Implementation of PSO in Wireless Sensor Network

Kritika

Computer Science and Engineering,
Patiala Institute of Engineering and Technology for women, Nandpur Kesho

***Abstract*: Wireless sensor networks have several sensors compatible with a limited capacity battery. The network hierarchy can be selected according to the required applications, such as bulk order. Group leaders play a key role in the assembly of a wireless sensor network. Particle Swarm Improvement (PSO) is a swarm-based intelligence method to identify the best solution by flock behavior. PSO is based on the movement and intelligence of swarms. The social learning factor can achieve a better convergence speed and the particle redefinition mechanism reduces the chances of falling to the local maximum. Optimization is a mathematical technique used to know the maximum or minimum functions in some possible areas. A variety of optimization techniques are involved in the best solutions. Particle Swarm Optimization (PSO) is a relatively recent, topical and robust optimization method that is widely used to detect a global optimal solution within a complex search space. The proposed approach can give the best results as demonstrated in the simulation results.**

***Keywords*: Wireless Sensor Network, Particle Swarm Optimization, Topology**

1. Introduction

A Wireless sensor can be defined as network as a network of devices that can notify the information collected from the monitored field on a wireless link. Data has gone through multiple nodes, and by gateway, data connects to other networks like wireless Ethernet.
Fig: Wireless Sensor Network
WSN is a wireless network that includes base station and multiple nodes (wireless sensors). This network is used to monitor physical or environmental conditions, such as sound, pressure, temperature, and data, such as data interacting with data on the network.

1.1 WSN Network Topologies

For radio communication networks, WSN structure includes various preferences, such as the guardian below.

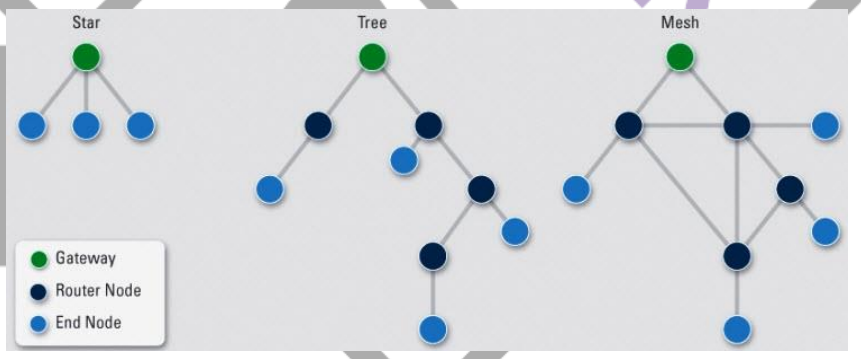

Fig 1. Wireless Sensor Network Topologies

1.1.1 Star Topologies

A Star topology is a communication topology which each node directly connects to the gateway. Can send or receive multiple remote nodes from a gateways message. In Star topologies, nodes are not allowed to send messages to each other. It allows low-latency communication between the remote node and the gateway (base station). Since it depends on a single node to manage the network, gateway must be inside the radio range of all individual nodes. Benefits include at least the ability to keep at least remote nods power consumption and easily control. The size of the network depends on the number of connections connected with the hub.

1.1.2 Tree Topologies

Tree topology is also known as a serious star topology. In a tree topology, every node is connected to a node at the top of the tree and then is connected to the gateway. The main advantage of tree topology is that the network can be extended easily and it is easy to detect error. The disadvantage network, it is simply trusting the cable; if it breaks, all the network will collapse.

1.1.3 Mesh Topologies

The Mesh topologies to allow transmit data from a node, which is in its radio range. If the node wants to send a message to another node, which is not within the range of radio communication, then it requires the intermediate node to move the message into the desired node. The advantages of this mesh topology include ease of separating and detecting errors in the network. The disadvantage is that network is too large and requires a lot of investment.

1.2 Design Goals of WSN

WSN contain hundreds or thousands of nodes that can be deployed in remote areas, can make network maintenance and organization unacceptable. To make reliable WSN design, the design challenge is necessary to understand the parameters. There are some challenges:

- **Deployment:** From many perspectives, deploying is related to WSN design. It defines the minimum number of essential sensor nodes for network construction. This sensor can also define the quality of platform that meets the needs of pre-defined life and coverage. Alternative design explains that the sensor network can find a sensor network for the expected life expectancy network and the expected life. Deployment answers a question: What is the maximum network life cycle and what is the scene of deployment for a number of nodes and coverage areas.

- **Security:** For many applications the security sensor is important for the network approval and use. The resource-related wireless sensor makes the nodes network very dangerous for various types of attacks; passive and functional. Some important attacks include service refusal, transferring data attacks, black holes, and Sybil attacks. Therefore protection network should consider availability, integrity, integrity and privacy.
- **Coverage:** One of the challenges is that the surveillance area is completely covered. It can be seen as a type of quality measurement (QoS) measurement that can be provided through a specific network. Coverage specifies the detection of events on a fixed time frame. In addition, due to weaknesses in some sensor sectors, coverage of deployment in coverage is included.

