Journal of College of Education for pure sciences(JCEPS)
Web Site: http://eps.utq.edu.iq/ Email: com@eps.utq.edu.iq
Volume 7, Number 3, September 2017

Determine The Location Of Nodes In Wireless Sensor Network By Using GA

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Abstract:

In several cases, it is important, or even necessary, for a device in the wireless sensor network to be aware of its location in the network. For example, the event detection process loses its importance if the wireless sensor network cannot provide any information about where the event occurred. However, site information cannot be manually configured on each device during deployment. It is also futile to place the future of the Global Positioning System (GPS) at each node, due to physical and publishing limitations (e.g. GPS does not work within the structure) and other limitations related to the power of the device. In this paper we proposed new methodologytodetermine the location of nodes by using Genetic Algorithms(GA).GA consider an important technique in the search for the best choice of a set of solutions available for a particular design. Through the results obtained using the proposed algorithm, this method can be considered more reliable and cost effective than traditional methods.

Keywords: WS N, Localization, Nodes, Base Station, GA

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تحديد موقع العقد في شبكات الاستشعار اللاسلكية باستخدام الخوارزميات الجينية

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الخلاصة:

في العديد من الحالات، من المهم، أو حتى ضروري، لعقدةداخل شبكة الاستشعار اللاسلكية أن تكون على بينة من موقعها في الشبكة. على سبيل المثال، تفقد عملية الكشف عن الحدث أهميتها إذا لم تتمكن شبكة الاستشعار اللاسلكية من تقديم أي معلومات حول مكان وقوع الحدث. ومع ذلك، لا يمكن تكوين معلومات الموقع يدويا على كل جهاز أثناء النشر. ومن غير المجدي أيضا وضع مستقبل النظام العالمي لتحديد المواقع (GPS) في كل عقدة، بسبب القيود المادية والنشر (على سبيل المثال GPS لا يعمل داخل الهيكل الكونكريتي) وغيرها من القيود المتعلقة بقوة الجهاز. في هذه البحث اقترحنا منهجية جديدة لتحديد موقع العقد باستخدام الخوارزميات الجينية (GA). هذه تقنية هامة في البحث عن أفضل خيار لمجموعة من الحلول المتاحة لتصميم معين. من خلال النتائج التي تم الحصول عليها باستخدام خوارزمية المقترحة، ويمكن اعتبار هذه الطريقة أكثر موثوقية وفعالية من حيث التكلفة مما هو عليه في الطرق التقليدية.

1.Introduction:

wireless sensor networks is an important technique for many application such as environmental, agricultural and military applications and applications of network services for future [1]. But this technology is facing many challenges , the most importantof these challenges are: energy and the values of the erroneous distances and high cost. To build WSN you must have large number of nodes and a number of anchors to create a comprehensive system of coordinates. The computational cost and time and the number of messages exchanged at the expense of the sites is not particularly simple if abounded communication between the sensors and anchors points. There are several techniques on how to learn the location of sensors automatically, either fully automatic relying on a network of wireless sensors themselves, or with the help of external an infrastructure[2].

2. Why Localization Is Important Issues :

An advances in wireless sensor networks (WSNs)make it a important technology. Because of its randomly andinfrastructure less nature, it has gained the attention of mostof the researchers in past few decades[1]. Network sensor nodes are having limited energy and resources.The most important characteristic of a sensor is to collect data,process it and transfer to the target. In WSNs,to get this type of information we need localizationtechniques[2]. Localization techniques are used todetermine the geographical location of sensornodes inside the networkas show in figure(1) localization. Localization in wireless sensor network is not onlyuseful for densitycontrol it is important toprovide the base of routing .It also useful for location determination . It can also be, tracking and other communication aspects, so everyonerealizes the importance every node should determine its locationvery accurately[3,4].

