RESEARCH ARTICLE OPEN ACCESS

Localization Problem Solution Using K-Mean Clustering and Bacterial Foraging Optimization in Wireless Sensor Network

Er. Nisha Devi [1], Er. Harpreet Kaur [2]
Student [1], Assistant professor [2]
Doaba college of Engineering and Technology
Kharar - India

ABSTRACT

Wireless Sensor Networks (WSN) popularity has increased tremendously in recent time due to growth of semiconductor and VLSI technology. WSN has the potentiality to connect the physical world with the virtual world by forming a network of sensor nodes. Here, sensor nodes are usually battery-operated devices, which operate in harsh environment. So, hence energy saving of sensor nodes is a major problem which should be implemented by considering various communication parameters like path loss, attenuation and power received. In Wireless Sensor Networks (WSN) also named Mobile ADHOC network (MANET), the sensors or the mobile transceivers are randomly deployed in the sensor field which brings the problem of coverage for all or some of the nodes. As the coverage problem can increase overall effective distance of all nodes from the sensor which further affects the fitness function which depends upon attenuation, path loss, power received which further effects overall throughput of the system. It is a unique problem and in maximizing coverage, the sensors need to be placed in a position such that the sensing capability of the network is fully utilized to ensure high quality of service. The main objective of the paper is to find optimum location of sensors and find the minimum distance between nodes and sensors. And the value of fitness function should be maximum for nodes and sensors.

Keywords-: *wireless sensor network ; K-mean clustering, BFO, fitness function, comparison*

I. INTRODUCTION

WIRELESS SENSOR NETWORK

A medium of transferring information without wires or cables or can even say without any physical link is termed as wireless communication network. Sensor networks deployed in harsh environment. A large numbers of nodes are brought together to make such a network and every sensor node is equipped with a transducer, microcomputer, transceiver and power source.

LOCALIZATION

In statically deployed networks, node position can be determined once during initialization. However, those nodes that are mobile must continuously obtain their position as they traverse the sensing region. Localization is an essential tool for the deployment of low-cost sensor networks for use in location-aware applications and ubiquitous networking. In a typical sensor network application each sensor node monitors and gathers local information. This problem of localization of sensor node can be solved by implementing K-mean clustering and bacterial foraging optimization by considering the distance along with pathloss, attenuation, and power received in a network of nodes.

