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IMPLEMENTATION AND RESULTS OF NODE CLUSTERING AND OBJECT TRACKING PROCESSES OF BFOA IN WSN

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Abstract: *In computer terminology science wireless sensor networks are an active research area with frequent workshops and conferences arranged each year. A wireless sensor network (WSN) consists of spatially disseminated autonomous sensors to monitor environmental or physical conditions, such as sound, temperature, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity [1]. The growth of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on [2].Here we have worked on object tracking algorithm and it should be designed in such a way that it result in good quality tracking with low energy consumption. The good quality tracking extends the network lifetime and achieves a high accuracy. In order to obtain an energy efficient tracking with low energy consumption, an assumption is made that all the sensor nodes have same energy level. Because, even if a sensor node fails, other sensor node can take the responsibility and carry out the tracking process. To obtain good quality in object tracking I have BFO algorithm and it is implemented using MAT lab 12.0.*

KEYWORDS: *WSN, BFOA, RSSI.*

INTRODUCTION

Wireless sensor network (WSN) is most often set up in an ad hoc mode by means of small-size identical devices grouped into network nodes distributed densely over a significant area. These devices, each equipped with central processing unit (CPU), battery, sensor and radio transceiver networked through wireless links provide unparalleled possibilities for collection and transmission of data and can be used for monitoring and controlling environment, cities, homes, etc [3]. In most cases WSNs are stationary or quasi-stationary, while node mobility can be ignored. There is no prearrangement assumption about specific role each node should perform. Each node makes its decision separately, based on the situation in the deployment region, and its knowledge about the network. In the case of networks comprising several hundreds or thousands of nodes, it is necessary to choose an architecture and technology which will enable relatively cheap production of individual devices [4]. For this reason, WSNs need some special treatment as they have unavoidable limitations, for example, limited amount of power at their disposal. Each battery powered device, participating in WSN needs to manage its power in order to perform its duties as long, and as effective as possible. Wireless sensors are thus characterized by low processing speed, limited memory and communication range [5].WSN is used in medical applications, military purposes, disaster area monitoring etc. The flexibility of wireless sensor networks comes with a series of challenges. Since wireless sensors are not physically connected to any central source they are completely dependent on their battery to operate; also wireless sensors positions are not determined prior to the network deployment, thus sensors should be able to operate in a way that can automatically generate an optimum routing path and deliver the sensed information back to the base-station.

ARCHITECTURE

The basic architecture of a WSN node is presented in Figure 1. It has four basic components: a sensing unit, a processing unit, a transceiver unit and a power unit. There can be application dependent additional components such as a location finding system, a power generator and a mobilize.