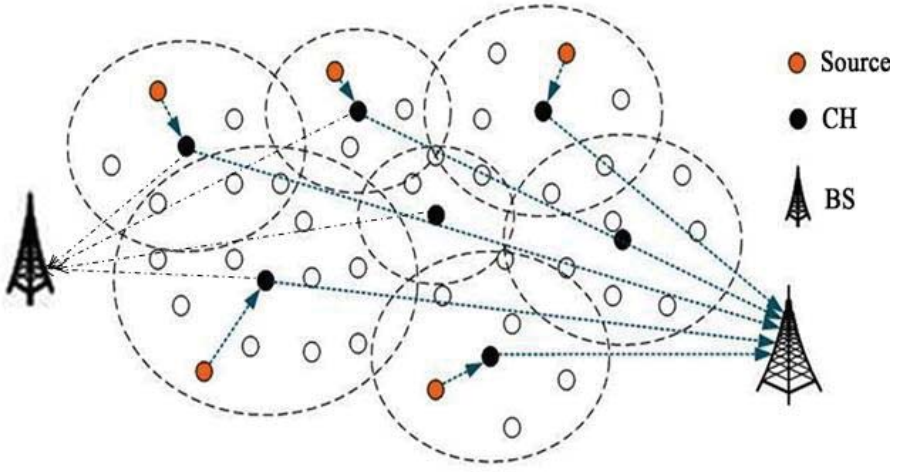


Fig (1): localization in wireless sensor network

3. Genetic Algorithm:

Genetic Algorithm is a method for solving mathematical and engineering dilemmas based on the simulation of the gene method for the reproduction of organisms[5].If we have a problem that has a very large number of solutions, the most wrong and some of them are true, and there is always the best solution, which is difficult to reach, the idea of genetic algorithms is to generate some solutions to the problem randomly, and then check these solutions and compare them with some criteria developed by the designer algorithm, Only those that remain are the least efficient solutions being neglected in accordance with the biological rule of "survival of the fittest."[6]

The next step is to mix the remaining solutions (the most efficient solutions) to produce new solutions similar to what happens in living organisms by mixing their genes so that the new object carries qualities that are a combination of the characteristics of its parents[8,9,10]. The solutions resulting from mating are also under the process of mating and selection is carried out until the process reaches either a certain number of frequencies (determined by the system user) or the resulting solutions or one of them reaches the ratio of efficiency or proportion a small error (defined by Almost Also the blood), and even the best solution[12].

The elements of genetic algorithms Although different genetic algorithms as branches of evolutionary computing, but they share at least the following element[13]:

1- A chromosomes of Populations: the group of search solutions or the search space.
2- Selection : the choice of the appropriate chromosomes as "religion" for mating between them, but this selection process is not random, it’s depends on the efficiency of the chromosome.
3- Fitness: a coefficient that gives each chromosome a specific value indicating the efficiency of the chromosome..
4- Crossover : After the selection of appropriate first-generation chromosomes, the passage through which new chromosomes (new offspring) are formed depends on the chromosomes of the mother.
5- Random Mutation: after the formation of the new offspring, are causing mutations changes in the form of chromosomal and this helps to reach to solve faster[11].

4. Proposed Methodology:

In this section a new method is proposed for the placement of the sensor nodes in the network. Genetic Algorithm is used for optimizing the results depending on compute the best fitness to the base station nodes. Fitness function (It is a mathematical dependent used to determine the efficiency of the chromosome, it is usuallythe best solution is thatthe value of the fitness function is greater or smaller depending on the type of issue.The steps of methodology as following :

1- Initialed the borders of network ,number of nodes range of nodes, etc. It is identified as shown in table (1).
2- The next step is to install the Anchor nodes in the networkthese anchors are used for the communication.
3- Calculate the location of Anchor nodes. to enable the sensitivity contract to contact them and send their location.
4- Performed clustering procedure to calculate the number of cluster in the network. Inside the cluster will determine the cluster head which will be responsible to communicate with anchor nodes.
5- Now, we must apply Genetic Algorithm this is important phase to computer the selection , Crossover and Mutation when used the GA we focus on the distance. When distance is less this will increase the fitness value of Anchors.
6- The last step is update the location with best fitness value .

