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Lifetime Extension of Wireless Sensor Network Using Harmony Search Algorithm

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Abstract – The lifetime of wireless sensor networks could be extended and it could cover all targets is based on memetic algorithm approach. Darwinian evolutionary and Lamarckian enhancement uses memetic algorithm. This algorithm also gives better solution than any other algorithms. Many Task Assignment Problems(TAP) and particle swarm optimization techniques formulated this harmony search algorithm. The harmony search algorithm performs certain steps. Firstly, show the WSN creation in MATLAB. Placing the nodes and sensor covers up which targets at a particular sensing range. Initially we will be generating the values using random permutation. We can also find the simulation with different sensing ranges and different population. It holds certain memetic algorithm processes such as Representation, fitness function, selection, crossover, mutation and compact operator. SET K-cover is initialized with harmony search, where cover forms a major advantage. Each covers plays a vital role in energy efficiency. Active and inactive state performs the usage of sensors and when it is not in use it will be inactive state which in turn helps us for conserving the energy. It also has been optimization techniques such as LP,NLP,DP. The improvisation of music player is named as harmony search.

Keywords - *Harmony search algorithm, Wireless sensor networks, Energy Efficiency.*

1. Introduction

Wireless sensor Networks has many tiny particles which are called as motes. There are many motes that communicate with each other. It passes the data along one another. During surveillance in military applications we have certain things such as shooter localization, perimeter defence, insurgent activity monitoring, precision agriculture. We are in need of three sensors for military applications. Those sensors usually collect, transmit and relay information. Sensors will perform only through wireless mode in which no wired connection is possible. The information will be transferred not through any electrical conductor. We depend on the optimization techniques to achieve "maximum benefit with minimum cost". There has been a considerable losses occur when a linear ideal model from a non-linear real world problem is developed. We need to pay attention in selecting the initial values to guarantee convergence to the global optima. This mathematical techniques, such as heuristic optimization is introduced. It will be done within a reasonable computation time. The algorithm which holds the rules and randomness mimicking natural phenomena those includes simulated annealing(SA),Tabu search(TS), evolutionary algorithm(EA). Tabu search could be used to solve discrete combinatorial optimization problems. We can say that the algorithm is good when a move from one solution to another results in best available solution. New applications were also implied in to the WSN such as home security, zebra net, environmental monitoring. For the sensing of targets we need to have the connectivity of the network. WSN also have certain characteristics such as robustness, responsiveness, heterogeneity, scalability. These formation of maximum number of covers has been done by other algorithms such as ant colony optimization, artificial bee algorithm, cuccoko algorithm. In order to sense the coverage, the connectivity of the network should be performed. From this connectivity, the collected information would be passed back to the data sinks. The TAP also follows greedy genetic algorithm, the file sharing and the repositories are connected through a heterogeneous interconnected network. Harmony search is being applied to certain optimization problems such as structural optimization and least-cast multicast routing. It is used for monitoring and tracking wildlife. It uses nodes significantly larger as heavier than motes.

Energy Efficient Wireless Sensor Network is basically achieved from the heuristic algorithm which then gave the optimal solution till now but it too have lacking behind in some criteria so am planning to workout on the criteria in which some heuristic algorithm were lacking and will try to create a advantage in power supply for the energy consumption. In this introduction, we are all going to deal with the basic terminologies which are all going to be initialized for making this solution possible. For that we have to know about WSN and its applications, challenges that WSN are facing and the energy in WSN and about the SET K- cover problem [5]. The wireless networks have no interconnections and sensor which could be able to sense the signals and it is also referred as detector which measures the physical

quantity and converts it to a signal. Transfer of information will be taking place without using any electrical conductor [5].

The existing method for this energy efficient is memetic algorithm which gives the optimal solutions to the energy problems till now. The inputs that have been given to the memetic algorithm is flexible which could be like an evolutionary algorithm [1]. The generic algorithm depends on the input type, fitness function to find the best solution and the mutation process which changes 0 to 1 and 1 to 0.