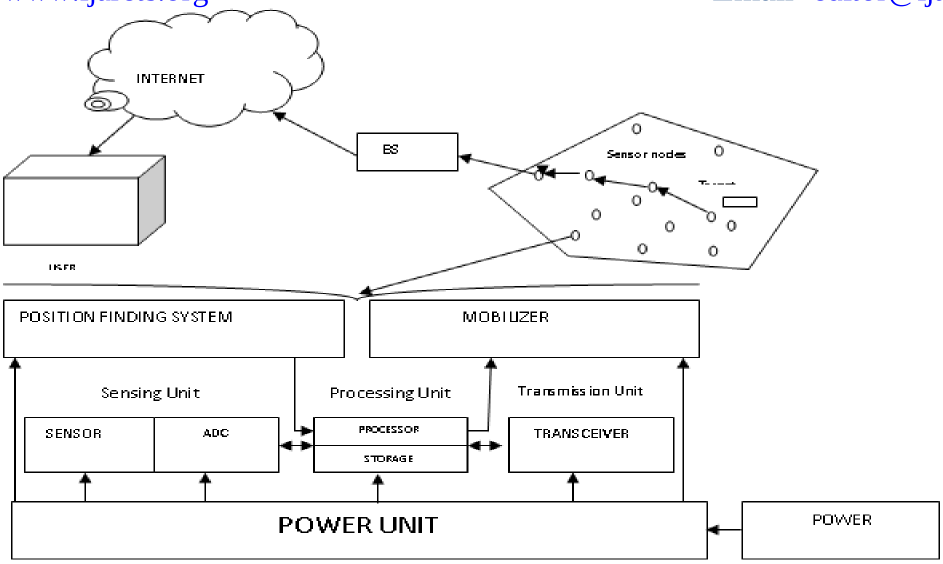

Figure 1: Architecture of a Wireless Sensor Node

(a) Sensing Unit: Sensing units are usually composed of two subunits: sensors and analog to digital converters (ADCs). Sensor is a device which is used to translate physical phenomena to electrical signals. There exists a variety of sensors that measure environmental parameters such as temperature, light intensity, sound, magnetic fields, image, etc. The analog signals produced by the sensors based on the observed phenomenon are converted to digital signals by the ADC and then fed into the processing unit.

(b) Processing Unit: The processing unit mainly provides intelligence to the sensor node. The processing unit consists of a microprocessor, which is responsible for control of the sensors, execution of communication protocols and signal processing algorithms on the gathered sensor data.

(c) Transceiver Unit: The radio enables wireless communication with neighboring nodes and the outside world. It consists of a short range radio which usually has single channel at low data rate and operates at unlicensed bands of 868-870 MHz (Europe), 902-928 MHz (USA) or near 2.4 GHz (global ISM band). At transmitted power levels of -10dBm and below, a majority of the transmit mode power is dissipated in the circuitry and not radiated from the antenna. However, at high transmit levels (over 0dBm) the active current drown by the transmitter is high [6]. Similar to microcontrollers, transceivers can operate in Transmit, Receive, Idle and Sleep modes. An important observation in the case of most radios is that, operating in idle mode results in significantly high power consumption, almost equal to the power consumed in the Receive mode. Thus, it is important to completely shut down the radio rather than set it in the idle mode when it is not transmitting or receiving due to the high power consumed

(d) Battery: The battery supplies power to the complete sensor node. It plays a vital role in determining sensor node lifetime. The amount of power drawn from a battery should be carefully monitored. Sensor nodes are generally small, light and cheap, the size of the battery is limited. Furthermore, sensors must have a lifetime of months to years, since battery replacement is not an option for networks with thousands of physically embedded nodes. This causes energy consumption to be the most important factor in determining sensor node lifetime.

REVIEW OF LITERATURE

Vipul Sharma et al. (2012) [7] their research presented an application based review of such variants and will be useful for new researchers exploring its use in their research problems.

A. Rajeshwari et al. (2012) [8] the simulation results enhanced performance of BFA based on total energy dissipation and no. of alive nodes of the network when compared with LEACH.

Narendhar.S et al. (2012) [9] it is observed that the proposed Hybrid Bacterial Foraging Optimization was effective than Bacterial Foraging Optimization algorithm in solving Job Shop Scheduling Problems. Hybrid Bacterial Foraging Optimization is used to implement real world Job Shop Scheduling Problems.

Navroop kaur Chattha et al. (2011) [10] A fitness function is used to balance the energy consumption in every cluster according to the residual energy and positions of nodes. In every round the node called auxiliary cluster-head calculates the position of the cluster head using Bacterial Foraging Optimization Algorithm (BFOA).

Cheng-Ta Lee et al. (2004) [11] Authors developed a heuristic algorithm to construct an efficient object tracking in wireless sensor networks (WSNs). A Lagrangean Relaxation- based (LR-based) heuristic algorithm is proposed for solving the optimization problem. The experimental results showed that the proposed algorithm gets a near optimization in the efficient object tracking. Furthermore, the algorithm is very efficient and scalable in terms of the solution time.

Archana Bharathidasan et al. (2002) [12] sensor networks are dense wireless networks of small, low-cost sensors, which collect and disseminate environmental data. Wireless sensor networks facilitate monitoring and controlling of physical environments from remote locations with better accuracy. Considerable research has been focused at overcoming these deficiencies through more energy efficient routing, localization algorithms and system design.

PROPOSED WORK

Here my main work is to track a moving object in from source to destination in wireless sensor network. To obtain the tracking firstly all the nodes are cluster. Here to save energy all the work is given to cluster head, when the transmission starts than the data is transmitted to the cluster head of each cluster and then the cluster heads will send this data to the base station, other nodes in a cluster will not linked with the base station. In this way the transmission distance of each node in the clusters is reduced and BS receives data only from CHs, so the number of reception at the BS also reduced. Hence the overall energy consumption is reduced.

