

# Network Life Time Analysis of WSNs Using Particle Swarm Optimization

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**Abstract**— WSN (Wireless Sensor Network) is one of the most standardized administration network utilized and applicable in some business and modern applications, On of its account, its specialized main improvement in a processor, corresponding, and its lowest control use in registering or applicable gadgets. The network is worked with hubs that are mainly to watch the environmental measure like temperature, mugginess, weight, position or movement of objects or particles, sense and vibration, noise and furthermore. By increasing its lifetime, the power of safeguarding measures is essential and necessary to upgrade and to increase the lifetime of network in WSN. Algorithms that use clusters are especially developed to improve and increase the network lifetime. One of the main technique that is used to increase the network lifetime is Sensor node Clustering. In this technique, data can be mainly aggregated at the Cluster head. Particle swarm optimization (PSO) is one of the most basic, successful and advancement algorithm used to increase the lifetime of network. It helps in framing or grouping the clusters and the data is aggregated at the Cluster head and then it is passed to Base station (BS)

**Keywords**-WSN, PSO, Cluster head, LEACH protocol

## I. INTRODUCTION

A Wireless Sensor Network (WSN) is one of the most sensor network that can sort of remote system and it incorporates the huge number of flowing nodes that are mainly self-coordinated, that contains low controlled gadgets named called as Sensor hubs or Sensor nodes called “Bits”. One of these systems mainly contains a huge number of battery operating gadgets. These gadgets are organized and grouped together and processed and exchange their information mainly to the administrator, and mainly control the capacities that are used for processing information and handling information. Nodes are one of the minor PCs, which work mainly to frame the system. A WSN is typically applicable on a worldwide scale for sharing data that is useful for many applications. Some of the applications are: Used in military for observance and surveillance for the structuring the framework of system, applicable in houses to know or figure out the homes are smart for example: automatic control of home appliances like television, AC, fridges etc. and also applicable in dead bodies for observation of patent. WSN is a large network that mainly contains huge number resources that are useful for purposes. In this network, the nodes are grouped and they coupled with some of the preset capabilities and they are used for sensing and processing the information, meet the objectives of the software. This Network is quite complex and quite tough or hard network when the specific sources or resources are restricted. The most important critical issues in wireless sensor network

(WSN) is of conversation cost that is optimized and of over headed scheme.

Huge efforts have been optimized to reduce the communication overhead. Due to aggressive nature of wi-fi network, “Optimization” is very critical issue and hence because of this network lifetime can be reduced. For example: for monitoring the information in environment and also applicable in navy, etc. Exchange link in a sensor network is a tough task mainly due to some resources and nature of transmission devices.

**Particle Swarm Optimization (PSO):** Particle Swarm Optimization (PSO) is a primarily based boost and development Technique to increase the lifetime of network. It has been adopted to gain the data at the Cluster head selection through several clustering protocols that are centralized and data can be aggregated and later it is sent to base station. Clustering is a repeatable process, there is less complicated the optimization and development approach and network lifetime is increased. PSO is a mainly famous and popular in clustering in wi-fi network. This technique is multidimensional developing and advancement technique. Implementation can be easily manipulated and gives the best solutions to the network and also best performance can be measured and intensity also measured. These are the benefits and strength of this technique.

## II. PROBLEM STATEMENT

Consumption of energy is one of the important goals of wireless sensor network. The main problem of this network elements can be sensed that power of resources that are highly restricted. In order to increase the lifetime, preservation measures are taken to develop the lifetime of network. In order to increase the lifetime of the WSN, PSO algorithm with different types of protocols with LEACH and techniques have been proposed and developed.