So in this introduction what we are going to propose is that the existing methodologies has given us the path in what way we have to proceed by looking at the lacking areas we need to do all possible measure to solve this energy problem in WSN using harmony algorithm[1]. So we are using MATLAB for designing the whole process states which first initially has the access to create the network with node and sensor and it should cover the targets whereas using this we are forming maximum number of covers which covers all targets.

1.1 New Heuristic Algorithm

It's basically a music related algorithm. Many instruments that are played together at the same time and for any music improvisation, each player has to sound any pitch which resides within the possible range and they are grouped together to make a vector. If the music is pleasant when various instruments were played together and makes one solution vector then that experience is stored in each variables memory and the possibility for getting the good solution will be increased by next time. We could say that heuristic algorithm is performing well when it could give better performance(on the basis of giving better solutions, less iterations) than the other existing algorithms [2]. In the harmony search algorithm we are dealing with the music analogy which has the musical notes, musical range and with other probabilistic measures.

The purpose for the harmony is that it can produce the better solutions than the other existing solution with the less number of iterations so it is not much time consuming and the energy is not wasted over here. Here there has been no decision variables has been setup initially and the harmony search of a hydrologic model has outperformed all the existing mathematical and heuristic methods [2].The various combinations of sounds in a music harmony are considered from aesthetic point of view. The relationship between sound waves which is having different frequencies were considered in harmony [7]. The musical performances also seek a best state by the aesthetic estimation and which gives the global optimal minimum cost or maximum benefit from a best state. The group of sounds which are played by joined instruments were determined by aesthetic estimation. The performance of aesthetic estimation could be improved by iteration by iteration [2].

2. Problem Definition

2.1 SET-K-COVER

The difficulty which has been there for forming the maximum number of covers which cover all the targets is described as the SET K- cover problem. The problem of the set k- cover has been proven to be NP-complete [1]. So these kinds of problems do not have the exact solution but it tends to be moved in to the polynomial solutions by making use of this criteria.

Collection S={S1……,Sn} of subsets of a finite set T={T1,…….Tm}, to find the maximum cover, k, of covers C1,…….Ck subset of S with Ci intersects Cj=0 for i!=j such that every component of T pertains to at least one component of Ci.

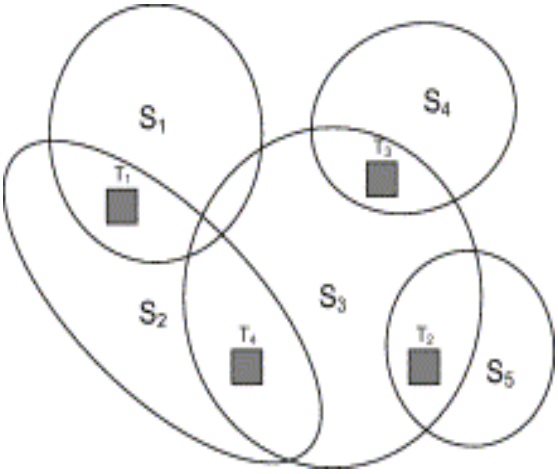

Fig 2.1 Deployment of WSN

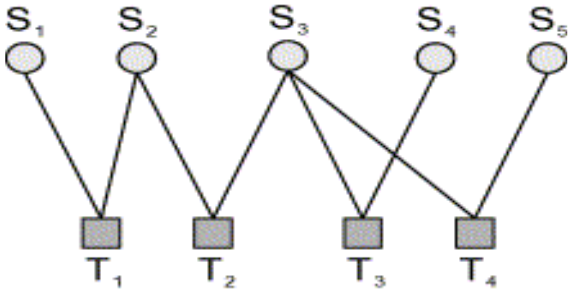

Fig 2.2 Bipartite graph

3. Proposed System

3.1 Harmony Algorithm for Power Effective In Wireless Sensor Network

- *Step 1:* Firstly, Initialize a Harmony Memory (HM).
- *Step 2:* From the harmony memory (HM) we need to improvise a new harmony.
- *Step 3:* Need to exclude the minimum harmony from HM, when the New Harmony is better than minimum harmony and we need to include the harmony in HM.
- *Step 4:* Go to step2 if the stopping criteria are not satisfied.