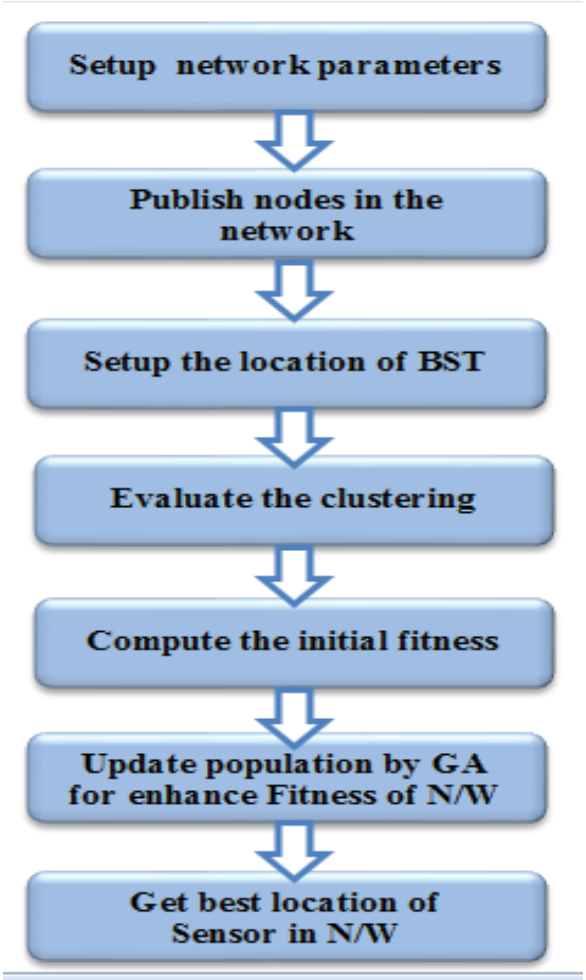
When compared the traditional method of estimating the distance between the anchor and the genetic algorithms, we find that their use is much better than the traditional method**Fig(2)** show the proposed methodology .

Table 1: Network Configuration of the proposed algorithm.

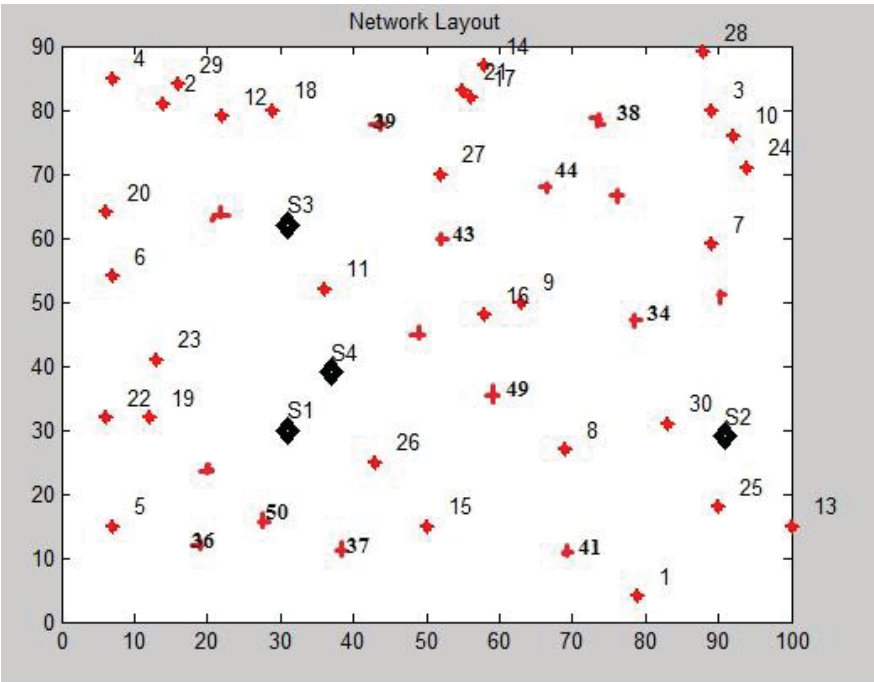
Properties	Value
Width	100 m
Height	100 m
Length	100 m
Number of Anchor	4
Number of Node	50
Error in Distance Calc. (%)	5
Error in Angle Calc. (%)	5
GA Population Size(%)	64
Maximum Iterations 100	100

5.Simulation And Results :

In this work, we used Matlab program to simulation the proposed methodology where the number of anchor nodes was four nodes only with 50 sensor nodes as shown in **fig (3).**In this paper, the use of genetic algorithms is to find the optimal solution to find best location of the anchor nodes in the network was compared with the traditional method



Fig(2): Proposed Methodology



Fig(3):network simulation in Matlab

Figure (4) show comparison between the traffic in the network when used traditional method and anther time with genetic algorism .the graph show that the genetic algorithm was have less traffic than the traditional method (e.g. anchor 3 in **fig(4)** will keep the traffic to minim value 4 units than node itself in traditional method it increased to be more than 11 unit.

