

# A Case Study On Swarm Intelligence Based Sensor Network Optimization

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**Abstract-** Wireless sensor network technology was the promising technology applied for many applications. The performance of network is highly depends on architecture, routing algorithm and protocols. There has been a rapid growth in Research on swarm intelligence and many of the researcher has been selected swarm intelligence concept for sensor network optimization. This research paper is a review of swarm intelligence were applied in the wireless sensor network optimization

**Keywords-** Swarm intelligence, Artificial Bee Colony, Wireless Sensor Network

## 1. INTRODUCTION

Wireless sensor network (WSN) widely used in monitoring purpose which is formed by collective of sensor nodes deployed in the monitoring domain.

Sensor node is developed by integrating sensors with processing unit, transceiver, memory unit, and external power supply. Figure.1 is sensor node architecture.

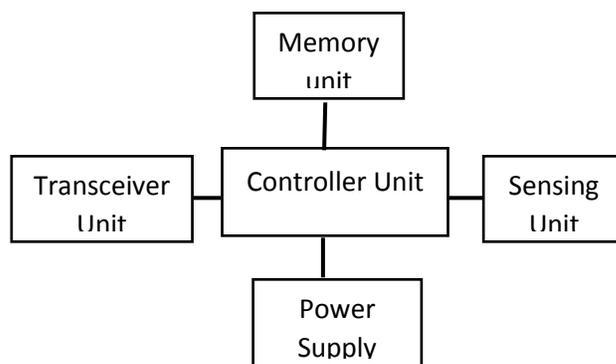


Fig. 1. Sensor Node Architecture

Sensor nodes sense the environment and sends the gathered the information to the sink node in terms of wireless communication and defined as sensor network. The size of the network is depends on the density of the nodes, sink node in a network has been selected single or multiple centered by density of nodes[1]. The network performance is assessed by its architecture topology, routing technique and characteristic like lifetime, responsive, robustness, scalability, heterogeneity, and self-configuration. WSN was widely used in many real time application like Military applications, Environmental applications, Health applications, Home applications and other commercial applications[2]

Researchers has been adopted techniques for sensor network performance optimizations in terms of

routing techniques, network topologies, data aggregation and synchronization for providing low cost limited energy constrain and self-organized network. Gaussian distribution, genetic algorithms, Radio Sleep Mode Optimization and Particle Swarm Optimization are some of the optimization models available in WSN[3].

## 2. SWAM INTELLIGENCE

In the year of 1989 the swarm intelligent concept was introduced by Gerardo Beni and Jing Wang. Swarm intelligence (SI) uses food foraging behavior of animals and the concept in decentralized and self-organized system naturally[4]. SI based algorithms gives the best solution for the optimization problems

like finding of best path for transmission, self-organization by finding of nearing neighbors. In WSN Based on the natural behavior of ant, honey bee, fish cuckoo and bat optimization problems were solved [5][6][7]. Fig.2 shows SI techniques used in Table.1. Existing work in swarm intelligence

WSN. SI models are broadly used by the researchers, in that artificial bee colony model have been used widely sensor network optimization. Table.1 shows survey on the SI algorithm used in WSN.

Author	Swam method	Application
Teodorović, Dušan (2008)	Ant colony	Traffic and transportation engineering applications
Rajani Muraleedharan, et.al(2008)	Ant system	Sybil attack prediction
Celal Ozturk et.al(2011)	Artificial Bee colony	Dynamic deployment of WSN
Buddha Singh, et.al(2012)	Particle swarm optimization	Energy-aware clusters with optimal selection of cluster head.
Gaige Wang et.al(2012)	artificial bee colony	dynamic deployment problem in WSN
Chen et.al(2012)	Hybrid ABC	reduce energy depletion
Xiangyu Yu et.al(2013)	artificial bee colony	Sensor deployment in WSN
Thi-Kien Dao et.al(2015)	Compact artificial bee colony	Topology control scheme in WSN
Yinggao Yue et.al(2016)	artificial bee colony	Data collection in sensor network
Jin Wang et.al(2016)	Particle swarm optimization	Clustering with mobile sink in WSN
Huadong Wang(2016)	artificial bee colony	efficient routing protocol for WSN
Hashim A. Hashim et.al (2016)	artificial bee colony	Optimal placement of relay nodes in wireless sensor network
Valero Rosset et.al (2017)	Ant Colony Optimization	Enhancing the reliability on data delivery and energy efficiency

