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# Intelligent Inspiration to Salvage Enery in Ad-hoc Network Using Biological Agent

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## Abstract

The wireless ad-hoc networks are decentralized, the nodes in the network communicated without any pre-established arrangement. One of the main challenging issues in an ad-hoc network is an efficient usage of the energy. The significance of the network is if one node flop due to energy level, then the entire network topology may change. Effective utilization of the nodes energy enhances the network longevity. The proposed paper, define an algorithm which uses the Genetic Algorithm (GA) technique to enhance the network lifetime by finding nominal track between the nodes by implementing a fitness rule with minimal time. Thus the 85% of the routing overhead may reduce by using biological agents.

**Keywords:** ad-hoc, Decentralized, Fitness, Genetic Algorithm, Track

## 1. Introduction

The ad-hoc network, has deployed easily anywhere, anytime due to the dynamic nature of nodes mobility. The nodes in the ad-hoc network are not physically connected because lack of infrastructure facility. It may lead to worst route discovery. These networks are decentralized owing to node mobility, multipath propagation and interference[1]. The ad-hoc network has some concerns like limited transmission range, mobility, security and battery constraints. Maintaining energy levels in an ad-hoc network is an inspiring task. Effectual use of the energy increase the network lifetime[2,3]. The node in the wireless network is furnished with a Network Interface Card. Every node in the wireless communication maintains some energy when it's activated and idle (Table 1). Recent literature survey says, energy preservation may be done in the network layer. The routing protocol in the network layer reduces the overhead and use the limited energy for routing[4,5]. The paper uses the Genetic Algorithm (GA) techniques to diagnose the minimal routing path in the network layer. Genetic Algorithm works faster than other routing algorithm[6,7].

## 2. Genetic Algorithm in Manet

John Holland suggested the Genetic Algorithm (GA) in 1970[6,8,9]. The ad-hoc network adopt the genetic algorithm for penetrating the minimal routing path from origin to destination[10]. Genetic Algorithm is built by the biological neural network. It works according to the fitness rule to improve the presentation of the algorithm[11].

The primary unit of the cell is known as neuron. Neurons define the pathway to transmit the electrical messages between receivers. (Potently it prefers the stimulus. The stimulus may defined as transmission range, power level, etc.). The nucelus is a portion of the cell body. The nucelus handles all the action of the cell. The nucelus contains the DNA, which inform the cell what type of enzymes and hormones to produce and how to perform. In network it suggests how to form and perform in the system depend on the network situation. The cell body is consisting in the neuron. The cell body is a part of a cell, nerve that contains the nucleus, but it does not hold the dendrites. It yields all the proteins. The Dendrites combined with the cell body. Dendrites are consisting the synapse, which is used for signal transferring to another

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**Table 1.** Wireless cards transmission power levels

| Card | Transmit Power Level |
|---|---|
| Cisco ironet 350 | 5,20,30,50,100 mW. |
| Socket Low Power | Max 25 mW. |

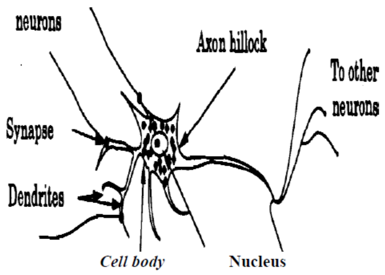


**Figure 1.** Structure of neuron[7].

neuron. The Synapse acts as a transmitter for sending signal to another and another can collect the signal as receiver and send the signal to another as a transmitter and another will receive the signal as a receiver. The features of the GA in ad-hoc networks are,

Robustness - The impairment of nerve cells never disturbs the presentation of the network.

Flexibility - The network structure can adjust automatically without any training.

Collective Search - The genetic algorithm performs searching very effectively when there is a large amount of records.

## 3. Methodology

### 3.1 Network Creation

The ad-hoc network topology is defined by G (V, E), where V is a set of nodes and E is a set of links between nodes. Entire nodes are assigned with a unique identifier among 1 to N, where N = |V|. The energized node in the network is represented by E(u) € V. The path for the node in the network represented by \`h\` hops among two nodes, the set of node represented by ($n_1$, $n_2$, ... $n_h$, $n_{h+1}$). This enhance that the nodes are sending the packet from source to destination by multihop.

### 3.2 Calculating the Weight of Links between Two Nodes

If the distance between two nodes is less than 100 meters, then direct communication between the nodes. Otherwise, multihop communication. The direct communication between the routes minimizes the number of routing paths. Reducing the routing path lead to save the energy of the node in the network. $D_v$ is the sum of weight among the nodes.

$$D_v = \sum \sqrt{((x_2 - x_1))^2 + (y_2 - y_1)^2)}$$

### 3.3 Fitness

The fitness function is based on the problem condition. The fitness function used to calculate the possible solution from the population. This fitness function is executed based on the requirements (nodes energy, delay, throughput). The fitness Function (F) is evaluated and defined by following a formula,

$$F = \begin{cases} 1 & \text{Fesiable Path} \\ \sum_{l=1}^{N} w_i(f_i, f_{i+1}) & \\ 0 & \text{Infesiable Path} \end{cases}$$

Here $w_i(f_i, f_{i+521})$ is the weight between source node ($f_i$) and intermediate node ($f_{i+1}$) in N number of nodes. The fitness value is equal to zero if the path is infeasible.

## 4. Proposed Algorithm

The objective of the proposed algorithm to decrease the energy consumption and establish an optimal path for routing.