- **Quality of Service:** Successful QoS solution has been developed for the traditional network. However, WSN architecture and functionality are different from the traditional network. It makes it exceptional to implement the traditional QoS solution of the WSNs. The requirements of the WSN QoS are primarily determined by the application. The general QoS requirements for wireless sensor networks are data accuracy, data collection, coverage, error tolerance, and network life acquisition. The basic contraction of QoS for WSN is limited sensor limited resource and network dynamics. During maintaining network energy, it is a huge challenge to implement an effective focus solution. There is a need to do so many investigations yet.

- **Energy and Lifetime**: Network deployment is an important element of life expectancy. Wireless sensor networks WSN need to work for months or years. The main limited element in the sensor network life is to supply energy. Each sensor is equipped with a limited battery. Because the node is posted in a harsh area, it may not be possible to change or recharge the node's battery. Some network actions use some sensor battery capabilities. The network is known for a specific life. Then network life should be considered to maximize the network life and maximize energy consumption.

1.3 Types of WSNs (Wireless Sensor Networks)

Wireless Sensor Networks (WSNs) are self-contained devices that monitor physical or environmental conditions. These networks can monitor the site off. Early (Terrestrial Wireless sensor networks (TWSNs), (Body Area Network (BAN), in water (Underwater Wireless Sensor Network (UWSNs), etc. can be used for wireless sensor networks. Depending on the environment, the type of network is set to be posted underwater, underground, land, and so on. Various WSNs include:

1. Terrestrial WSNs
2. Underground WSNs
3. Underwater WSNs
4. Multimedia WSNs
5. Mobile WSNs

2. Background

Kulkarni & Venayagamoorthy (2010) Wireless Sensor Network (WSNs) is a network of autocomplete nodes used to monitor the environment. Wireless sensors network developers face communication problems of communication, missiles and computing restrictions, and limited energy due to challenges. Many of the wireless sensor networks have been developed as issues of multi-dimensional reform and are found through bio-inspired techniques. Particle Certification Optimizer (PSO) is a simple, effective and computationally efficient optimization algorithm. It has been implemented to resolve WSNs issues such as maximum deployment, node localization, clustering, and data collection. This article indicates issues in WSN, PSO is introduced and discusses its applicable WSNs applications. It also briefly describes that PSO is customized to resolve these issues. **Banka, H., & Jana, P. K. (2016)** In this paper, recommends the based algorithms based on a mental change correction (PSO) called PSO-MSPA to overwhelm multiple WWS in WSN. Algorithm is developed using an effective particle coding scheme and a novel fitness function. PSO - MSPA energy efficiency, they consider gateway to count on different parameters such as Evelyn's distance and hop count. By

changing the number of gateway and sensor nodes, different ideas of WSN are tested widely, and the results are analyzed to show the effectiveness of the analyzed algorithm. **Pandey, A., Rajan, A., & Nandi, A. (2018)** Wireless Sensor Networks (WSNs) are widely used in many applications that are related to sensing and weight measurement. Nodes used in the network are basically powered by batteries, and due to strange areas, it is not always easy to change. Various projects have been introduced and implemented to manage this BSN resources of BSN. In this article, they use the mask flame correction algorithm in clustering and routing to improve the center of the network. The results obtained from this algorithm are compared with different algorithms before compared to variable correction, genetic algorithm and minimal distance cluster algorithms. **Wang, J., Gao, Y., Liu, W., Sangaiah, A. K., & Kim, H. J. (2019).** Energy efficiency and energy balance are important investigative issues based on the self-regulating wireless sensor network (WSNs) routing protocol design. Since the load of many documents forwarding using a clustering algorithm, however, to obtain energy balance and energy efficiency, generally present energy holes around the cluster head (CHs). Due to harmful clustering for NP-hard problem is proven, so solving the problem has proven to take advantage of several Meta disclosure algorithms. Additionally, there is a proposal that energy-centered energy centers use special search clustering particle crowd optimization (EC-PSO) to avoid energy risks and called CHS Selection

3. Particle Swarm Optimization (PSO)

Features of particle tips are in the field of artificial intelligence. The term "artificial intelligence" or "artificial life" is based on the principle of human behavior hearing. It involves designing a computer system capable of working, which requires human intelligence. For example, only humans were able to recognize the first person speech. But now, speech recognition is a common feature of any digital device. This is possible through artificial intelligence. Other examples of human intelligence may include decision makers, language translations, and visual ideas. These are probably different techniques. This technique to apply artificial intelligence to computers is often called artificial intelligence methods.

