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Optimistic Path using Artificial Bee Colony Approach

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Abstract:-

Wireless sensor network (WSN) is a network that is made of hundreds or thousands of these sensor nodes which are densely deployed in an unattended environment with the capabilities of sensing, wireless communications and computations (i.e. collecting and disseminating environmental data). It consumes energy to transmit, to forward and to receive the data over network. Network lifetimes depends on energy level of nodes, depends on processing power of node, memory and transmitter power.

In this paper our main focus to maintain the maximum lifetime of network, during data transmission in an efficient manner. For this we proposed a new technique called ABC (Artificial Bee Colony) approach from swarm intelligence for optimistic path. In order to demonstrate the performance of the ABC algorithm, it is tested on five high dimensional numerical benchmark functions that have multimodality.

Keywords:- WSN, Sensor Node, ABC Algorithm, Benchmark functions.

1. Introduction:-

Wireless sensor networks consist of individual nodes that are able to interact with the environment by sensing or controlling physical parameters. These nodes have to collaborate to fulfill their tasks. The nodes are interlinked together and by using wireless links each node is able to communicate and collaborate with each other. Many different routing, power management and data dissemination protocols have been designed for wireless sensor networks (WSNs), dependent on both the architecture of wireless sensor network (WSN) and the applications that WSN is intended to support. These protocols support the practical existence of WSNs and efficiently make them an integral part of our lives in the real world [1]. WSN is applied in routing and difficult power supply area or area that cannot be reached and some temporary situations, which do not need fixed network supporting and it can fast deploy with strong anti-damage. In order to avoid the problem we proposed a new technique called Bio inspired mechanism for path optimization. ABC is one of the Bio inspired mechanisms.

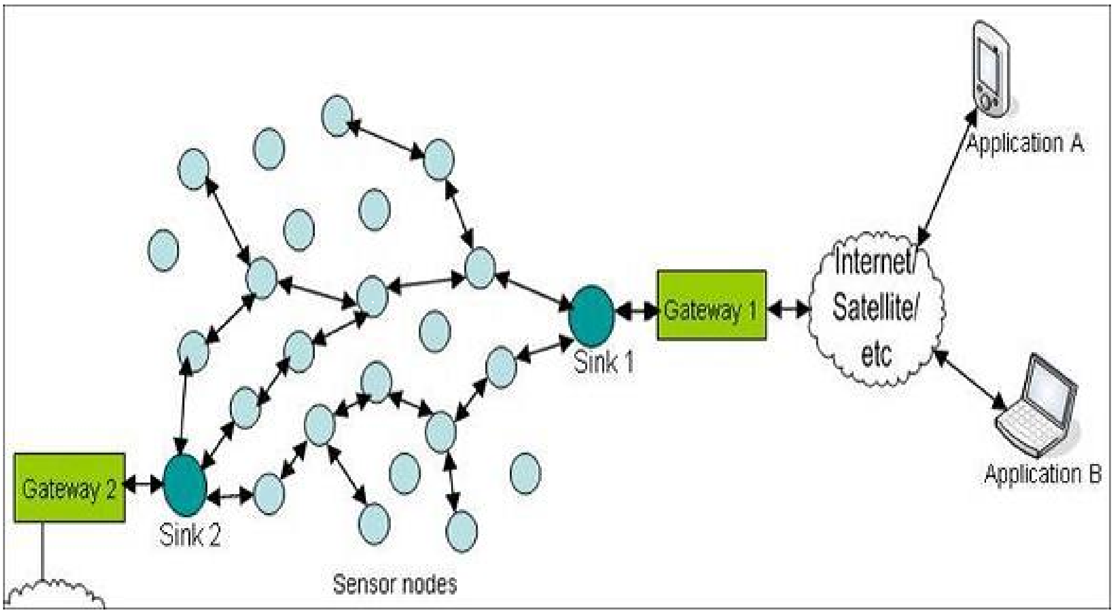

Figure 1: Architecture for Wireless Sensor Networks (WSN).

2. Sensor Nodes:

Sensor nodes are the network components that will be sensing and delivering the data.