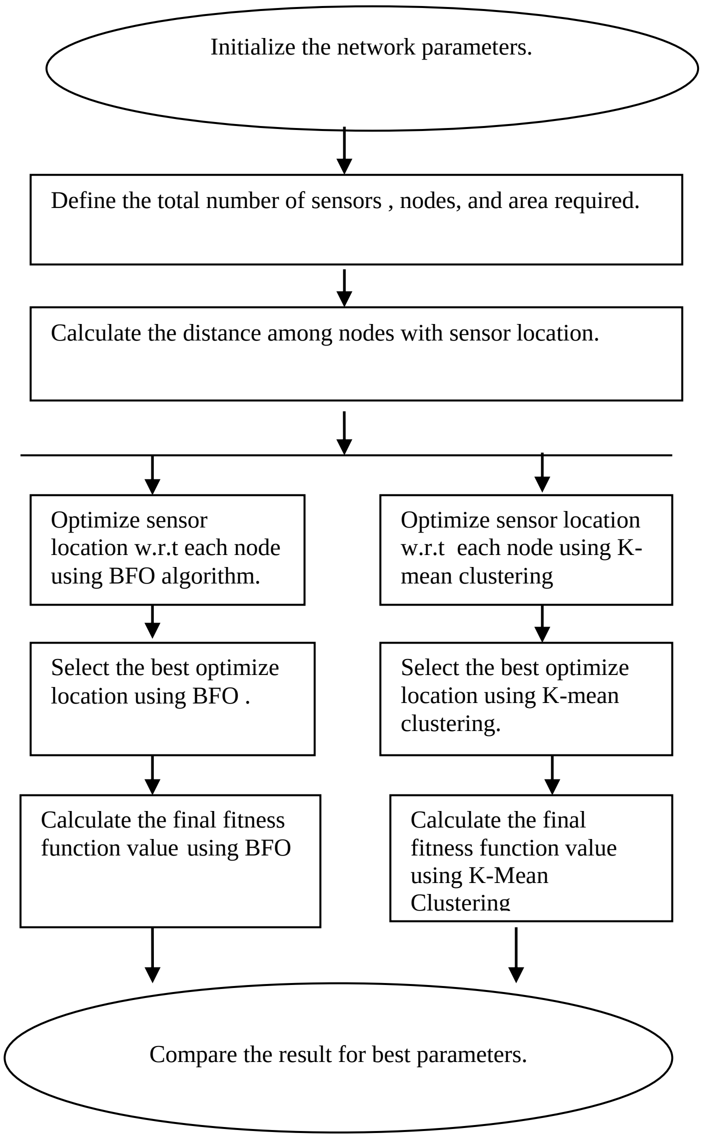
II. DESIGN OF PROPOSED SYSTEM

Step 1: Initialize the network parameters.
Step 2: Define the number of sensors, nodes, coverage area .
Step 3: Calculate the distance among nodes with sensor nodes
Step4: Optimization of sensor locations with each node using K-mean clustering and BFO.
Step 5: Select the best optimized location determined by K-mean clustering and BFO.
Step6: Calculate the final fitness function value which include distance and parameters value with K-mean clustering and BFO.
Step 7 : Calculation of parameters

In mathematics, the **Euclidean distance** or **Euclidean metric** is the "ordinary" distance between two points that one would measure with a ruler, and is given by the Pythagorean formula. By using this formula as distance, Euclidean space becomes a metric space. The associated norm is called the **Euclidean norm.**

Step 8: Comparative analysis.

\



flow chart of localization problem solution using k-mean clustering and bfo

III. K-MEAN CLUSTERING

***k*-means clustering** is a method of vector quantization, originally from signal processing, that is popular for cluster analysis in data mining. *k*-means clustering aims to partition *n* observations into *k* clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. The cluster heads are formed by determining the Euclidean distance from each node.

3.1 EUCLIDEAN DISTANCE

$$Euclidean\ distance = \sqrt{(x1 - x2)^2 + (y1 - y2)^2}$$

Where x1, x2, y1, y2 are the coordinates of sensor node and normal node

3.2 Pathloss

Pathloss describes the loss of energy strength of signal as it travellers to the receiver.

path_loss(u,v)=69.55+(26.16*log10(freq))-(13.82*log10(h_trans))-(3.2*(log10(11.75*h_rec)))+(44.9-6.55*log10(h_trans)*dist(u,v))

Where,
h_trans=height of transmitter
h_rec= height of receiver

3.3 Attenuation

Attenuation is a result of long distance transmission of signal. It is loss in the strength of signal with time.

Attenuation (u, v) = (42.6+20*log10(840)+26*log10(dist(u,v)))

3.4 Received power

It is the total amount of power received by the receiver.
power(u,v)=(10*log10(trans_power))-abs(path_loss(u,v)

Where,
trans_power= transmitted power
abs(pathloss)= absolute value of pathloss

IV. BACTERIAL FORAGING OPTIMIZATION

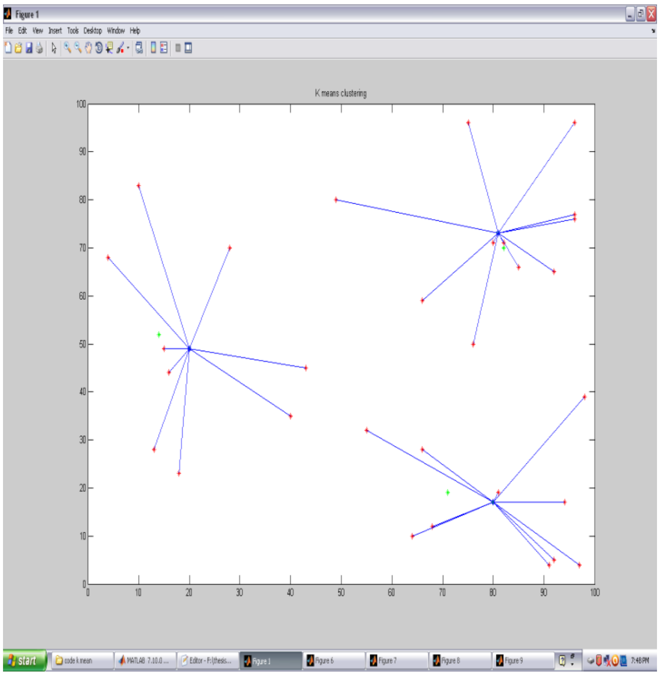
[Step 1] Initialize parameters *p, S,* N_c, N_s, N_{re}, N_{ed}, P_{ed}, *C(i)(i=1,2…S)*,$_i$ θ .
[Step 2] Elimination-dispersal loop: *l*=*l*+1
[Step 3] Reproduction loop: *k*=*k*+1
[Step 4] Chemotaxis loop: *j*=*j*+1
[Step 5] If $j < N_c$, go to step 4. In this case continue chemotaxis since the life of the bacteria is not over.
[**Step 6**] Reproduction
[**Step 7**] If $_{re}$ $k < N$, go to step 3. In this case, we have not reached the number of specified reproduction steps, so we start the next generation of the chemotactic loop.
[**Step 8**] Elimination-dispersal.

