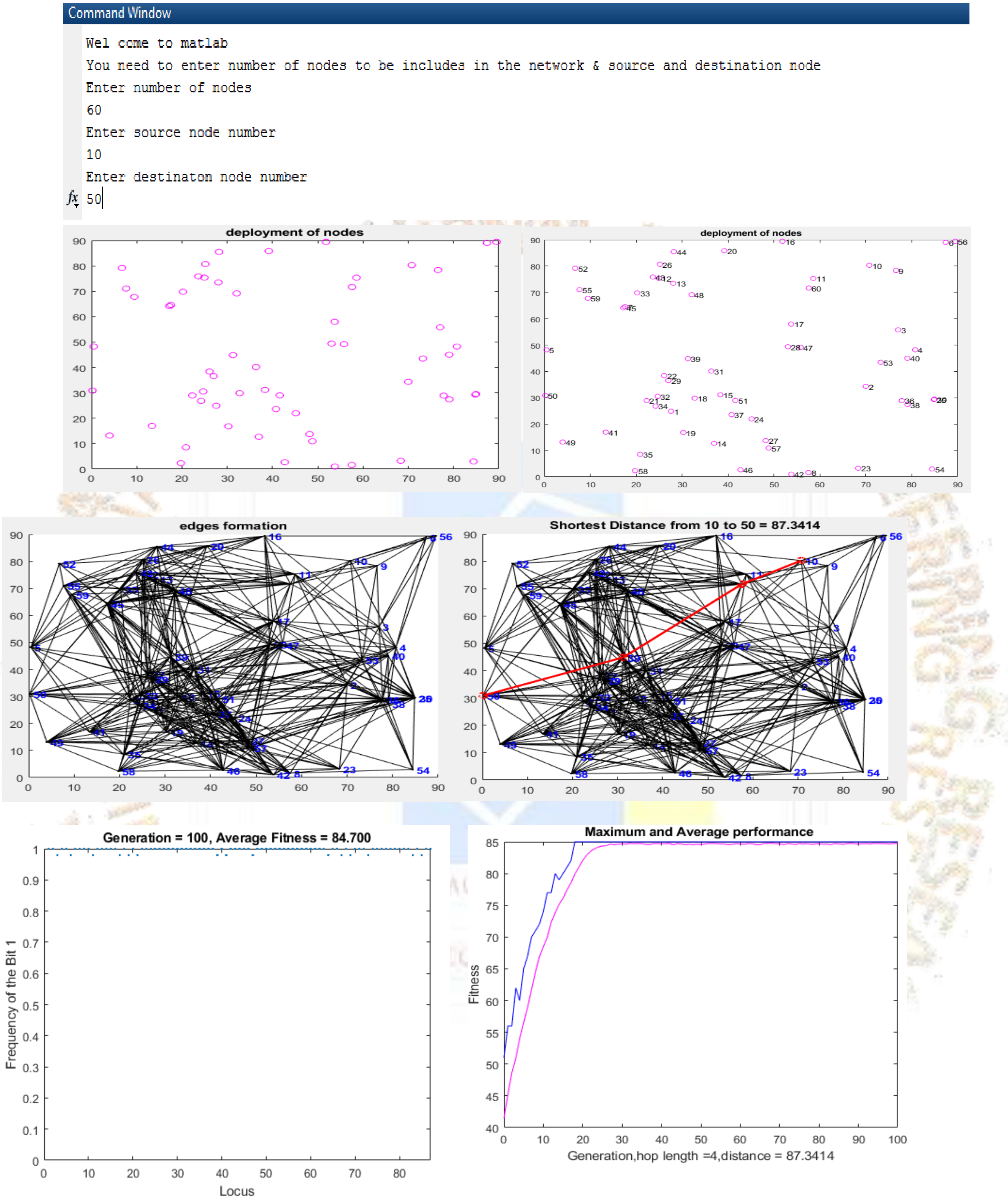
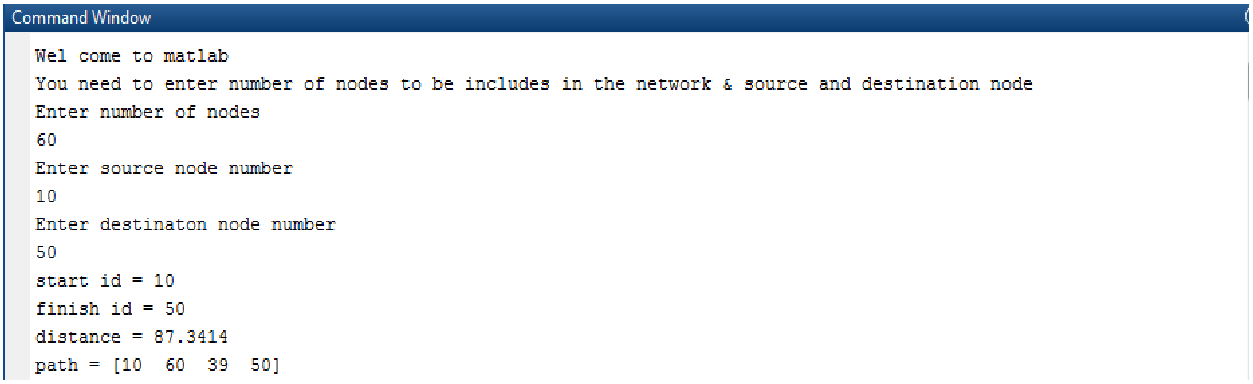


