# Transmission Power Minimization for IOT based Fully Connected Cluster using Implementation of PSO Technique

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***Abstract*—the Internet-of-Things is the concept of connecting any device with sensor devices. This includes everything from cell phones, appliances, components of machines, wearable devices. Now days, Wireless sensor networks (WSNs) are interconnected IOT that communicate wirelessly to collect data from cluster areas. However, WSN comprise energy-limited devices, the techniques that serve to minimize energy have become a latest trend in research. Since energy saving comes at a lowering the network cost, its consequences can be considerable in order to keep their communication effective. In this research work, the use of particle swarm optimization (PSO) technique is used minimize transmission power for IOT based fully connected cluster. The transmission powers of each node are calculated without creating disconnected areas in a sensor cluster. The proposed PSO algorithm reduces energy of sensors cluster network when compared to the common deployment of nodes with a single transmission power.**

***Index Terms*—Internet of Things, Wireless sensor networks, PSO, cluster networks.**

## I. Introduction

As the Internet of Things (IoT) becomes real but it has, different problems like different energy-constrained nodes and mesh networks. One of the complicated issues is related to the optimization of transmission power for each node of cluster network when whole network is connected. New challenges arise due to increasing diversity of related networks to form the Internet of things (IOT).A centralized algorithm may have an efficiency in distributed scenarios of IoT network communication increased overhead with other nodes. several studies in the literature analysis various centralized solutions are derived to solve different wireless sensor networks problems. According to the previous analysis Particle swarm optimization (PSO) is one of the easy solution because fast to converge and computationally efficient. Thus, PSO is considered for this work. The set of solutions for WSNs are possible using PSO which include optimal nodes deployment, energy-aware clustering, node localization, and data aggregation. The proposed work considering nodes deployment and connectivity to minimize energy consumption while keeping the cluster fully connected cluster. At the present research and analysis phase with real technologies like different bandwidth, power consumption and range.WSN is an effective technique for extending the clustering in network lifetime. The normal WSN cluster routing methods assume that there is no hurdle in a field of interest in many applications in order to generate report parameters such as humidity, temperature, pressure, chemical and light activity. Transmitted reports from these sensors are collected by base stations. Therefore, energy reduction is an important task of proposed project. In these networks, in order to support data aggregation through efficient network organization, the sensors can be divided in a number of clusters to improve the reliability of measurements, reducing the overhead on the network communication it leads to significant energy reduction. Most of difficulties to WSNs can be modeled as optimization problems using Meta heuristic approaches. Particle swarm optimization is one of the solutions for minimizing power transmission technique for fully connected cluster network. The optimal solution to calculate the minimal power for each sensor node to connect each and every node of a wireless sensor network. PSO is one possible solution, which will be considered in this proposal. Its results will be compared to a simplistic solution, where all nodes adopt the highest needed power to connect a node. Hence, it will be possible to assess the distance from the PSO solution to the simplistic one and, also, the energy saving of the former over the latter. The test procedures applied to the simplistic method and the PSO proposal are presented. Algorithms presented using MATLAB programming. The PSO proposal achieves deterministic results for each run. The results are tested five times run for each scenario, and the best result is considered among these five runs. In this work, PSO is used to find the minimal necessary power to connect every node of a wireless sensor network to calculate different transmission powers for each node, without creating disconnected areas in a sensors cluster. The achieved results show that the proposed PSO algorithm is able to save sensors energy when compared to the common deployment of nodes with a single transmission power.

## II. WIRELESS SENSOR NETWORKS

### A. *Introduction*

Wireless Sensor Networks (WSNs) can be defined as a self-configured and infrastructureless wireless networks to monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants and to cooperatively pass their data through the network to a main location or sink where the data can be observed and analysed.A sink or base station acts like an interface between users and the network. One can retrieve required information from the network by injecting queries and gathering results from the sink. Typically a wireless sensor network contains hundreds of thousands of sensor nodes. The sensor nodes can communicate among themselves using radio signals. A wireless sensor node is equipped with sensing and computing devices, radio transceivers and power components.The individual nodes in a wireless sensor network (WSN) are inherently resource constrained: they have limited processing speed, storage capacity, and communication bandwidth. After the sensor nodes are deployed, they are responsible for self-organizing an appropriate network infrastructure often with multi-hop communication with them. Then the onboard sensors start collecting information of interest. Wireless sensor devices also respond to queries sent from a “control site” to perform specific instructions or provide sensing samples. The working mode of the sensor nodes may be either continuous or event driven. Global Positioning System (GPS) and local positioning algorithms can be used to obtain location and positioning information. Most of the time, the research on wireless sensor networks have considered homogeneous sensor nodes. But nowadays researchers have focused on heterogeneous sensor networks where the sensor nodes are unlike to each other in terms of their energy.The authors addresses the problem of deploying relay nodes to provide fault tolerance with higher network connectivity in heterogeneous wireless sensor networks, where sensor nodes possess different transmission radii. New network architectures with heterogeneous devices and the recent advancement in this technology eliminate the current limitations and expand the spectrum of possible applications for WSNs considerably and all these are changing very rapidly.