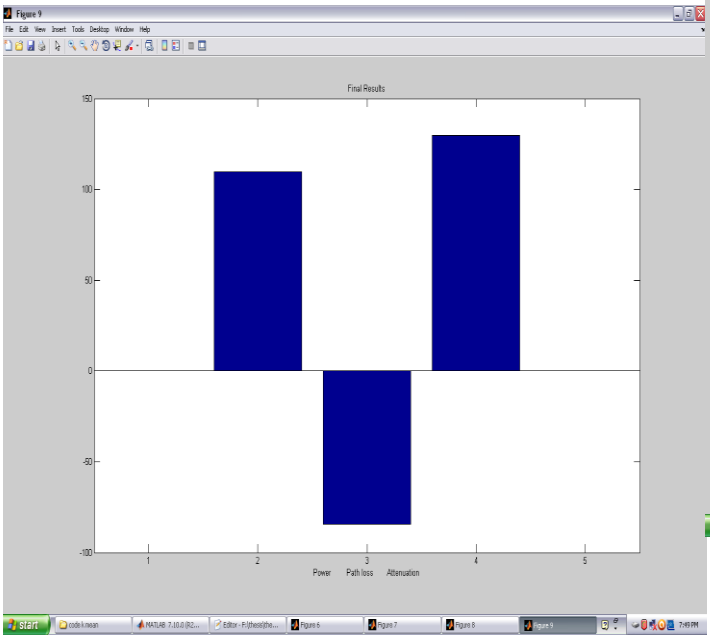
V. EXPERIMENTS AND RESULTS

We present an implementation of two different techniques algorithm as one form clustering and other of swarm intelligence and a comparison is also evaluated to show the best results among all.

Here minimum numbers of nodes are to ultize to cover a large area of network and to find the location of sensor in the coverage area. We implement a task in which we need to identify the exact location of sensor in overall area with help of **BFO** algorithm and then to determine the distance among all the nodes with each other and sensor also. Results at the end are compared to the **K- Mean Clustering** technique' results and a better one is established.

5.1. Performed with K-Mean Clustering





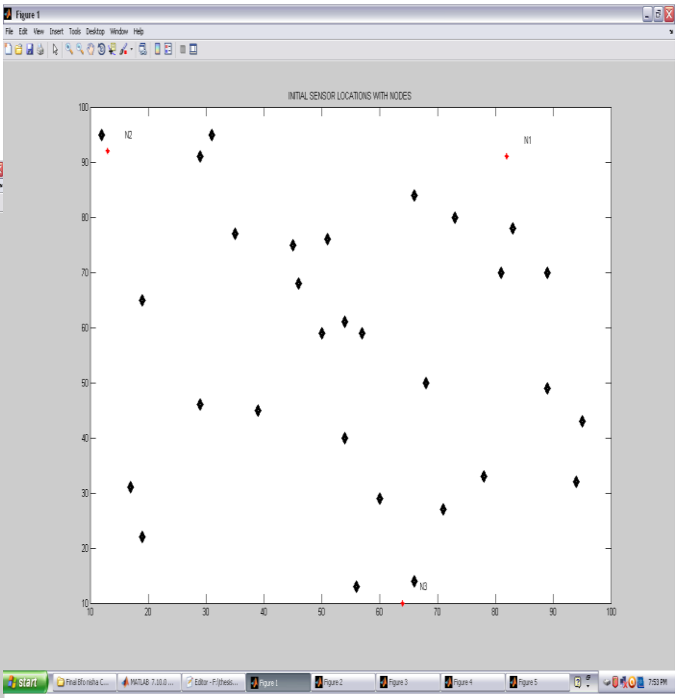
PARAMETERS	K-MEAN CLUSTERING
NO. OF SENSOR NODES	30
NO. OF CLUSTER HEADS	3
FINAL RECEIVED POWER	109.6783
FINAL PATHLOSS	-84.4990
FINAL ATTENUATION	129.7530