Figure 4.2 (a)-Input network size, source and destination node, (b) deployment of nodes, (c) numbering of nodes, (d) possible routes between nodes, (e) shortest path and (f) MGA fitness curve for case 2.

Case 3: Total number of nodes in WSN-60, Source node 10 and destination node 50.





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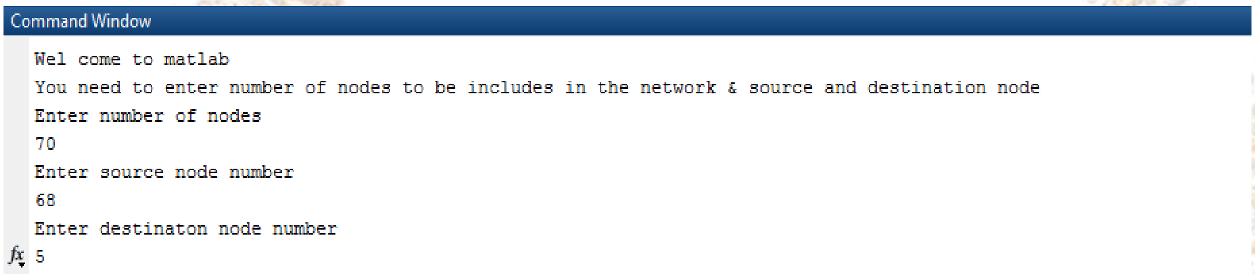
Command Window
Wel come to matlab
You need to enter number of nodes to be includes in the network & source and destination node
Enter number of nodes
60
Enter source node number
10
Enter destinaton node number
50
start id = 10
finish id = 50
distance = 87.3414
path = [10  60  39  50]
```

Figure 4.3 (a)-Input network size, source and destination node, (b) deployment of nodes, (c) numbering of nodes, (d) possible routes between nodes, (e) shortest path and (f) MGA fitness curve for case 3.

Case 4: Total number of nodes in WSN-70, Source node 68 and destination node 5.



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Command Window
Wel come to matlab
You need to enter number of nodes to be includes in the network & source and destination node
Enter number of nodes
70
Enter source node number
68
Enter destinaton node number
fx 5
```
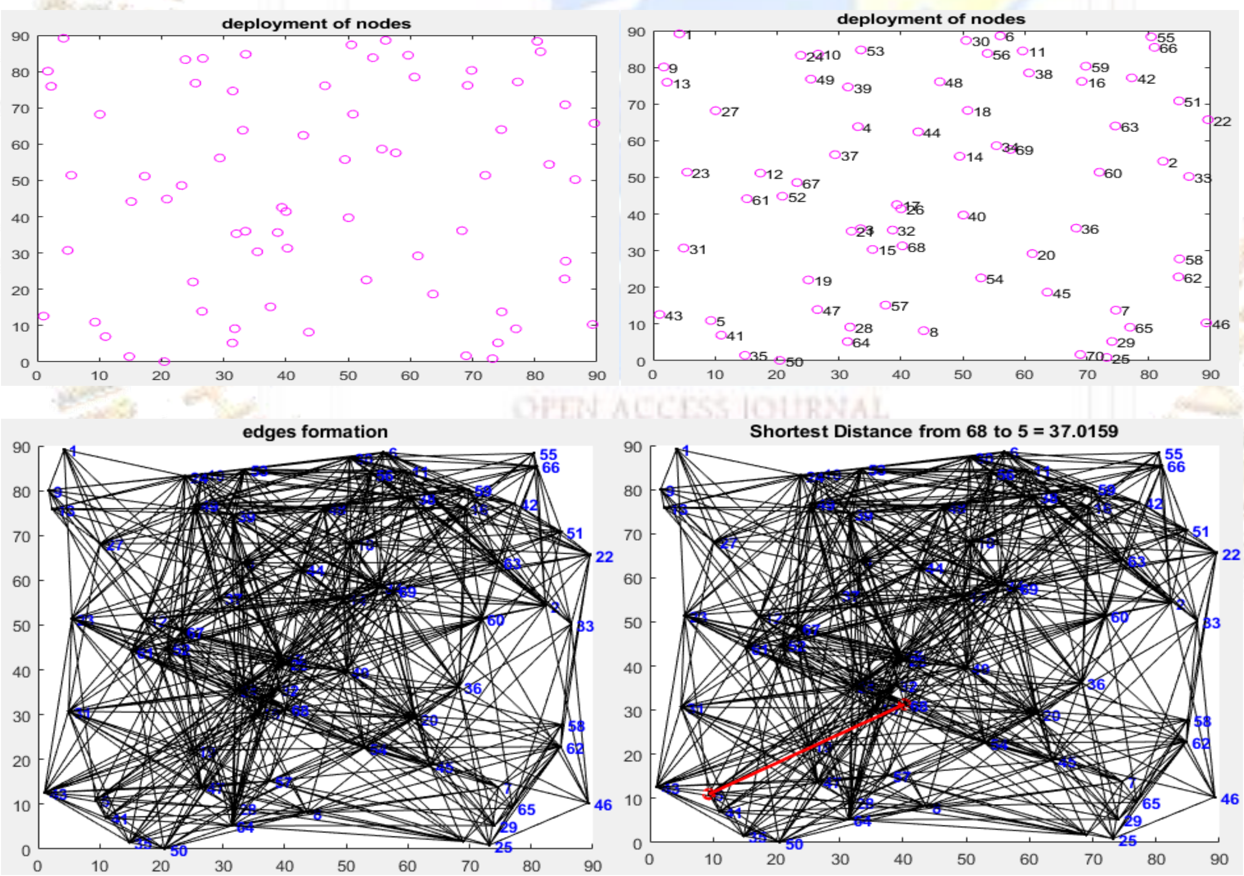