Depending on the routing algorithms used, sensor nodes will initiate transmission according to measures and/or a query originated from the Task Manager. According to the system application requirements, nodes may do some computations. After computations, it can pass its data to its neighboring nodes or simply pass the data as it is to the Task Manager. The sensor node can act as a source or sink/actuator in the sensor field.

3. Role of Swarm Intelligence:-

Swarm intelligence can be defined as the measure introducing the collective behavior of social insect colonies or other animal societies to design algorithms or distributed problem-solving devices [2].

Or

“Swarm intelligence can be defined as the emergent collective intelligence of groups of simple agents.”

Generally, the algorithms in swarm intelligence are applied to solve optimization problems. The classical algorithm evolutionary computing and is used to solve problems of optimization is the Genetic Algorithm (GA) [3]. Later then, many swarm intelligence algorithms for solving problems of optimization are proposed such as the Cat Swarm Optimization (CSO) [4], the Parallel Cat Swarm Optimization (PCSO) [5], the Artificial Bee Colony (ABC) [6], the Particle Swarm Optimization (PSO) [7], the Fast Particle Swarm Optimization (FPSO), and the Ant Colony Optimization (ACO). Moreover, several applications of optimization algorithms based on computational intelligence or swarm intelligence are also presented one after another.

4. Artificial Bee Colony Algorithm (ABC):-

In a real bee colony, some tasks are performed by specialized individuals. These specialized bees try to maximize the nectar amount stored in the hive using efficient division of labor and self organization. S.Hemamalini and Sishaj P.Simon," Economic Load dispatch with value-point effect using artificial bee colony algorithm", [8].

Artificial Bee Colony algorithm has opened up a vast stage for WSN protocol suite design. Like any swarm intelligence scheme, they are compatible to any stage of a WSN design and implementation, which makes them an attractive choice as the base. Though the generic version gives inferior performance in high target goals, a few adaptations to fit into our formulated problem gives colorful results. This paper makes such a proposal, which has been molded to optimize the total deployment scenario Further goals include adapting the same algorithm with minor parameter variations for the routing scheme. Hence it can, by itself, constitute the backbone of a complete WSN network layer protocol suite. The analysis part can be done in NS2 simulator, or even MATLAB.

ABC algorithm for constrained optimization problems was investigated through the performance of several experiments on well-known test problems. ABC algorithms were tested on six high dimensional numerical benchmark functions that have multimodality. From the simulation results it was concluded that the proposed algorithm has the ability to get out of a local minimum and can be efficiently used for multivariable, multimodal function optimization.

Proposed Algorithm:

- In the proposed system we are creating a network with n nodes.
- The value of n is any integer number.
- Define the two nodes as source and destination.
- In this algorithm one of the important points is threshold value.
- Take threshold value as td.
- N1=source node and N2=destination node.
- Repeat the following subsection until we reach the destination node N2.
- Initiate counter=1;
- While counter <=td.

- If (N2 receives data)
- Then end acknowledgement to N1 and break;
- Else
- Retransmit data
- Increase counter by 1.
- End while
- If (counter >td)
- Then find nearest neighbor as Nn. Go to step .
- End
- Exit