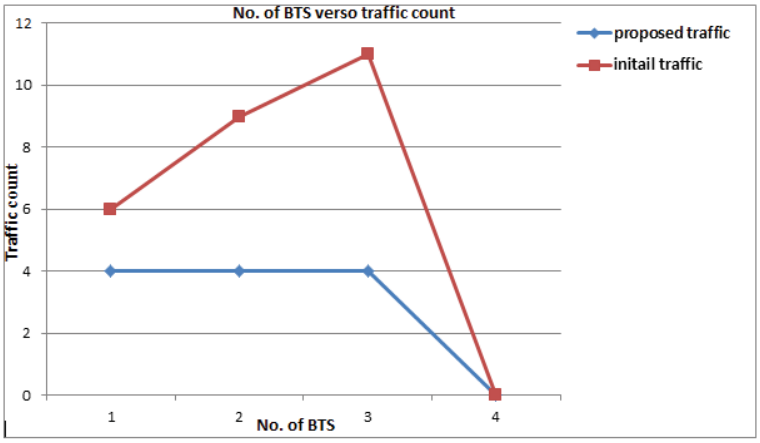
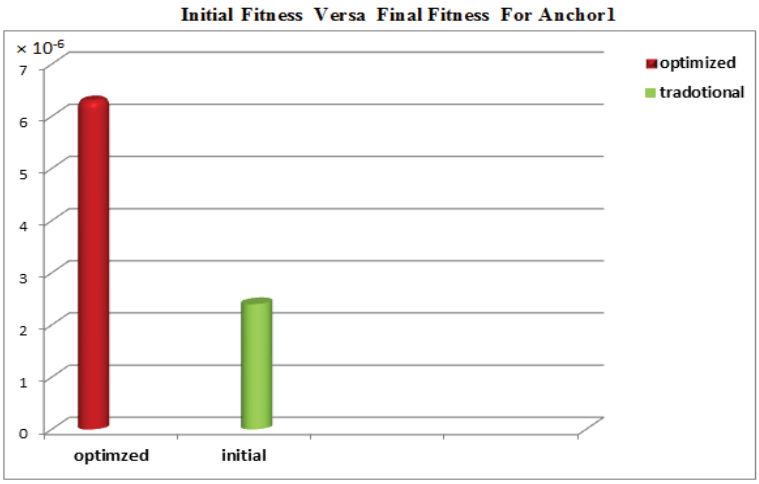


Fig (4): Comparison graph on the basis on the Traffic count wr.t to the number of anchor nodes

Since the fitness factor is inversely proportional to the distance, we will discuss the value of fitness in all anchor nodes within the network, before and after the use of genetic algorithms. fitness is calculated using the following equation:

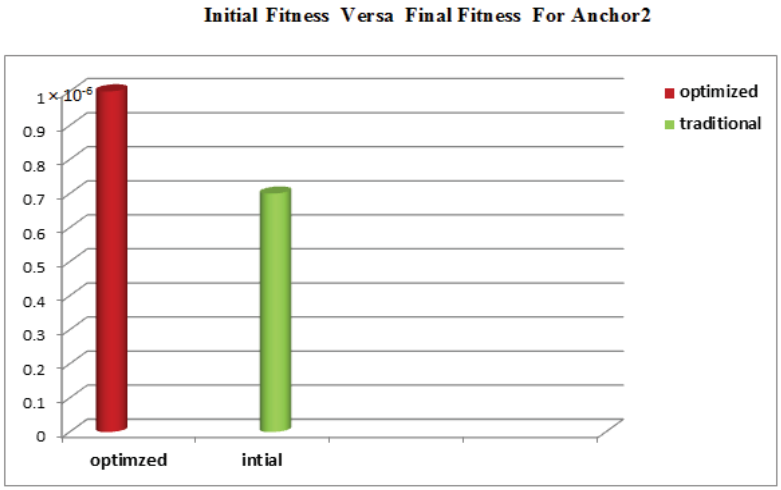
$$\text{Fitness} = 1/\text{path loss} \times \text{attenuation} \times \text{distance} \dots\dots\dots (1)$$

Fig (5) show the value of fitness to all node in the network before using GA.At the beginning the distance between the sensor and Anchors was large so that the fitness will be small then in caseof decreasing the distance in the Anchor1, the initial value was 1.4×10^{-6} but after applying fitness function to the same anchor it is became 5.9×10^{-6}.