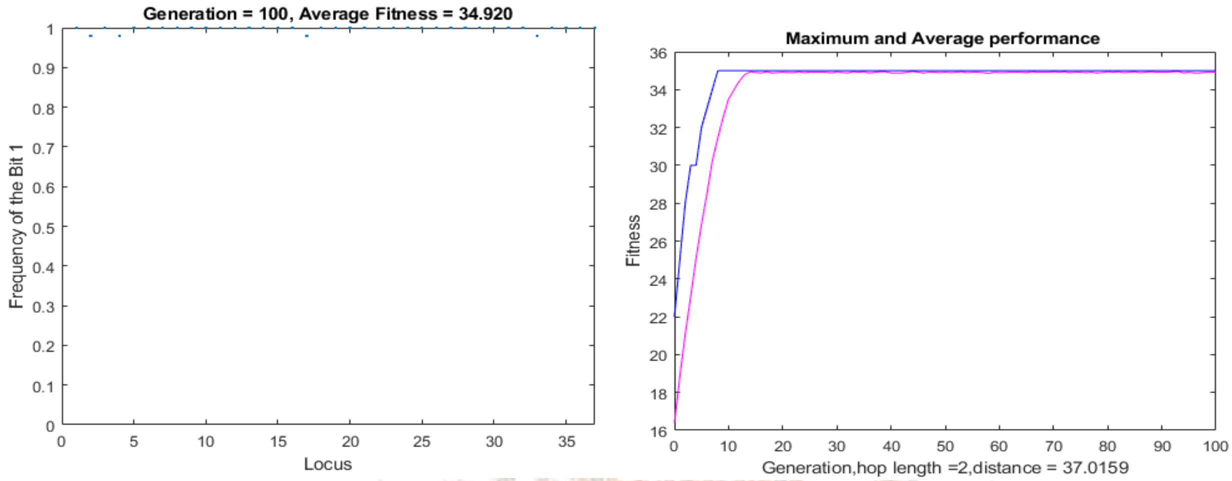
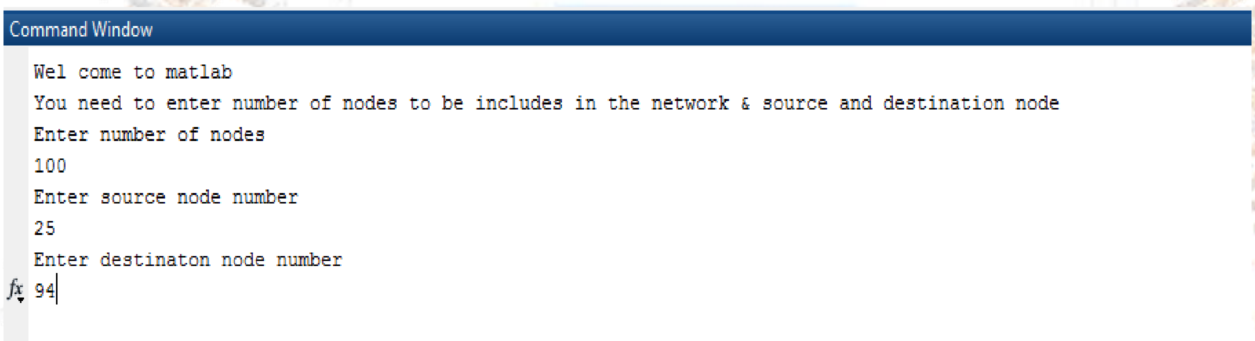