Figure 2: Consider a jazz trio component which is composed of fiddle, saxophone and keyboard. During the starting process the harmony memory is loaded with random harmonies such as (C,E,G), (C,F,A) and (B,D,G) which are ranked according to there best and worst harmony generation. Whereas in the improvisation procedure, three different instruments combine together to form a new harmony. Where fiddle sounds {C} out of (C,C,B); saxophone sounds {D} out of (E,F,D) and keyboard sounds {A} out of (G,A,G). Every note has the same opportunity of forming a new harmony. New harmony (C,D,A) is better than any of the existing harmonies in the HM and the worst harmony will be excluded from the harmony memory.

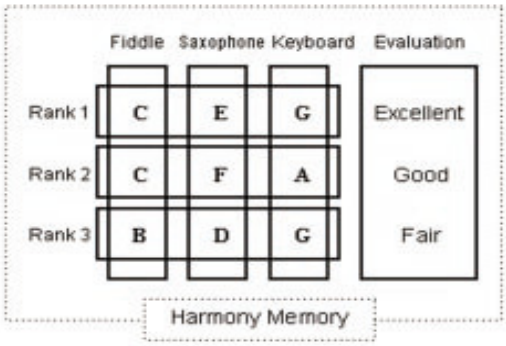

Fig. 3.1 Structure of Harmony Memory

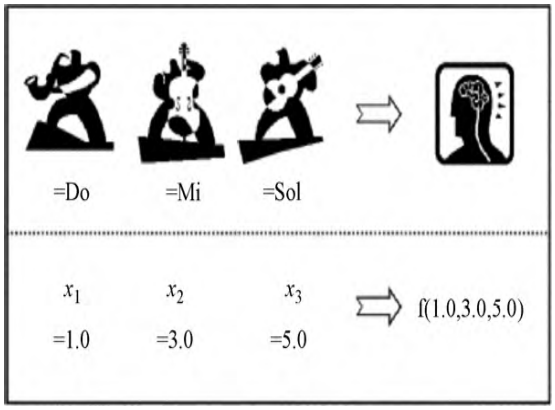

Fig. 3.2 Analogy between Music improvisation and Engineering Optimization

Table 1. Comparison between Optimization and Musical Performance

Comparison Factor	Optimization process	Performance Process
Best state	Global optimum	Fantastic Harmony
Estimated by	Objective Function	Aesthetic Standard
Estimated with	Values of variables	Pitches of Instruments
Process Unit	Each iteration	Each practice

3.2 Steps Involved

1. Firstly initialize the problem and algorithm parameters. It has harmony memory size (HMS), harmony memory considering rate (HMCR), bandwidth (bw), pitch adjusting rate (PAR), number of improvisations (k).

2. After the initialization process, generate a initial harmony memory.

$$HM=\begin{bmatrix} x_1^{'}...x_n^{'}\ldots f(X^{'}) \\ x_1^{hms}.....x_n^{hms}\cdots\ f(X^{hms}) \end{bmatrix}$$

3. A new harmony have to be improvised.

   - Generating a new harmony is called as improvisation. The new harmony vector $x'=(x_1', x_2', x_3')$.
   - Rand() is the newly generated number in the region of (0,1).
   - Where bw is the arbitrary distance bandwidth.

4. If the newly generated vector fitness ratio is better than the existing one, replace the worst harmony which is in the harmony memory with x'.