Our BFO algorithm is used to select the cluster head on the basis of energy associated with each node within the cluster. In this way optimization of sensors position in each cluster is performed by BFO. When we have the cluster heads. Randomly the source and destination of the object are generated and the source transfers the object to its destination, as soon as the object starts moving base station will check for the object distance from different clusters using RSSI (Reduced Signal Strength Indicator) . It estimates the distance between two sensors by measuring the power of the signal transmitted from sender to receiver, as the signal strength is inversely proportional to squared distance and check for the minimum distance. As soon as the distance is calculated base station inform the cluster head by giving the wake up call to the cluster head and this leads to the CH become active while all other continues to remain in sleep mode. Then active CH chooses three of its nodes as sensor nodes on the basis of distance from the CH. Then those three sensor nodes will continues the process of tracking of the moving object by calculating the current location of object with the help of trilateration algorithm which forms relation between three nodes and by solving three formed relations the coordinate of target (x,y) is obtained, and accordingly will inform to the cluster head which then give information to the base station and if the predicted location is outside the current cluster, then the cluster head near to the predicted location will become active cluster head and procedure continues until object reaches to its destination.

BFOA

Algorithm for cluster head selection is as such follows:

Step1 *Initialization of parameters*

p: Dimensions of search space *S: Number of bacteria in the population*

Nc: Number of chemotactic steps *Ns: Swimming length*

Nre: Number of reproduction steps *Ned: number of elimination dispersal steps*
Ped: Elimination Dispersal probability *C(i): Size of step taken in random direction*

Step2 *Elimination-dispersal loop: l = l +1*
Step3 *Reproduction loop: k=k+1*
Step4 *Chemotaxis loop: j=j+1*

a) For i =1, 2….S, take a chemotactic step for bacterium i as follows.

b) Compute cost function J(I,j,k,l) . The cost function of the BFO is calculated in the following way: First sum the distance squares from each node to the CH for a one cluster. Then this value for all the clusters should be summed over.

c) Let J last)=J(I,j,k,l) to save this value since we may find a better value via a run.

Step5 *If (j < Nc), go to Step 4.*
Step 6 *Reproduction: Computer the health of the bacterium i:*

$$J^{i}_{\text{health}} = \sum_{j=1}^{N_c+1} J(i, j, k, l)$$

Sort bacteria and chemotactic parameters C(i) in order of ascending cost Jhealth. Bacteria with the highest Jhealth values die, the remaining bacteria reproduce.

Step 7 *If (k < Nre), go to Step 3.*
Step 8 *Elimination-dispersal: Eliminate and disperse bacteria with probability Ped.*
Step 9 *If (l < Ned), go to Step 2.*