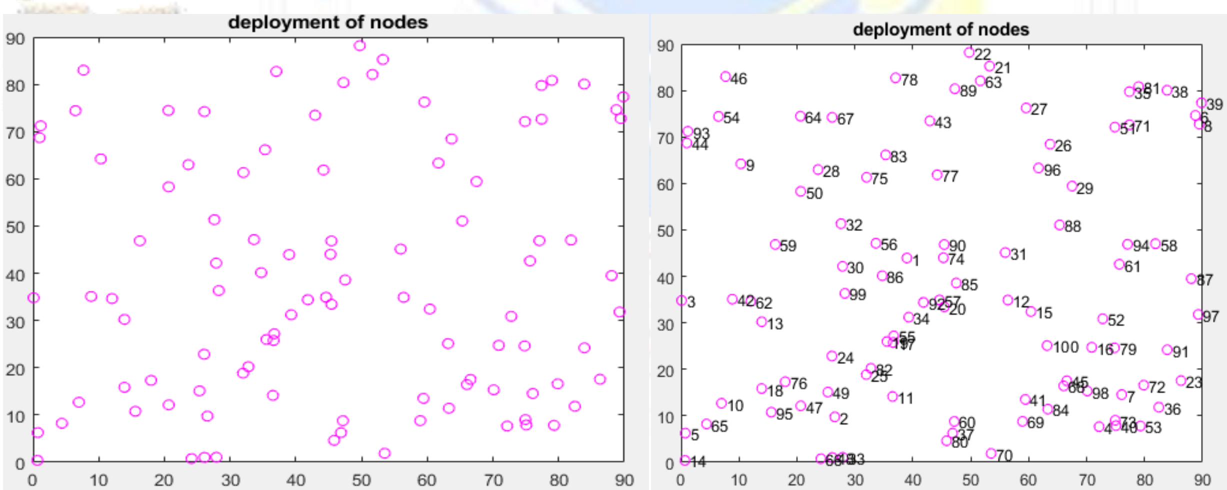
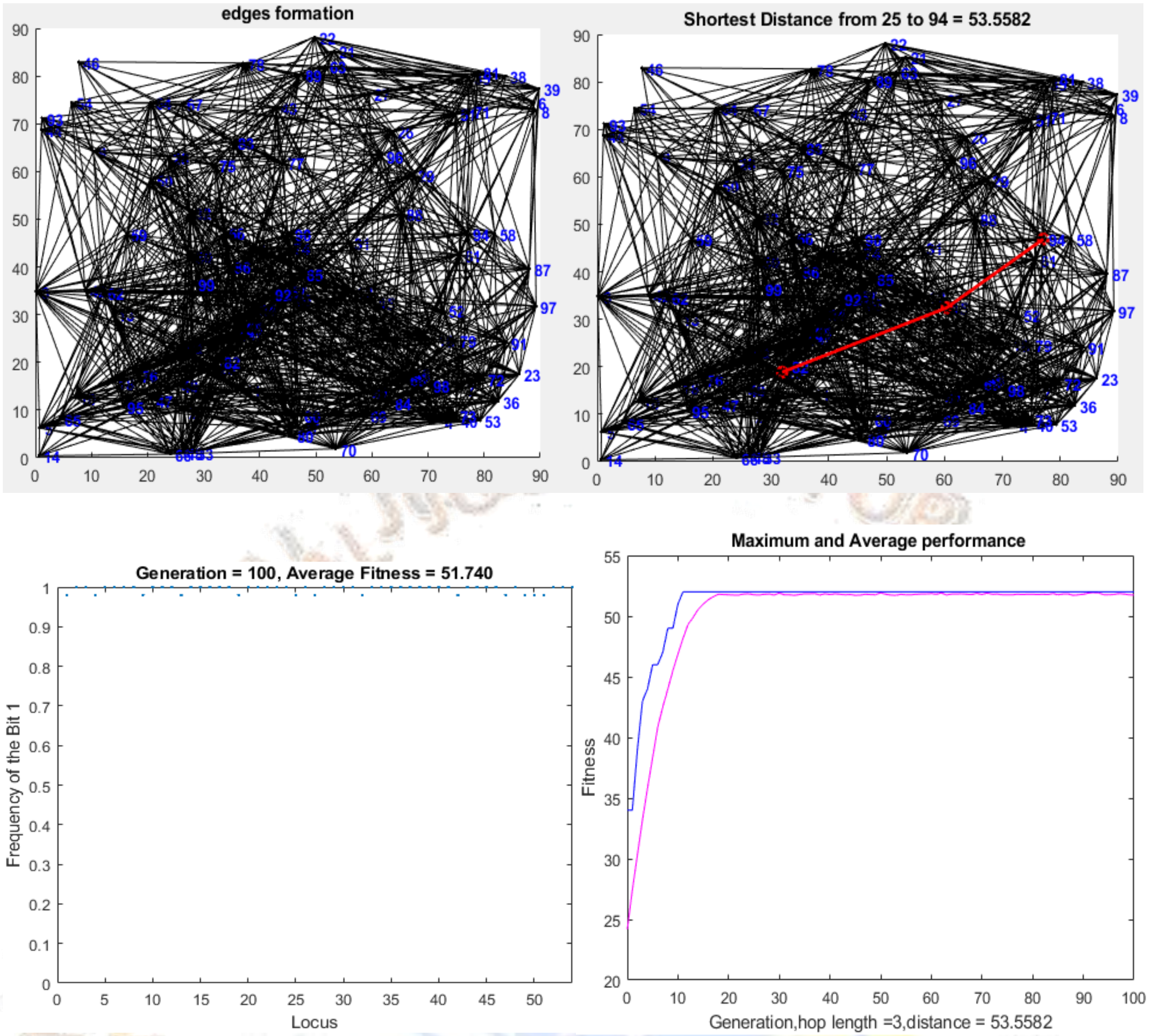


