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A Review of Data Collection and Path Optimize in WSN

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Abstract

The main task of a wireless sensor node is to sense and collect data from a certain domain, process them and transmit it to the sink where the application lies. The main characteristics of a WSN include power consumption constrains for nodes using batteries or energy harvesting, ability to cope with node failures, mobility of nodes, dynamic network topology, communication failures, heterogeneity of nodes, scalability to large scale of deployment, ability to withstand harsh environmental conditions. The direct communication between a sensor and the sink may force nodes to emit their messages with such a high power that their resources could be quickly depleted. Therefore, the collaboration of nodes to ensure that distant nodes communicate with the sink is a requirement. In this way, messages are propagated by intermediate nodes so that a route with multiple links or hops to the sink is established.

Keywords*: Cache, Cluster, LRU, Wireless Sensor Network, Routing Protocol.*

1. Introduction

Wireless Sensor Networks consists of very small sensors that are characterized by limited processing power and energy resources. WSNs are used in various domains like military applications, medical engineering, and industrial task automation. We need an optimal network in order to use its processing power at maximum. Technological advance has brought the opportunity to develop and use sensor devices with very small dimensions, low consumption and processing power. Generally a Wireless Sensor Network (WSN) is composed of a large number of wireless sensors with low processing power and energy consumption for monitoring a certain environment. Wireless communications are spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, 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. The development 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. Problem Formulation and Methodology

There is no infrastructure, wireless links are unreliable, sensor nodes may fail, and routing protocols have to meet strict energy saving requirements. Routing is a challenging task in WSNs because of their unique characteristics which makes it different from other wired and wireless sensor networks like cellular or mobile adhoc networks. In the wireless sensor networks, One of the most important and challenging problem in designing process is to develop an efficient routing protocol for providing the high traffic load which causes a data queue overflow in the sensor nodes. Since this queue overflow may causes data transmission failures, so to address this problem issue, we need a new enhanced routing protocol. The sensor nodes are aware of the data traffic rate to monitor the network congestion. The fitness function is designed from the average and the standard deviation of the traffic rates of sensor nodes. Thus, the optimal root path is traced for the data transfer. While transmission of data it alerts the sink node about the occurrence of the traffic.

3. Parameter for Routing Protocols in Wireless Sensor Network

The design of routing protocols for WSNs is challenging because of several network constraints. WSNs suffer from the limitations of several network resources, for example, energy, bandwidth, central processing unit, and storage. Due to the reduced computing, radio and battery resources of sensors, routing protocols in wireless sensor networks are expected to fulfil the following requirements;

• Energy Efficiency: Routing protocols should prolong network lifetime while maintaining a good grade of connectivity to allow the communication between nodes. It is important to note that the battery replacement in the sensors is infeasible since most of the sensors are randomly placed.

• Scalability: The numbers of sensor nodes in sensor networks are in the order of tens, hundreds, or thousands, network protocols

4. Swarm Intelligence

In recent years, swarm intelligence becomes more and more attractive for the researchers, who work in the related research field. It can be classified as one of the branches in evolutionary computing.

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

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) [8, 9, 10, 11, 12]. Later then, many swarm intelligence algorithms for solving problems of optimization are proposed such as the Cat Swarm Optimization (CSO) [13-14], the Parallel Cat Swarm Optimization (PCSO) [15], the Artificial Bee Colony (ABC) [16-17], the Particle Swarm Optimization (PSO) [18,19,20,21], the Fast Particle Swarm Optimization (FPSO) [22], and the Ant Colony Optimization (ACO) [23-24]. Moreover, several applications of optimization algorithms based on computational intelligence or swarm intelligence are also presented one after another [25, 26, 27].

Examples:

- group foraging of social insects
- cooperative transportation
- division of labour
- nest-building of social insects
- collective sorting and clustering