5. Once the maximum iteration gets satisfied, stopping criteria is applied. Otherwise step3 is repeated.

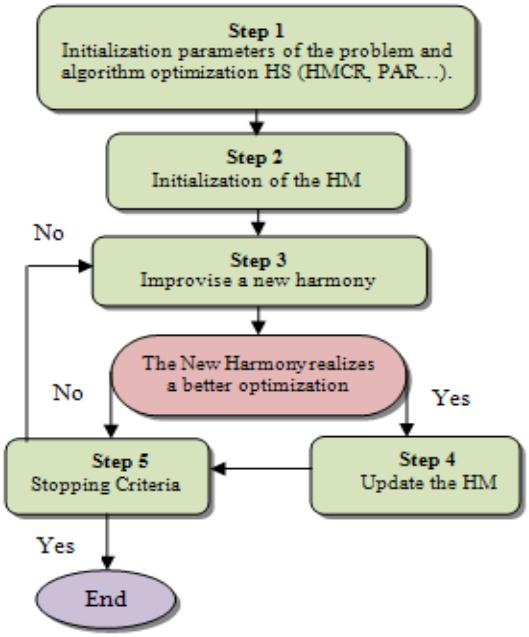

Fig. 3.3 Flow Chart

4. Conclusion

Harmony memory considering rate(HMCR) and pitch adjusting rate(PAR) are calculated and the result is shown in the form of a graph, as it is the metaheuristic algorithms it will take the inputs in the form of 0's and 1's. the formation of maximum number of covers is possible when the targets are placed inside the particular sensing range. Sensors collects various targets and those sensors which covers all targets will be gathered as a single cover. Harmony has the functionality as per the memetic algorithm where the representation is used for representing order based chromosomes. We need to find the fitness function value of the chromosomes, then we need to do the crossover and mutation to ensure the legality in an order. So there should not be any duplicate numbers in an order.

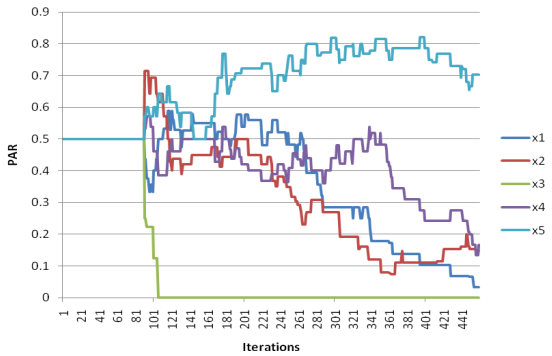

Fig. 4.1 Graph A

$$HMCR_i = \frac{n\left(y_i^j = Memory\right)}{HMS}$$

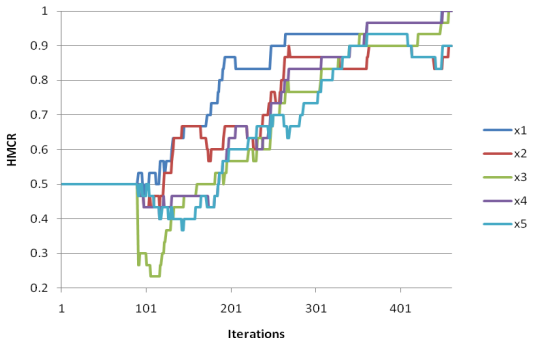

Fig. 4.2 Graph B

$$PAR_i = \frac{n\left(y_i^j = Pitch\right)}{HMS}$$

References

[1] Chaun-Kang Ting, Chein-Chih Liao "A memetic algorithm for extending wireless sensor network lifetime" Information sciences 180 (2010) page no.:4818.

[2] Zong Woo Geem, Joong Hoon Kim, G.V.Loganathan "A new heuristic optimization algorithm harmony search" simulation 76:2, 60-68.

[3] Weyland, Dennis "A rigorous analysis of the harmony search algorithm" metaheuristic computing1(2):50-60.

[4] Sorensen,Kenneth "The metaphor exposed" operational research.

[5] Yu Gu, Yusheng Ji, Jie Li, Baohma Zhao, "centralized and clustered k-coverage protocols for WSN" Eurasip 2012:74[march 2012].

[6] Guotang Nan, Guanxiong Shi, Zhifei Mao, Min quaingLi , "Efficient energy consumption in two tiered sensor network using genetic algorithm" Eurasip 2012:44[14 feb 2012].

[7] Dexuan Zou, Liquon Gao, Steven Li, Jianhna Wu, Xin Wang "A novel global harmony search algorithm for task assignment problem" Journal of systems and software 83(2010)1678-1688.