Next figure 2 is showing the flow chart of proposed work

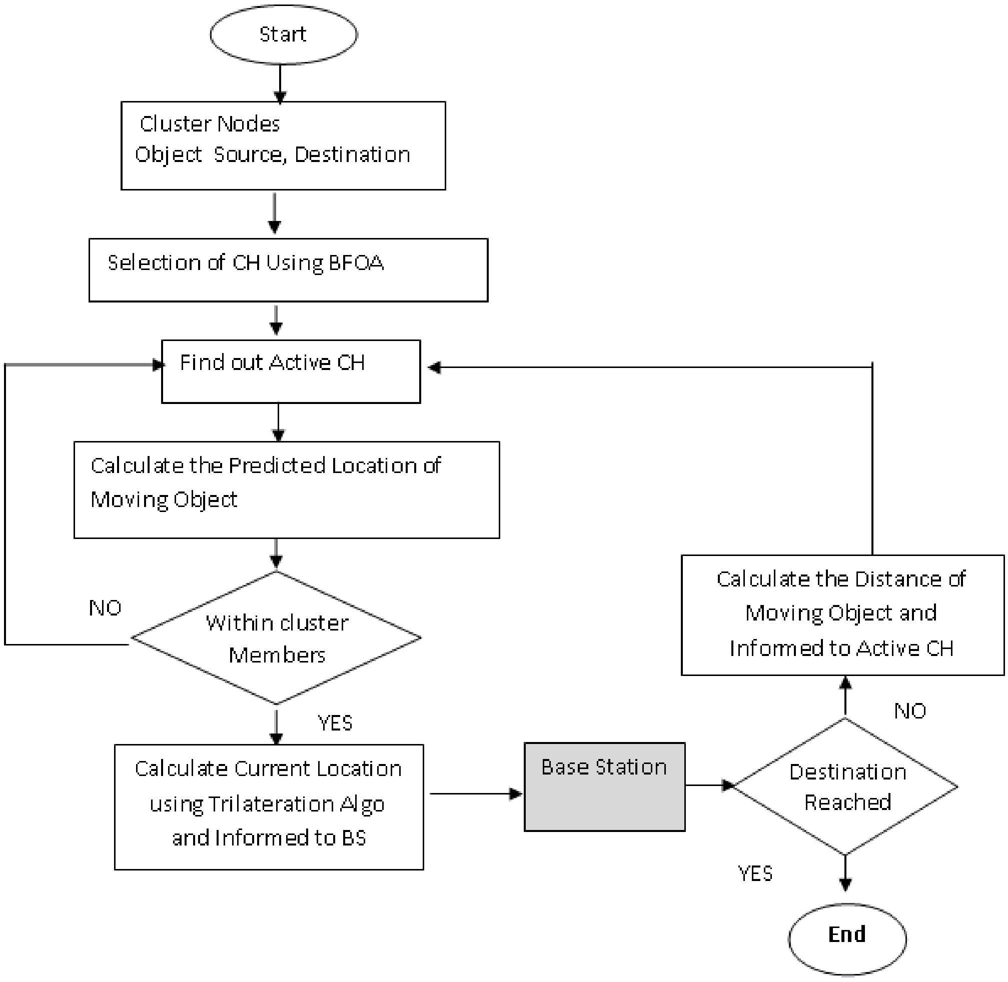

Figure 2: ***Flowchart of proposed algorithm***

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IMPLEMENTATION

The whole activity of our proposed work is divided into three parts the clustering, selection of cluster heads and the data transmission. Here we will see the implementation results of the BFO algorithm using MATLAB.

A. Clustering in WSN

In figure 3, colorful nodes are visible which are formed by applying Bacterial Foraging Optimization Algorithm i.e. BFOA on wireless sensor network. And the colorful nodes which formed by applying BFOA are termed or considered as Clusters. Here four different colors are used to denote a different cluster that is there are four clusters blue, yellow, red and green respectively. Figure is as follows:

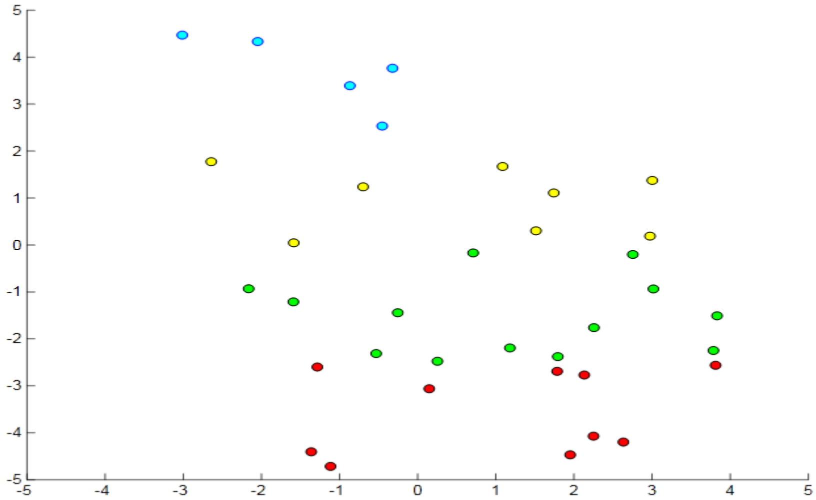

Figure 3: ***This figure shows cluster formation in the wireless sensor network by Bacterial foraging Optimization algorithm***

B. Selection Of Cluster Head

Figure 4 is representing the selection of cluster head, randomly generated source and destination nodes. Data transmission is also represented in this figure which is taking place in between source and destination node through cluster heads. In this figure, black triangle denotes base station of this network. Nodes in the shape of square or rectangle denotes source and destination node. And in all clusters the nodes having black in their center are cluster heads of the respective cluster. The figure is as follows:

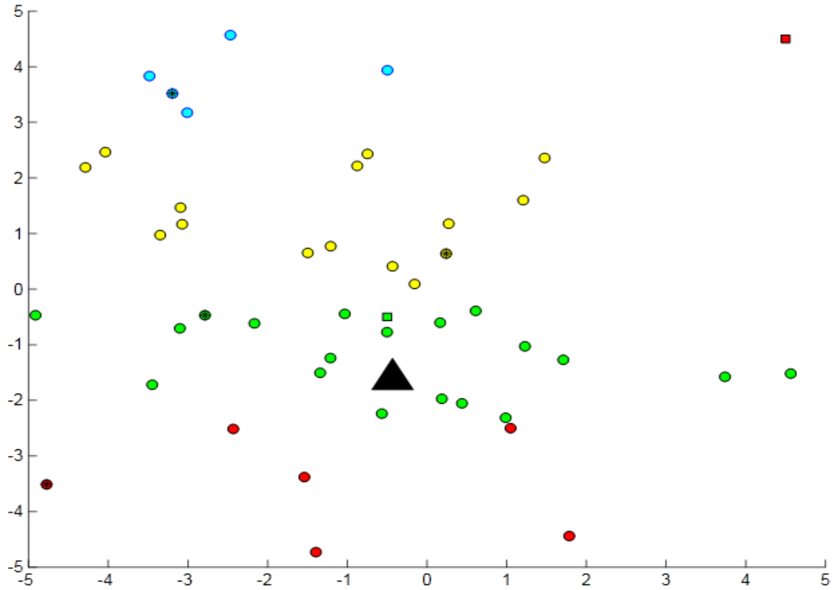

Figure 4: ***This figure shows cluster head selection, random source and destination generation.***

C. Data Transmission

Figure 5 is representing the transmission of data from source to destination. Data transfer starts from source that is Green Square and the black diamond represents the data and path is followed as cluster head of green color cluster and then to the cluster head of red color of cluster and data reaches to the destination that is red square. These red color circles show the broadcasting areas of the source, destination and cluster heads that are being used to transmit the data. The figure is as follows:

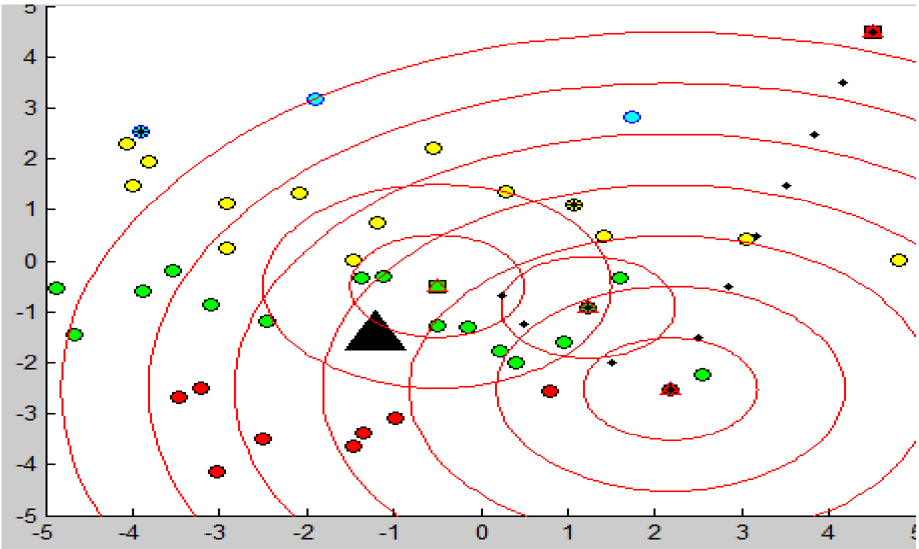

Figure 5: ***This figure shows the transmission of data from source to destination via cluster heads.***

SIMULATION RESULTS

Table 1 shows the results of simulation, in which the random source and destination are generated using the BFOA. Base station keeps tracks of the path followed by the data and stores the record in form of the table that also shows the value of energy consumed by the nodes to transfer the data from source to destination.