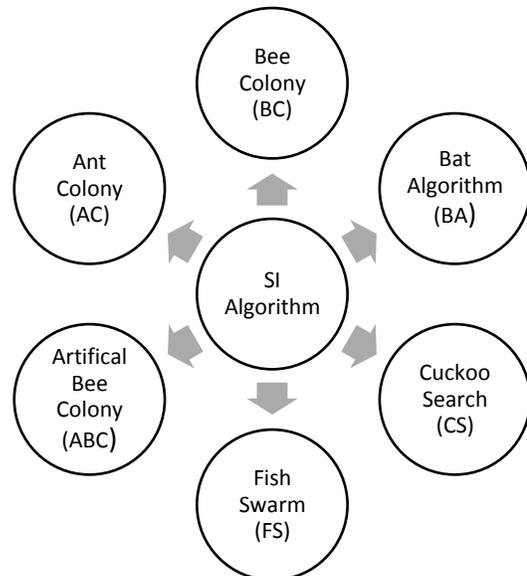


Fig.2.SI Techniques in WSN

### 3. ARTIFICIAL BEE COLONY ALGORITHM:

Artificial bee colony algorithm (ABC) is one of the SI algorithm inherits the natural honey bee food forage behavior. Bees are identifying the rich food location by conveying information among themselves which is the good example for team work, self-organizing and task performance[5].

There are three types of bee sets (employed bee, onlooker bee and scout bee) being in ABC, each bee sets performs optimization process like searching of food source by employed bees, finding of the location of The ABC initially create a randomly distributed swarm group size denoted as  $N$ , the  $i^{th}$  location of the food source is given as  $A_i = \{A_{i1}, A_{i2}, \dots, A_{in}\}$ , Each employed bee  $A_i$  generates new candidate solution  $V_i$  in the neighborhood of its present position  $V_{ik} = A_{ik} + \varphi_{ik}(A_{ik} - A_{jk})$ . rich food source by onlooker bees and moves towards new food source by scout bees[8].

Four types of tasks performed by ABC algorithms[9]-, initialization, updating of population, source selection and elimination of populations.

Where,  $A_i \neq A_j$   $K : \{1,2,3, \dots, n\}$  number of employed bees  $\varphi_{ik}$ : Random number  $[-1,+1]$

$A_j$ : Randomly selected food source. If the fitness value of  $V_i$  is better than  $A_i$ , then  $A_i$  is updated with  $V_i$ , otherwise  $A_i$  keep unchanged. An

onlooker bees select the food source depending upon its probability value is given as

$$P_i = \frac{fit_i}{\sum_{n=1}^N fit_n}$$

Where,  $fit_i$  is the fitness of the  $i^{th}$  food source

[8] Proposed ABC based data collection algorithm, obtained prolonged network life time by improving data collection efficiency and reduce data transmission. Quantum ABC based Energy efficient cluster head selection algorithm proposed by [10], it assure reliable network connectivity and improves network efficiency. [11] Proposed ABC algorithm to solve sensor node deployment problem by made modification in scout bee phase.

#### 4. CONCLUSION

It is evident, that swarm intelligence concepts has been adopted in sensor network optimization problem solving. ABC algorithm widely used in sensor network for solving problems in all aspect. It is one of the promising concept in WSN to improve network efficient in terms of node deployment, data collection, energy aware transmission and increases in network life.

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