The rest of the paper has managed as follows:

Section II contains the architecture and description of WSN, Section III contains the Literature review, Section IV contains the various Optimization or development Techniques, Section V contains the WSN

### III. ARCHITECTURE OF WSN

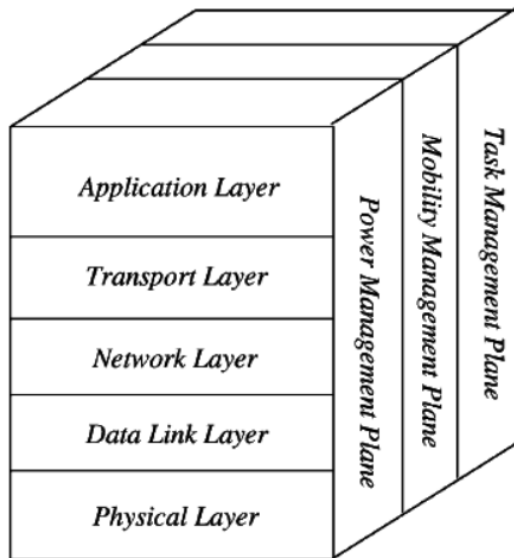


Fig:1 Architecture of WSN

This section gives mainly the architecture of WSN. The architecture of WSN contains five layers and three planes of management of network.

- **Application Layer:** This layer is chargeable for controlling the traffic that is mainly used for transferring the data without any disturbance and also gives platform for software that is mainly applicable for many purposes. One of the important task of this layer is for conversion of information or the data in a very understandable, neat format shape to find high-quality rated facts, so data can be understand in well equipped manner.
- **Transport Layer:** The function of the shipping or transport layer is to deliver or pass the information without any disturbance or deleting the information and that has reliability manner.

- **Network Layer:** One of the important aspect of this layer is “Routing”. This layer has huge number of tasks based on the platform software, however one of the main duties of this is in conservation of electricity, less storage of memory, process of buffering, and sensor don’t have the perfect identity and they are prepared by themselves to do the tasks.
- **Data Link Layer:** This layer is for the purpose of detecting the frames, streaming of records, and error controlling and so on.
- **Physical Layer:** This layer is used for transformation of bits for above medium. This layer is used selecting the frequency for operating the data, technique for frequency carrier, for modulation of signals and for detection and also for encrypting.

### IV. LITERATURE REVIEW

This segment gives the literature evaluation in the direction of cluster head selection in Wireless network.

Particle Swarm technique is kindly attributed to Kennedy, Eberhart and Shi[1] and they become the first for simulating and finding the social behavior, and as stylish description of the organisms movement in a fowl flock or fish school. Rules are simplified and it turned into observed acting of development. The book that was written by Kennedy and Eberhart describes many philosophical facts of PSO technique and also gives the information related to swarm intelligence.

The Prof N.V.S.N describes the information related to energy green developing approach that use set of rules for Firefly. These rules depend mainly on the velocity of mild and node distance. Depth of light is greater, there is less distance among the nodes. Data is first off sent to the nearest node so there is less conservation of energy and minimises the inter cluster distance. And also improves the performance and evaluate related to LEACH and PSO-C protocols. [2]

Another Professor called Rajeev Kumar proposed and discovered the development technique called “Ant bee colony optimization and Ant colony optimization (ABCACO). This development technique increase the network lifetime. This developed technique uses clustering hierarchy. Operation can be done and decrease the space and gap between cluster head and base station. High performance of the network can be measured [3]

[4]Varsha Gupta and Shashi Kumar Sharma: These two gives information related to cluster head selection on modified Ant Colony optimization by using LEACH protocol.

[5]Sunil R. Gupta, a researcher showed the prove that the scheme of the clusters develops the long holes of network.

There is burden of management when nodes grow nearer to the sink at the base station because of this extra amount of energy can be depleted.

Clustering is the dividing challenge mainly for the population. Mainly the data factors can be divided and spread into facts that are related to business that are within the same groups are very same to alternative points of data that are within the same cluster that were in the different groups. The clustering technique increases the lifetime and improves the performance and efficiency [6] [7].

Many protocols have been developed and the goal is to increase the lifetime by selecting cluster head based on different architectures. LEACH [Low power Adaptive Clustering Hierarchy][5] widely used protocol. In this formation of cluster can be done when the nodes select themselves as cluster heads. Every node become once as cluster by 1 by P rounds where P defines cluster head percentage.