Table 1: ***Table showing Source to Destination Path***

SOURCE NODE	PATH NODES	DESTINATION NODE	ENERGY CONSUMED
27	26,41,20	23	1.5
44	22	4	0.5
3	9,17,47,45	41	2
49	5,14	38	1
10	12,16,13,20	34	2
13	35,22	47	1
29	5,14,2	17	1.5
8	46,26,16	42	1.5

CONCLUSION

Wireless technologies, in the simplest sense, enable one or more devices to communicate without physical connections–without requiring network cabling. Wireless communication technology is increasing daily; with such growth sooner or later it would not be practical or simply physically possible to have a fixed architecture for this kind of network. With the progression of computer networks extending boundaries and joining distant locations, wireless sensor networks (WSNs) emerge as the new frontier in developing opportunities to collect and process data from remote locations. WSNs rely on hardware simplicity to make sensor field deployments both affordable and long-lasting, without any maintenance support. Nodes used in WSNs, also known as motes, are self-sustained; they have a built-in radio, microcontroller, RAM, and flash memory. The task of cluster formation and cluster head selection is performed using reproduction and elimination and dispersal steps of BFOA. Energy efficient data transmission is provided using prediction based clustering algorithm. Object tracking is done using RSSI(Reduced Signal Strength Indicator) by the base station by maintaining the details of path travelled by the object and by making the nearest CH active and keeping all others in sleeping mode provides energy efficient object tracking in WSN using BFOA.

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REFERENCES

1. Shen .C, Srisathapornphat .C, Jaikaeo.C, Sensor information networking architecture and applications, IEEE Personal Communications, August 2001, pp. 52–59.
2. Akyildiz I. F., Su W., Sankarasubramaniam .Y, and E. Cayirci, "A survey on sensor networks," Communications Magazine, IEEE, vol. 40, pp. 102-114, 2002.
3. Chong Chee-Yee; Kumar. S.P., "Sensor networks: evolution, opportunities, and challenges", Proceedings of the IEEE, vol.91, no.8,pp. 1247-1256, Aug. 2003.
4. Akyildiz, I.F.; Weilian Su; Sankarasubramaniam, Y.; Cayirci, E., "A survey on sensor networks", Communications Magazine, IEEE, vol.40, no.8, pp. 102-114, Aug 2002.
5. Culler .D, Estrin .D,. Srivastava .M, "Overview of Sensor Networks," Computer Magazine,IEEE, vol. 37, no. 8, pp. 41-49, August 2004.
6. Otis Brian, Rabaey Jan, and Ultra-Low Power Wireless Technologies for Sensor Networks: Springer, 2007.
7. Sharma Vipul,. Pattnaik S. S and Garg Tanuj, “A Review of Bacterial Foraging Optimization and Its Applications”, National Conference on Future Aspects of Artificial intelligence in Industrial Automation (NCFAAIIA), Proceedings published by International Journal of Computer Applications (IJCA) 2012.
8. Rajeshwari .A, Vimala Devi .V, Lakshmi. A. S, Nagajothi. N “Civilizing Energy Efficiency in Wireless Sensor Network Using Bacteria Foraging Algorithm”, IOSR Journal of Computer Engineering (IOSRJCE), ISSN: 2278-0661, ISBN: 2278-8727, Volume 7, Issue 5, PP 61-65, www.iosrjournals.org, Nov. - Dec. 2012 .
9. Narendhar. S and Amudha. T, “A Hybrid Bacterial Foraging Algorithm for Solving Job Shop Scheduling Problems”, International Journal of Programming Languages and Applications (IJPLA) Vol.2, No.4, October 2012.
10. Chattha Navroop kaur, “ENERGY BALANCING INTELLIGENT CLUSTRING PROTOCOL FOR WIRELESS SENSOR NETWORK”, Journal of Global Research in Computer Science, Volume 2, No. 7, , Available Online at www.jgrcs.info July 2011.
11. Cheng-Ta Lee, Yeong-Sung Lin Frank, and Yean-Fu Wen, “An Efficient Object Tracking Algorithm in Wireless Sensor Networks”, 2004.
12. Bharathidasan Archana, Ponduru Vijay Anand Sai, “Sensor Networks: An Overview”, 2002.