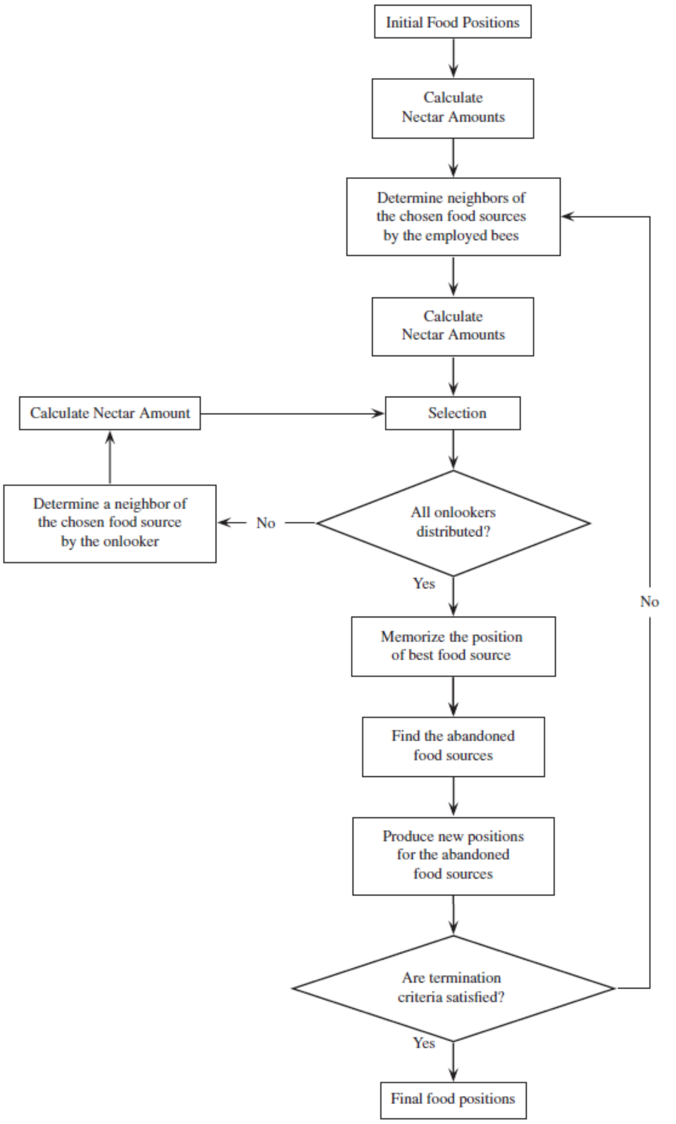

Figure 4: Flowchart of the Artificial Bee Colony Algorithm.

5. Benchmark Functions:-
Benchmark functions are designed to test the performance of the optimization algorithms. In particular they are intended to represent some of the complexity that can be encountered in real-world optimization problems. In this study, we have chosen six functions, with different degrees of complexity, to test the algorithm presented in the former section. We are interested to learn that the algorithm is better suited to a certain kind of objective function shape. [9]

Characteristics of Numerical functions:
The numerical functions used in the experiments have some characteristics.

5.1 Multimodal functions:
If a function has more than one local minimum, this function is called as multimodal (M) and multimodal functions.

Example:
Rastrigin function, Griewank function etc….

5.2 Unimodal functions:
If a function have only one local optimum, and this is global optimum, this function is called as unimodal (U) and unimodal functions. Example: Sphere function, Sum square function, Trid6 function, Trid 10 function etc….

5.3 Separable function:
If a function with n-variable can be written as the sum of the n functions of one variable, then this function is called as separable (S) function.

Example:
Sphere function, Sum square function, Rastrigin function.

5.4 Non-separable functions:
Non-separable function cannot be written in this form because there is interrelation among variables of these functions. Therefore, optimizing non-separable functions is more difficult than optimizing separable ones.

Example:
Trid 6 function, Trid 10 function, Griewank function etc….

Table1: Parameters of the ABC algorithm as used in.

Swarm Size	20
Number of scouts	5% -10% of number of bees
Number of onlookers	50% of the swarm
Number of employed bees	50% of the swarm
Limit	#onlookers. dimension

Scenario Parameters:
The following performance evaluation matrices are used to calculate the performance of the network.

Table 2: Scenario Parameters based on the different numerical functions.

Functions	Total packets	Delay	Packets Trans	Packet Delivery Ratio	Loss	Throughput
F1	760	3.7307	260	7.5	0.9901	203.7127
F2	760	3.115	260	7.5	0.9901	243.9205
F3	430	3.7424	260	7.5	0.9901	203.0799
F4	430	3.8374	270	2.4	0.9944	198.0514
F5	490	3.2263	270	3.3	0.9933	235.5668
F6	390	3.7329	270	1.8	0.9933	131.2661

Table3: Scenario Parameters of wireless sensor network.

No. of Iterations	Total Packets	Delay	Loss	Throughput	Packet Delivery Ratio
0	760	3.2544	7.5	209.27	0.9901
500	760	3.2444	7.5	232.10	0.9901
1000	430	3.2435	7.5	218.67	0.9901
1500	430	3.2391	2.4	233.72	0.9966
2000	490	3.2387	3.3	210.85	0.9973

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