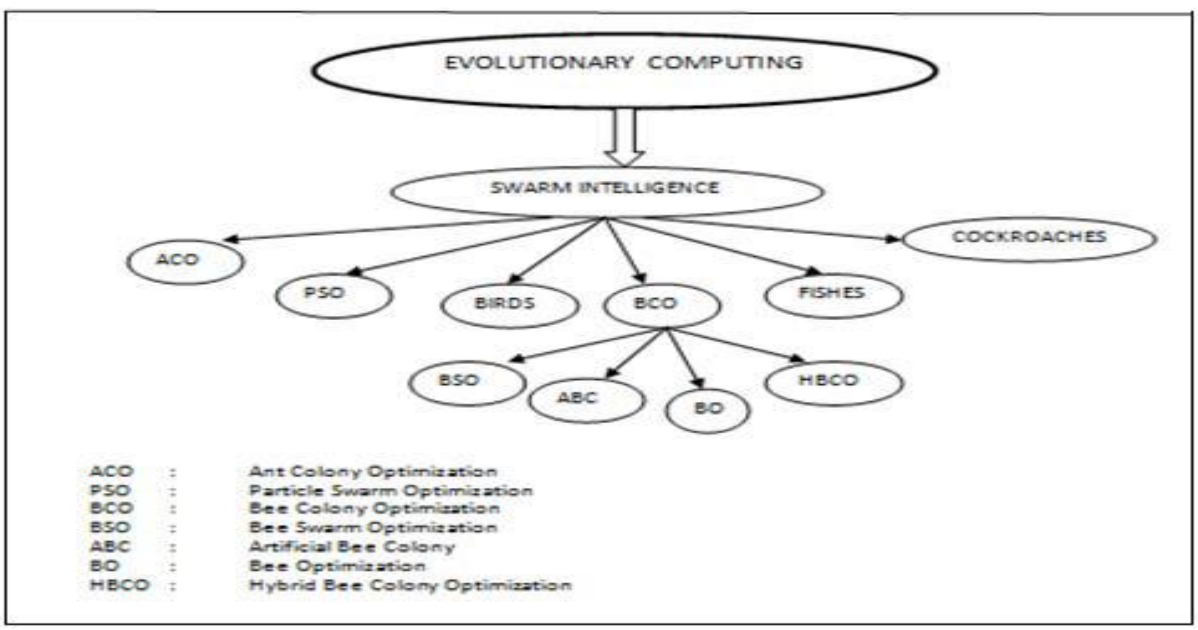

Figure 1: Evolutionary Computing

4.1 ACO

ACO is one of the Bio-inspired mechanisms. ACO is a dynamic and reliable protocol. It provides energy aware, data gathering routing structure in wireless sensor network. It can avoid network congestion and fast consumption of energy of individual node. Then it can prolong the life cycle of the whole network. ACO algorithm reduces the energy consumption. It optimizes the routing paths, providing an effective multi-path data transmission to obtain reliable communications in the case of node faults.

4.2 PSO

Particle swarm optimization (PSO) is a popular multidimensional optimization technique. Ease of implementation high quality of solutions, computational efficiency and speed of convergence are strengths of PSO. PSO has been a popular technique used to solve optimization problems in WSNs due to its simplicity, high quality of solution, fast convergence and insignificant computational burden. However, iterative nature of PSO can prohibit its use for high-speed real-time applications, especially if optimization needs to be carried out frequently. PSO requires large amounts of memory, which may limit its implementation to resource-rich base stations. Literature has abundant successful WSN applications that exploit advantages of PSO.

4.3 Artificial Bee Colony

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. The Artificial Bee Colony (ABC) algorithm, proposed by Karaboga in 2005 for real-parameter optimization, is a recently introduced optimization algorithm which simulates the foraging behavior of a bee colony [18]. The minimal model of swarm-intelligent forage selection in a honey bee colony which the ABC algorithm simulates consists of three kinds of bees: employed bees, onlooker bees and scout bees. Half of the colony consists of employed bees, and the other half includes onlooker bees. Employed bees are responsible for exploiting the nectar sources explored before and giving information to the waiting bees (onlooker bees) in the hive about the quality of the food source sites which they are exploiting. Onlooker bees wait in the hive and decide on a food source to exploit based on the information shared by the employed bees. Scouts either randomly search the environment in order to find a new food source depending on an internal motivation or based on possible external clues.

This emergent intelligent behavior in foraging bees can be summarized as follows:

1. At the initial phase of the foraging process, the bees start to explore the environment randomly in order to find a food source.
2. After finding a food source, the bee becomes an employed forager and starts to exploit the discovered source. The employed bee returns to the hive with the nectar and unloads the nectar. After unloading the nectar, she can go back to her discovered source site directly or she can share information about her source site by performing a dance on the dance area. If her source is exhausted, she becomes a scout and starts to randomly search for a new source.
3. Onlooker bees waiting in the hive watch the dances advertising the profitable sources and choose a source site depending on the frequency of a dance proportional to the quality of the source.

5. Some Function Explanations

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….

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….

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.

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.

6. Conclusion

It is available to all nodes over the network. The paper reviews various work done that include cache to enhance the network life time. In future, an approach can be designed that will improve the effective use of cache for a limited energy network and can be used in real time applications. we presented a new protocol for WSN path optimization Operation. The protocol is achieved by using Bio-inspired mechanism to optimize routing paths, providing an effective multi-path data transmission to obtain reliable communications in the case of node faults. We aimed to maintain network life time in maximum, while data transmission is achieved efficiently.Our study was concluded to evaluate the performance of artificial bee colony based algorithm in terms of Packet Delivery Ratio, Average end-to end delay and Throughput. Our proposed algorithm can control the overhead generated by bees, while achieving faster end-to-end delay and improved packet delivery ratio. The capability of the ABC algorithm for constrained optimization problems was investigated through the performance of several experiments on well-known test problems. Bio-inspired mechanism(ABC) were tested on six high dimensional numerical benchmark functions that have multimodality.

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