The persons called Kuila & Jana[8] proposed a one of the most approach called clustering and routing ,problems can be understood without any doubt and solved and also increase the lifespan of WSNs and also gives details related to Linear/Nonlinear Programming (LP/NLP). Problems definitions can take and proposed by a means of some particular strategies for PSO. The manner of routing has been settled up with encoding of particle scheme and also has a fitness of multiobject. The algorithm can be defined via the balancing the lode by preservation of nodes of power.

Singh, (in the year 2016)[9] have proposed a Multi-Hop LEACH: It's a energy efficient routing conference mainly for sensor network. This method is applicable and visioned in both PSO approach and in V-LEACH protocol and also used in design of multi-hop machine. In this data exchange has been implemented to dissipation of restricted power and within the data transfer from CH to the sink.

Fateh boutekkouk: He developed one of the technique related to hybrid based on heterogeneous network for increasing the lifespan. Two techniques are proposed related to firefly and chain that is mainly based on routing. First approach is for locating the quality of highest clustering with efficient use of algorithm of firefly. After selecting the cluster, the cluster that is in inside location have to locate best chain based on mechanism of routing and also consumes lesser strength[10]

Rejina Parvin developed a more suitable and efficient optimized power green routing protocol (E-OEERP) for preventing the forming of one of the residual nodes. In this paper, techniques called (PSO) and gravitational seek algorithm (GSA) are efficiently used. In some of the stage, during the formation of cluster, the nodes that are not a

member of any one of the cluster. Such nodes are called as residual or character nodes. These nodes transfer the high power to the base station. A cluster can be formed on the basis of residual energy and iterations can be prevented. GSA tells the next hop distance of the node.[11]

[12]P.Leela and K.Yogitha proposed rules that are used for increase the network lifespan. For due to better consumption of power some of the approach may be used such as hybrid clustering approach, where as in firefly set of rules, clusters are cleanly shaped, where in artificial bee colony a less energy is intake.

## V. VARIOUS OPTIMIZATION TECHNIQUES

1. **Ant Colony Optimization (ACO):** It is totally based on behaviour of ants. It mainly solves the problem of locating and pinning one of the most excellent and useful direction from source path to destination path based on the real conduct of ants. At first, ants start to move randomly to locate their source and they returned to their colony. Ants while leaving their pheromones whilst and moving back to their colony mainly indicates the route for their food. Different ants with the same route to attain on their meals source. The ant left Pheromone makes the ant stronger as many ants move on identical or similar path. The amount of pheromone that is deposit or deployed, which mainly rely on the quantity and quality of their great source of meals. After some time, whilst food sources can be slightly decreases and also describes the one of the most important shortest path details for transmission of records in WSN.

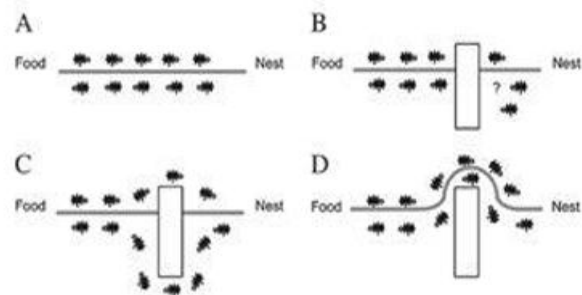


Fig:2 Ant Colony Optimization

2. **Fire Fly Optimization (FFO):** It is one of the Meta heuristic and advancement algorithm. It mainly tells about the flashing behaviour of the fireflies and also gives details related to function of the particle. It especially relies on one of these strategies or steps:
  1. Fireflies are unisex.
  2. Attraction can be done based on the light that is directly proportional to the amount of brightness.
  3. Increase in distance, decrease in depth.