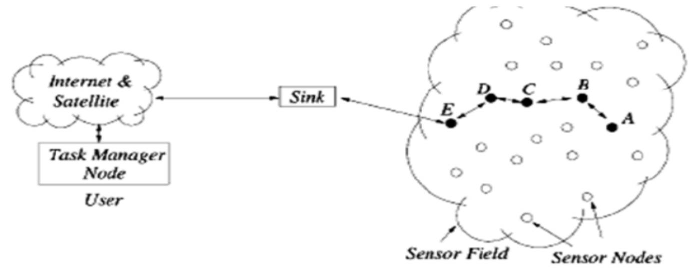


Fig. 1. A typical Wireless Sensor Network

### B. *B. WSN Design issues*

There are a lot of challenges placed by the deployment of sensor networks which are a superset of those found in wireless ad hoc networks. Sensor nodes communicate over wireless, lossy lines with no infrastructure. An additional challenge is related to the limited, usually non-renewable energy supply of the sensor nodes. In order to maximize the lifetime of the network, the protocols need to be designed from the beginning with the objective of efficient management of the energy resources.Wireless Sensor Network Design issues are mentioned in, for simulation and testing of routing protocols for WSNs are discussed in. Let us now discuss the individual design issues in greater detail. Fault Tolerance, Scalability, Production Costs, Hardware Constraints, Sensor Network Topology, Transmission Media,Power Consumption.

### C. *C. WSN structure*

A sensor node is made up of four basic components such as sensing unit, processing unit, transceiver unit and a power unit. A functional block diagram of a versatile wireless sensing node is provided in Fig. Modular design approach provides a flexible and versatile platform to address the needs of a wide variety of applications. For example, depending on the sensors to be deployed, the signal conditioning block can be re-programmed or replaced. This allows for a wide varietyof different sensors to be used with the wireless sensing node. Similarly, the radio link may be swapped out as required for a given applications’ wireless range requirement and the need for bidirectional communications.

## III. DEPLOYMENT IN WIRELESS SENSOR NETWORKS

The performance of a wireless sensor network is greatly influenced by the process of deploying the sensor nodes. The issue of deployment and positioning of sensor nodes in a WSN is a strategy which is used in defining the topology of the network, the number and the position of the sensor nodes. Coverage: it is among the most predominant issues to ensure the quality of service in a WSN. Several types of coverage are presented: area coverage, barrier coverage and point (event or moving target) coverage. Fig. 3 presents the different coverage types. • Optimization of the energy

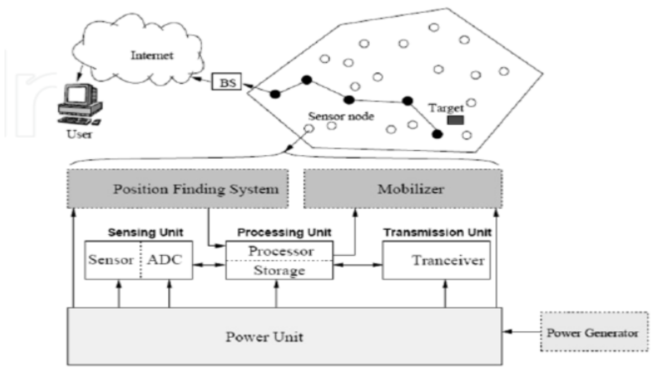


Fig. 2. The components of a sensor node

consumption by nodes and assurance of the energy efficiency,

- Network connectivity,
- Lifetime of the network,
- Network traffic,
- Reliability of data
- Cost of deployment (the number of deployed nodes)
- Fault tolerance and load balancing between nodes.

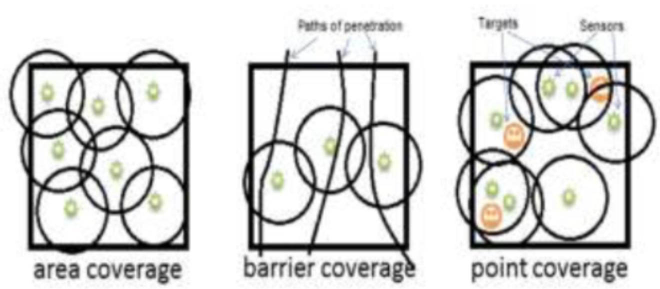


Fig. 3. Coverage types

In what follows, we discuss centralized, decentralized and hybrid approaches to solve the problem of deployment. Then, we present some similar problems and applications of the deployment.