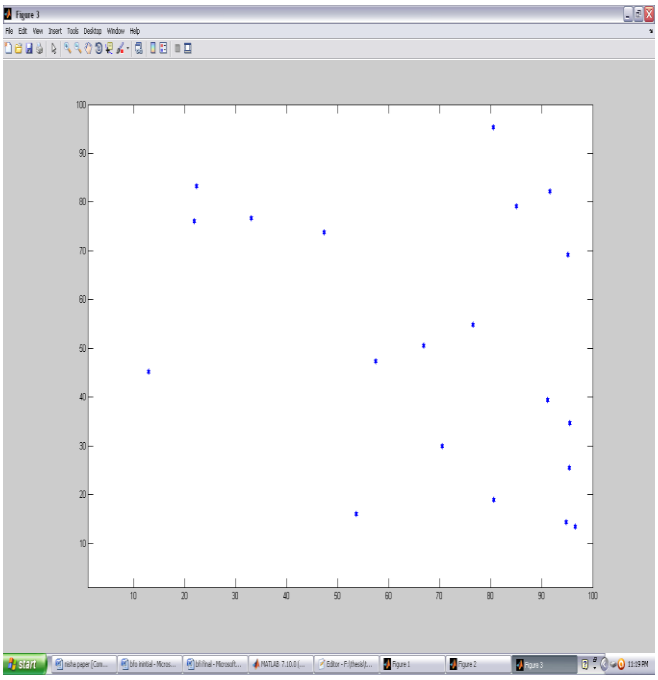
Table 5.1

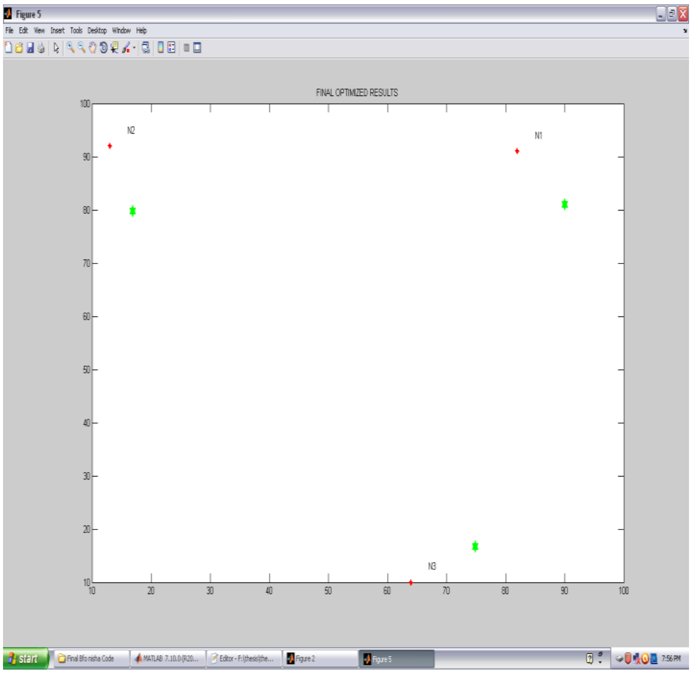
5.2 Performed with BFO Algorithm

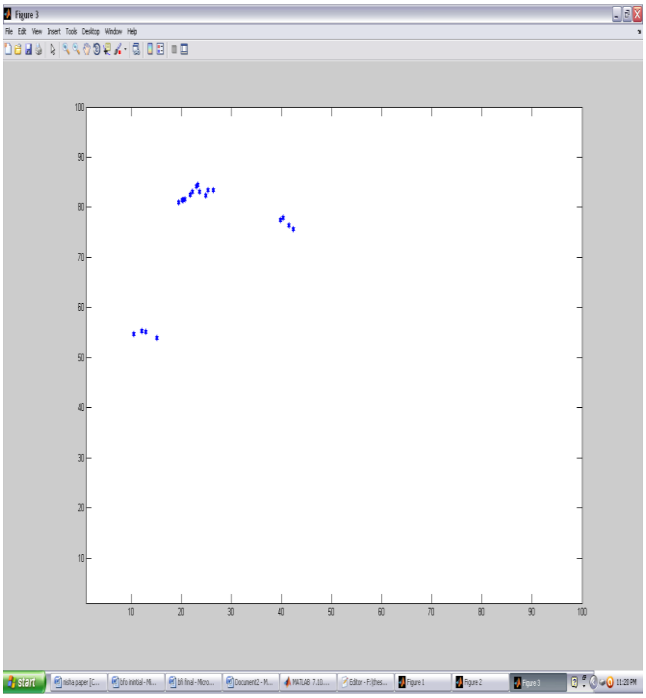
PARAMETERS	BFO ALGORITHM
NO. OF SENSOR NODES	30
NO. OF CLUSTER HEADS	3
FINAL RECEIVED POWER	218
FINAL PATHLOSS	-139
FINAL ATTENUATION	102