Particle Swarm optimization (PSO) is a population based stroke optimization technique developed by Dr. Eberhart and Dr. Kennedy in 1995, this inspired by social behavior of bird flocking or fish school education.

PSO evolution has many similarities with computing techniques like genetic algorithm (GA). This system updates algorithms with random settings and searches for best value. However, unlike GA, no evolution operators in PSO such as crossovers and mutations. In PSO, fly the problem by following the possible solutions called particles following the current best particles.

Each part tracks its rules in the space of trouble, which has yet to be obtained from the best solution. (Fitness value is also stored.) This price is called pbest. There is a good value obtained by any particle in any particle except the particle. This place is called 1best. When the particle receives all the population as operational neighbors, the best value is the world's best value, which is called Justice.

Improvement of the particle change involves a change in speed (high speed) in which each part at each stage indicates its maximum position and the maximum position (local version of PSO) at each stage. High speed is in weight through a random period, which generates random numbers separately to speed up and downward positions.

In the last few years, PSO has been successfully implemented in many research and application areas. The results show that PSO gets better results in cheaper way faster, in other ways.

Another reason for PSO is that there are some parameters to adjust. A version is a bit different and is suitable for different types of applications. Used for partial background modes that can be used in various types of applications and specific applications for specific needs.

4. Simulation

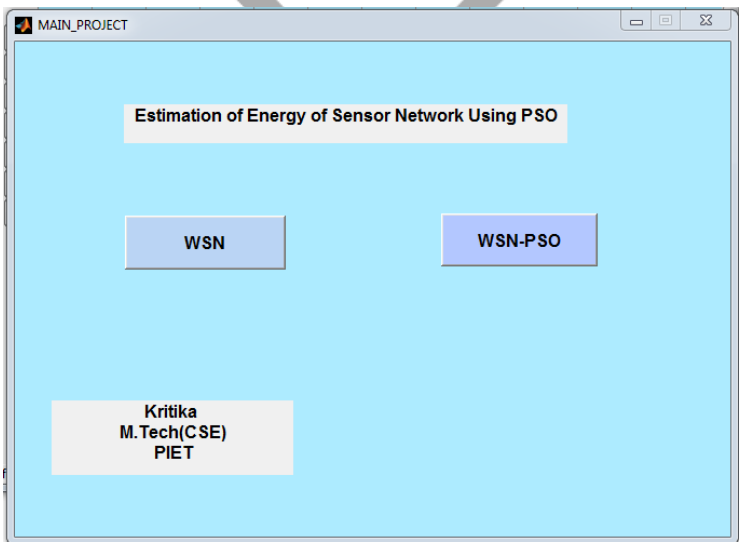

Fig. 2. Simple Layout of project

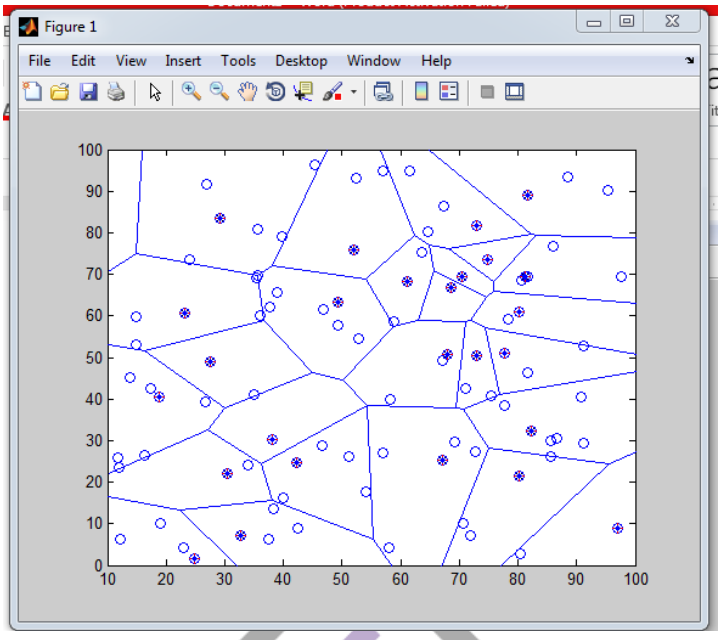

Fig. 3. Cluster of nodes with cluster head

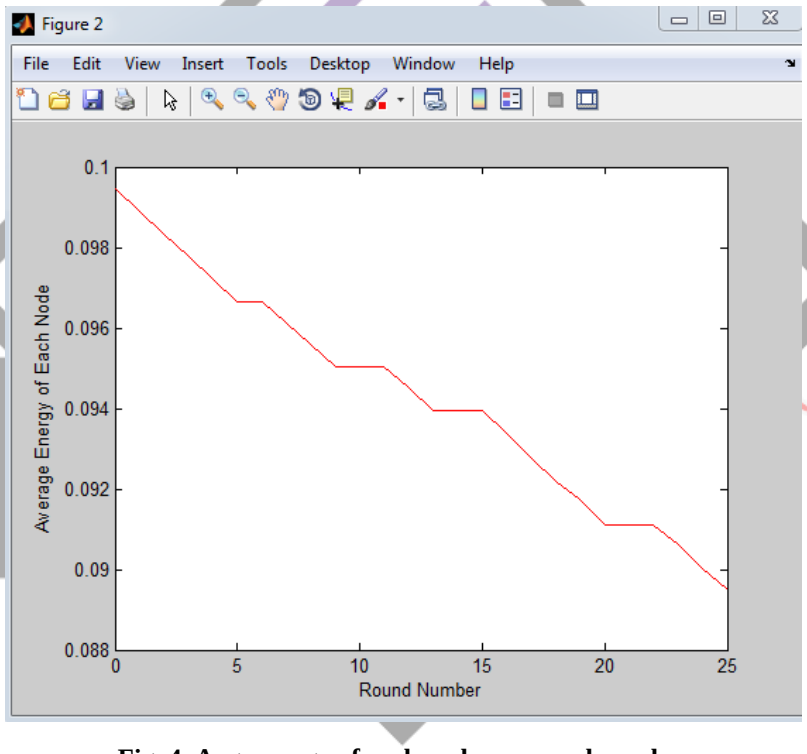

Fig. 4. Avg. energy of each node vs. round number

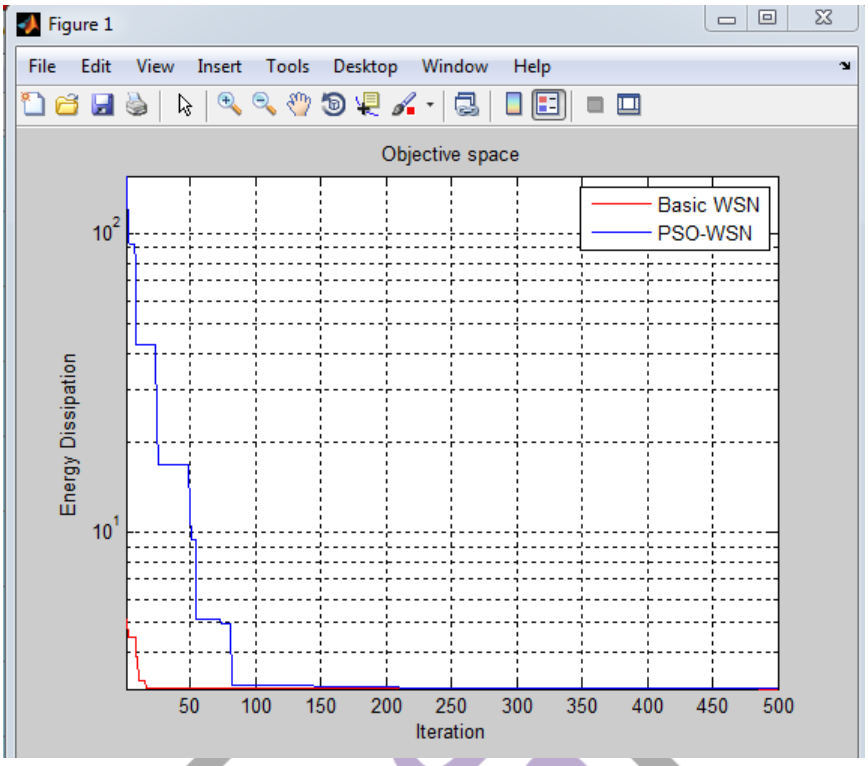

Fig. 5. Comparison between basic WSN and PSO-WSN

5. Conclusion and Future Work

Wireless sensor networks comprise several sensor nodes being supported by limited capacity battery source. The network hierarchy may be chosen as per required applications, such as clustered arrangement. Cluster heads play a major role in clustering Wireless Sensor Network. Particle swarm optimization (PSO) is one of the swarm based intelligence methods for locating optimum solution by imitating the behavior of flocks of birds and fish schooling. PSO is based on the movement and intelligence of swarms. Social learning factor can achieve better convergence speed and particle reselection mechanism reduces the chances of being trapped in local maximum. Optimization is a mathematical technique that is used to find out the maxima or minima of functions in some feasible region. A variety of optimization techniques participate for the best solution. Particle Swarm Optimization (PSO) is a relatively latest, topical and potent method of optimization that is broadly used to uncover the global optimum solution in a complex search space proposed framework is cluster based technique in which respective cluster heads are chosen according to particle swarm algorithm based on re-selection mechanism. Proposed approach is able to give best results as proved in simulation results.

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