**Input:** \`N\` -Number of Nodes.

**Output:** Optimal Route.

**Process:**

Define number of nodes in the network

Find the weight between each node.

- If the weight is less than 100 then fellow direct communication
- Else fellow multi-hop communication.

Apply Genetic Algorithm (GA)

- Establish the fitness value.
- Use the fitness value to find the optimal route.
- Find mutation result.
- Determine the best energy efficient route.
- End.

## 5. System Framework

In ad-hoc environment nodes are initialized in the network. Initially, we have to determine the total nodes in the network. The communication may be either direct or multi hop communication depends on the distance between nodes in the network. Implementing Genetic Algorithm (GA) operator such as fitness to find the optimal energy efficient route.

## 6. Analytical Models of Influential Factors

The performance of the algorithm measured using following parameters.

1) **Delay:** It is proportional to its packet length. $D_t$ is transmission delay, in seconds,

$$D_t = N/R\,,$$

N-Number of bits, R-Rate of transmission.

2) **Hop Count:** To find the number of hops between source and destination in a particular transmission area D using Euclidean Distance (ED),

$$ED = 4^{*} D^{*} \int_0^1\int_0^1 \sqrt{a^2+b^2}\,(1-x)(1-y)\,dx\,dy = 0.52^{*} D$$

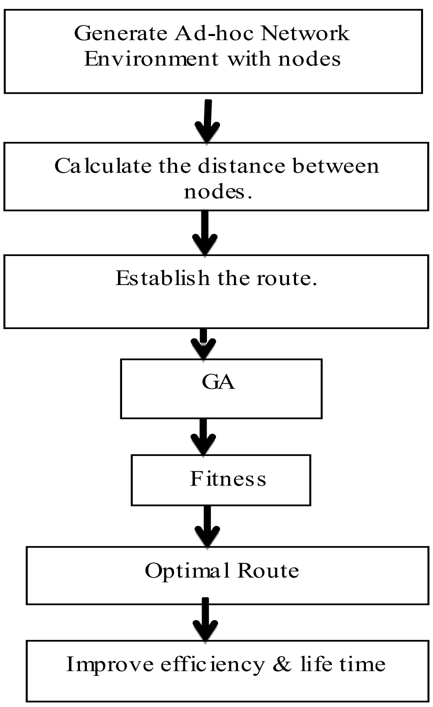


**Figure 2.** System framework.

3) **Throughput**: It defines the number of packets, delivered by intermediate node per second.

$$\text{Throughput} = \frac{\text{number of data received by node}}{\text{time}}.$$

4) **Cost:** It used to find the minimal path to transmit the data through the network.

5) **Consumed Energy**: The average energy expended by a node with respect to the primary energy. It is defined as,

$$\text{Energy Consumption} = \frac{\text{sum of consumed energy}}{\text{number of nodes}}.$$

## 7. Simulation Result

The experimental studies of power management in an ad - hoc network use the genetic algorithm technique to recover the network presentation. The initial population done with 100 nodes with 10% of tournament selection. The node termination state done at $51^{th}$ generation among 1000 possible generation. The Figure 3 validate the maximum throughput of the nodes per second. The Figure 4 demonstrates the node generation and distance between the node to establish the possible communication.

## 8. Conclusion

The development of the ad-hoc network became popular in the pitch of wireless networking. The nature of node mobility has compact the infrastructure cost. Energy maintenance is one of the key challenging issue in ad-hoc network. To increase the network life, an energy preserving algorithm is required. The paper forced on GA technique for self-spreading nodes in an ad-hoc network

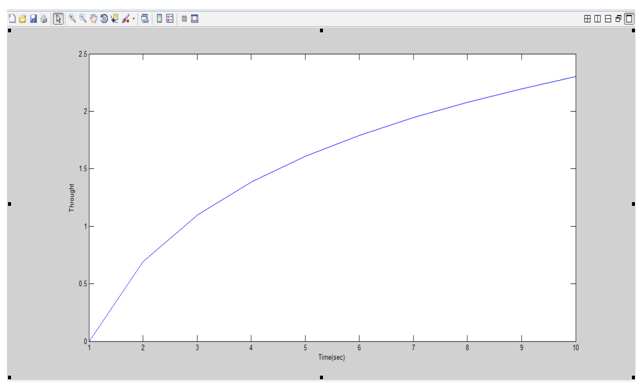


**Figure 3.** Throught Vs Time

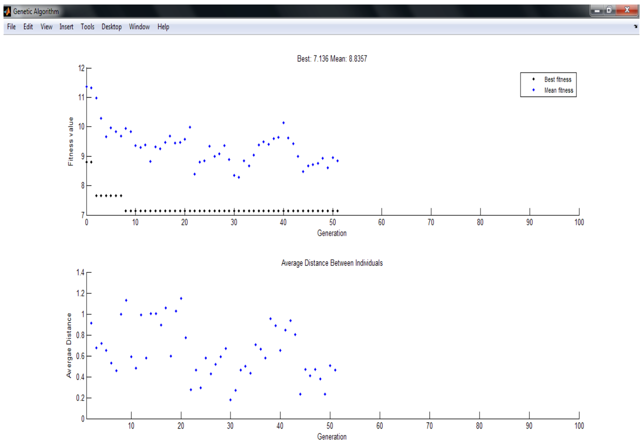


**Figure 4.** Best Fit Vs Distance Between Nodes

to increase the network lifetime. The fitness function allows finding the minimal routing path between source and destination.

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