## IV. DEPLOYMENT IN WIRELESS SENSOR NETWORKS

A wireless sensor networks consist of tiny sensor nodes to monitor physical or environmental conditions such as temperature, pressure, sound, humidity etc. The network must possess self configuration capabilities as the positions of the individual sensor nodes are not predetermined. Routing strategies and security issues are a great research challenge now days in WSN but in this paper we will emphasize on the routing protocol. A number of routing protocols have been proposed for WSN but the most well known are hierarchical protocols like LEACH and PEGASIS.

### A. Phases of LEACH

As described earlier the operation of LEACH consists of several rounds with two phases in each round. Working of LEACH starts with the formation of clusters based on the received signal strength. The first phase of LEACH is Set-up phase and it has three fundamental steps. 1. Cluster Head advertisement 2. Cluster setup 3. Creation of Transmission Schedule During the first step cluster head sends the advertisement packet to inform the cluster nodes that they have become a cluster head on the basis of the following formula: Let x be any random number between 0 and 1. Where n is the given node, p is the probability, r is the current round, G is the set of nodes that were not cluster heads in the previous round, T(n) is the Threshold.

$$T(n) = \begin{cases} \dfrac{P}{1 - P[r * \bmod(1/P)]} & \text{if } n \in G \\ 0 & \text{otherwise,} \end{cases}$$

## V. PARTICLE SWARM OPTIMIZATION

Kennedy and Eberhart introduced Particle Swarm Optimization (PSO) to overcome optimization problems of non-linear functions. The optimal solution search for a give problem in d-dimensional can be performed by the algorithm through the iterative process.Due to the exchange of experiences with swarm and interaction of particles. fitness function and their positions are updated individual and collective information.when ever the solution is reached stop the execution steps.The equation describes the speed and position updates of every particle.where velocity vector; vi=[vi1, vi2, vi3, ..., vid] and position vector; xi=[xi1, xi2, xi3, ...,xid] , gBest= global Best , pBest=position Best, r1,r2 are randomly generated values in the interval [0,1].The position and speed of the particle is written as The algorithm is stopped when a quasioptimal solution is found or by reaching the maximum number of execution steps. Equations define the speed and position updating of each particle in the tth step of the algorithm. For a determined particle i in the d-dimensional search space, it can be considered that: xi=[xi1, xi2, xi3, ...,xid] is the particle position vector; vi=[vi1, vi2, vi3, ..., vid] is the particle velocity vector; pBesti is the individual position of particle i that has the best fitness value; gBest is the global position that has the best swarm fitness value; c1 and c2 are the social and cognitive parameters, and; r1 and r2 are values randomly generated in the interval [0,1]. The term is known as the inertia factor, used to achieve a better control of the particle velocity in the search space. It will be initialized with a maximum value Max and decreased linearly to a minimum value Min, subject to the maximum number of steps of the algorithm, according to Shi and Eberhart . The position and the speed of each particle is

$$v_i(t+1) = \omega v_i(t) + c_1 r_1[pBest_i - x_i(t)] + c_2 r_2[gBest - x_i(t)]$$

$$x_i(t+1) = x_i(t) + v_i(t+1)$$

The position and the speed of each particle is limited by the constraints [xMin; xMax] and [vMin; vMax], respectively, in order to prevent paths outside the search space from being explored, according to Poli et al.

Algorithm. pso model:

## VI. RESULTS

Fig 4,Fig 5,Fig 6,Fig 7

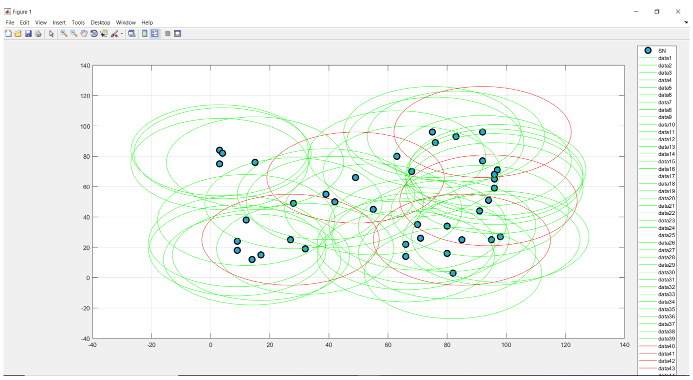

Fig. 4. Cluser formation of network

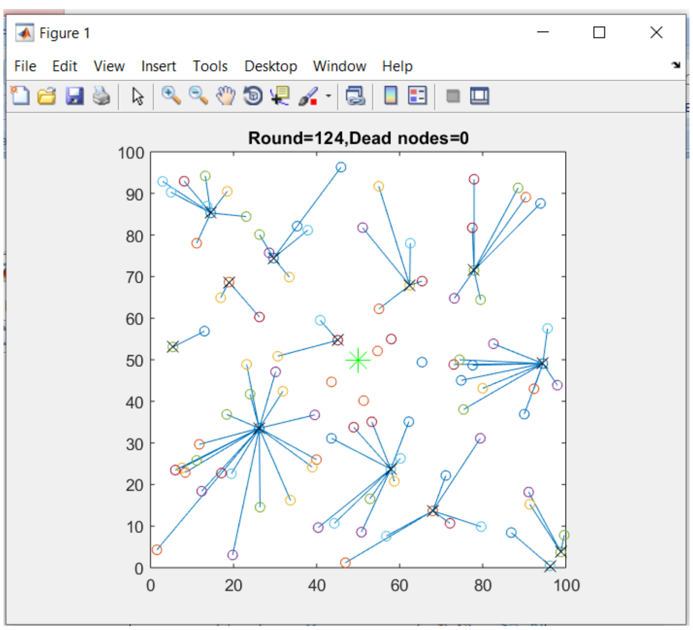


Fig. 5. Implementation of LEACH

## VII. CONCLUSIONS

More sensor node connected becomes inter connected to make IOT becomes real. WSN comprise energy-limited device to save energy become a new trend Cluster formation

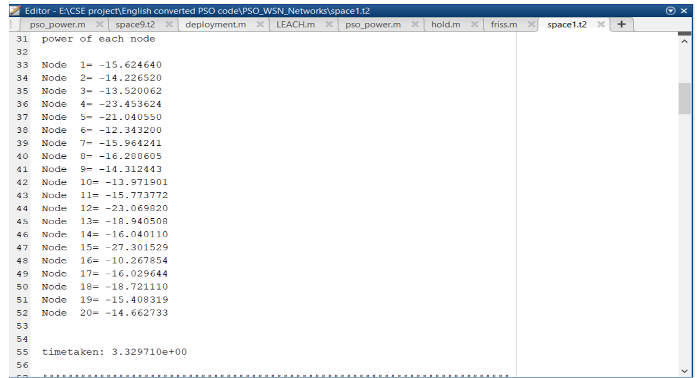


Fig. 6. Energy calculation using PSO

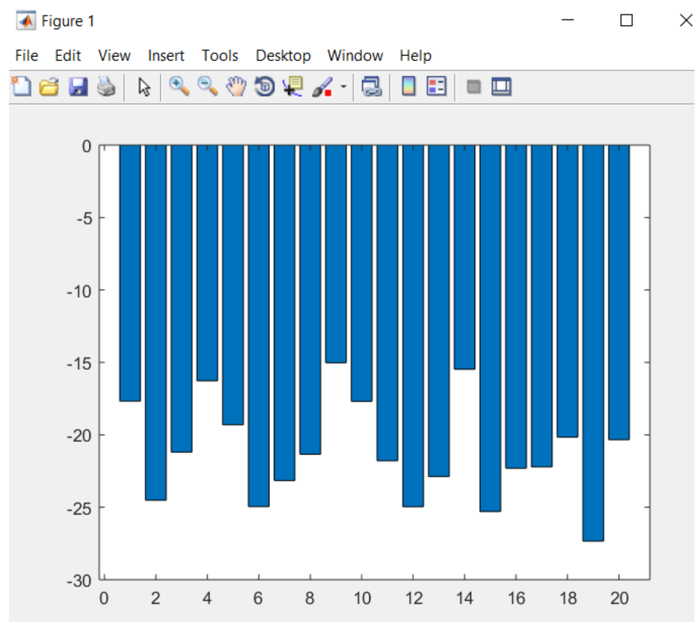


Fig. 7. Energy scenario for individual nodes

using LEACH algorithm. PSO method has been proposed to calculate different sensor nodes transmission power in order to save sensors energy. In this work, a PSO method has been proposed to calculate different sensor nodes transmission power in order to save sensors energy while keeping all nodes connected. When compared to a constant power setup for the sensors, which is a common practice on the deployment of such networks, the PSO method could save total network transmission power.

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