Table 5.2









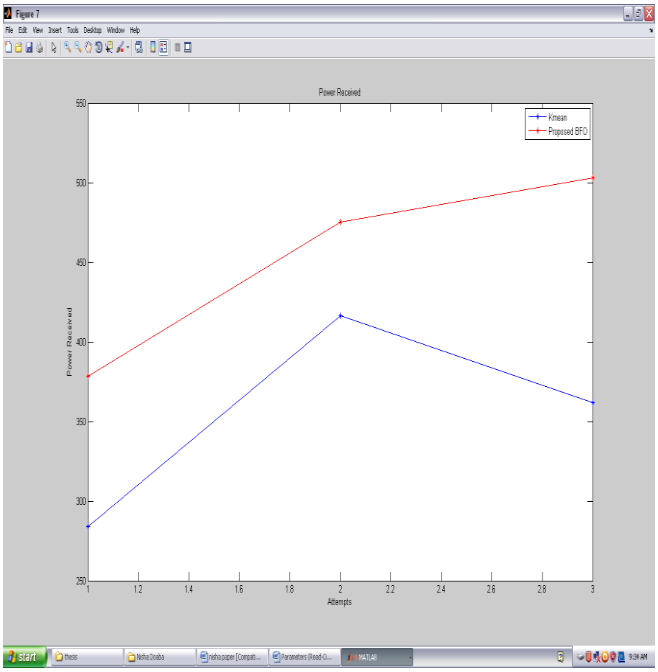
5.3 COMPARISON

We compare the two algorithms on the basis of three parameters like received power, pathloss, attenuation with distance. **That shows that BFO has better results than K-Mean Clustering.**

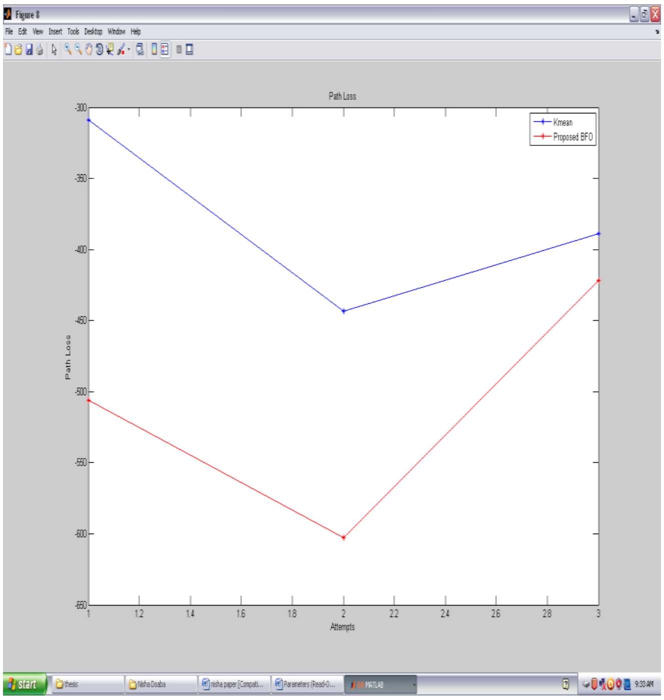
Parameters	Kmean Clustering	Proposed BFO
Power	283.9246 416.4617 361.7834	378.564 475.278 503.11
Path - loss	-309.0008 -443.4617 -388.7834	-506 -603 -422
Attenuation	134 136.24 142.1	124.45 116.12 102