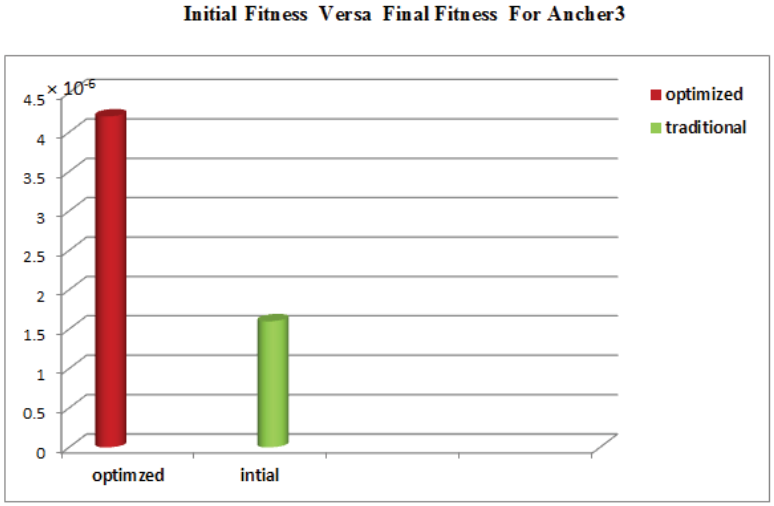
Fig(5): Fitness Function ofthe Anchor1

In**Fig(6)** we find that the Anchor2 in the network will have initial value was 0.6×10^{-6}units after applying GA the fitness function to the same anchor is became 10^{-6} units. This indicate that the use of algorithms makes the optimization of the network better.



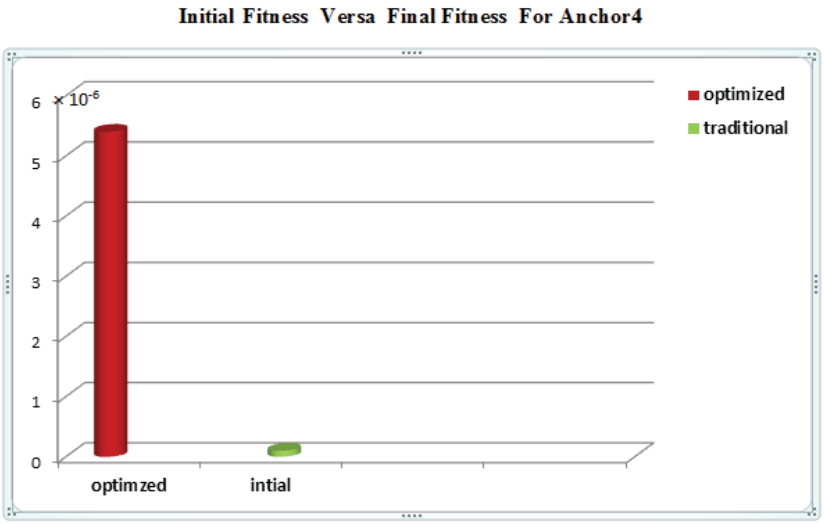
Fig(6): Fitness Function ofthe Anchor2

We note from **Fig(7)** we find that the Anchor3 in the network will have initial value 1.4×10^{-6} units after applying GA, the fitness function to the same anchor it is became 4.1×10^{-6}units. This indicate that the Genetic Algorithm better than traditional.



Fig(7): Fitness Function ofthe Anchor3

Finally in**Fig(8)**the Anchor4 in the network will have initial value 0.1×10^{-6} units after apply GA the fitness function to the same anchor it is became 4.5×10^{-6}units. This indicatethat the Genetic Algorithm better than traditional.



Fig(8): Fitness Function ofthe Anchor4

6. Conclusion :

Location in wireless sensor networks is an important tool for many environmental, agricultural, military and future service network applications But this technology faces many challenges, the most important of which is the cost of energy and the values of wrong and vague distances. A large number of anchors must be available to establish a comprehensive coordinate system. The cost of computation and time and the number of messages exchanged when calculating sites is not simple, especially if the points of communication between sensors and anchors.It is important, for a node in the wireless sensor network to be aware of its location in the network.Unless the data sent is meaningless. In this paper, we proposed a new methodology depended on Genetic Algorithm from the result that obtained, we can consider this methodology more reliable and better than the traditional methods. In the future we try to used Hybrid Genetic Algorithm and compare between with this work.

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