Figure 4.4 (a)-Input network size, source and destination node, (b) deployment of nodes, (c) numbering of nodes, (d) possible routes between nodes, (e) shortest path and (f) MGA fitness curve for case 4.

Case 5: Total number of nodes in WSN-100, Source node 25 and destination node 94.







Command Window

```
You need to enter number of nodes to be includes in the network & source and destination node
Enter number of nodes
100
Enter source node number
25
Enter destinaton node number
94
start id = 25
finish id = 94
distance = 53.5582
path = [25  15  94]
```

Figure 4.5 (a)-Input network size, source and destination node, (b) deployment of nodes, (c) numbering of nodes, (d) possible routes between nodes, (e) shortest path and (f) MGA fitness curve for case 5.

Table 4.1- comparison between different cases

Case 1	Total number of nodes	Source node	Destination nodes	Number of hopes	Distance between nodes
1	45	21	35	3	72.73
2	50	5	49	4	98.81
3	60	10	50	4	87.34
4	70	68	5	2	37.61
5	100	25	94	3	53.55

5- CONCLUSION AND FUTURE SCOPE:

In the proposed methodology, we has employed prims algorithm with genetic optimization algorithm to find shortest path between source and destination nodes with minimum intermediate nodes. In our proposed work, different number of node size networks is initiated with varying source and destination node addresses and distances. We have achieved minimum hop lengths for each operation performed over proposed methodology. In future, an integrated optimization can be employed to enhance the performance of WSN in terms of lifetime and hop length.

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