Table 5.3

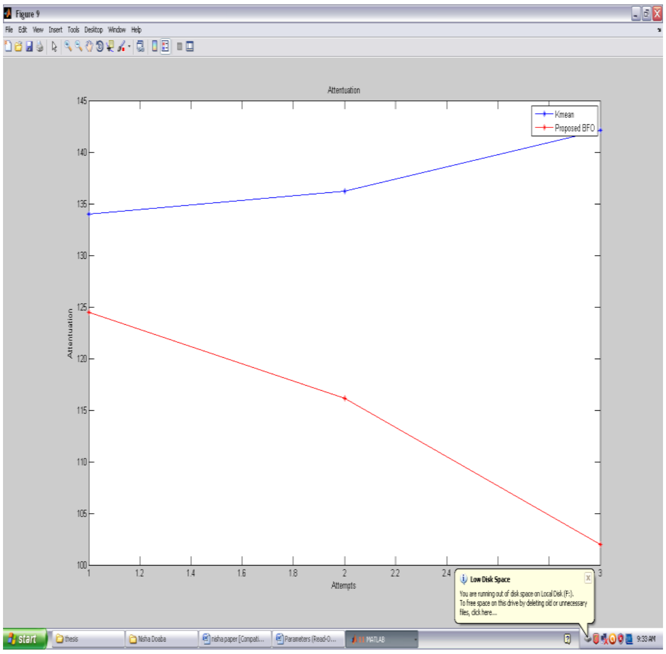
POWER RECEIVED- figure show that power received of BFO is more as compared to K-Mean Clustering.



PATH LOSS- figure show that pathloss K-Mean Clustering is more as compared to BFO.



ATTENUATION- figure show that K-Mean Clustering has more attenuation as compared to BFO.



VI. CONCLUSION AND FUTURE SCOPE

The paper presents the implementation and comparitive analysis of K-Mean Clustering and BFO.This approach is to determine a new and efficient technique to evaluate the best optimized location of the sensor in the network based of distance. BFO is effective and efficient in solving the optimization sensor location problem in coverage area. It is implemented to avoid the numbers of searches made to get the best location and a comparative analysis shows that proposed algorithm is best in identify the location as a minimum number of iteration used. In this paper three parameters power received, attenuation and path loss is determined with distance. Results of these parameters show that BFO is best. In the future more work can be done to find the efficiency and to improve the fitness function. Furthermore, it can be implemented with genetic algorithms and other optimization methods.

REFERENCES

[1] G. Kavitha(2014) Foraging Optimization For Cluster Head Selection, Wireless sensor networks (WSN) are popular as they are potentially low cost solutions to various realworld challenges

[2] Florian Klingler_ y,; (2013) _Department of Computing, Hong Kong Polytechnic University,Faster Distributed Localization of Large Numbers of Nodes Using Clustering.

[3] Almuzaini, K.K. ; (2012) Dept. of Electr. & Comput. Eng., Univ. of Victoria, Victoria, BC, Canada ; Gulliver, T.A., Localization in Wireless

Networks Using Decision Trees and K-Means Clustering.

[4] Drew Schmitt, Nicholas McCoy (2011), Object Classi_cation and Localization Using SURF Descriptors

[5] Byoung-gi Lee ; (2010) Korea Inst. of Sci. & Technol., Seoul, South Korea ; JongSuk ChoiMulti-source sound localization using the competitive k-means clustering

[6] Hu Yu Lan (2010) A multidimensional scaling localization algorithm based on bacterial foraging optimization

[7] A.Pal ;(2010)"Wireless Sensor Networks Current Approaches and Future Challenges" Network Protocols and Algorithms ISSN 1943-3581, Vol. 2.

[8] J. Y. Yu and P. H. J. Chong, "A survey of clustering schemes for mobile ad hoc networks," *Communication Surveys and Tutorials,IEEE*, vol. 7, no. 1, pp. 32-48.

[9] A.W. Krings Z. (Sam) Ma, "Bio-Inspired Computing and Communication in Wireless Ad Hoc and Sensor Networks," *Ad Hoc Networks,Elsevier*, vol. 7, no. 4, pp. 742-755 , June 2009..

10] B. Atakan, O.B. Akan, and Tuna Tugcu, "Bio-inspired Communications in Wireless," in *Guide to Wireless Sensor Networks*.: Springer-Verlag London Limited, 2009, ch. 26, pp. 659-687.

[11] M. Chatterjee, S. K. Das and D. Turgut, "WCA: A Weighted Clustering Algorithm for Mobile Ad Hoc Networks," *Cluster computing,Springer Netherlands*, vol. 5, pp. 193-204, April 2002 IEEE Transactions on Industry Applications, vol. 1

[12] Aruna, Vikas Gupta,‖*Soft Computing Implementation for Mobile Ad-hocNetwork Optimization using Bacterial ForagingOptimization Algorithm,"* International Journal of Computer Science and Communication Engineering Volume 2 .