**Existing System: Genetic Algorithm (GA)**

3. **Genetic Algorithm (GA):** Mainly solves the optimization problems. In this, there is a set of rules that contains strings called “chromosomes”. Chromosome mainly describes a search area on that contains points. Strings are in the binary form that is 0’s or 1’s. The algorithm can be carried out as follows:

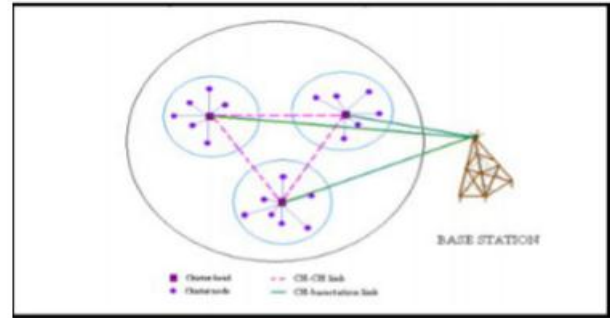
1. Generated randomly in area that is seek and fitness fee can be evaluated.
2. Creation of Populace foundation on Crossover, repair and operations of mutation.
  - First select or choose person (dad and mom) that is crossover and for mutation.
  - Then Crossover the genetic materials that are alternate among some individuals for production of offspring.
  - Again and again Genetic algorithm handles population for fine adjustments that are used to create a new technology of chromosomes.
  - Manner can be persevered till the large wide and large numbers of generations are accomplished.

	ACO	PSO	FFO	GA
Representation	Based on behaviour of Ants	Based on behaviour of animals which has no head	Based on behaviour of fireflies	Related to genetic organisms
Operation	Find optimal path from source to destination	Finds a food near to position	Finds position of particle	Search solves the optimise problem
Nodes deployed	Distributed Manner	Central nodes deployed for local and global best position	Random Manner	Random Distribute -d manner
Advantages	For active Application	Identify Lbest Gbest position	Multiple Optima -zation	Compound Problems Handled
disadvantage	More paths, more Energy Consumed	Cannot Work For non Coordinate system	Only for Nodes Deployed randomly	Energetic Sets of Data Difficult To operate

**Schematic representation of Clustering mechanism**

Information or data can be gathered through sensor nodes. Data can be aggregated and nodes can be partitioned into a number of small groups that are called as “Clusters”. In a network, every cluster elects themselves and mainly called as “Cluster-Head (CH)”. CH may be elected by means of the sensor nodes or pre-assignment of the community clothier. A CH collects the information from the different sources and elects themselves as Cluster head and aggregates the data and

then it has sent to BS. Bandwidth can be conserved and network lifetime is increased.



**Fig:3 Schematic representation of Clustering Mechanism**

**Aggregation of Data in WSN**

Data can be collected from different multiple sources and can be aggregated to get better results that highly reliable the verbal exchange of information overhead is randomly decreased. Chief utility of a dispensed WSN is to locate in an particular occasion.

**PSO-Clustering types:**

One of the four variants of PSO: PSO-TVIW (PSO with time varying inertia weight), PSO-TVAC (PSO with time varying acceleration constants), HPSO-TVAC (hierarchical PSO-TVAC) and PSOSSM (PSO with supervisor student mode) for electricity conscious clustering in WSNs.

- **PSO-C(Centralized-PSO):** It is Centralized-PSO algorithm, the nodes have the energy that is above medium and there is common powered resource that nodes are elected themselves for cluster heads selection. There is comparison with LEACH protocol and also compared with LEACH-C protocol. Results are displayed that PSO to LEACH and LEACH-C in period of time with network existence time and also throughput. And also GA and K-means based clustering algorithms are performed.
- **Minimum Spanning Tree-PSO(MST-PSO):** It is based on clustering algorithm .It is related to the graph weight. The path can searched from between nodes and its cluster heads and it is searched from the complete ideal tree. And there is consumption of energy
- **Distributed PSO (D-PSO):** It is mainly used to minimize or to control the different type of nodes that are hidden in network and there is uneven hyperlinks and there increase in the power transmission of node subsets in sensor community.

**LEACH:** It is self-organized cluster protocol in which electricity energy can be circulated and there is load balancing of nodes in system. The nodes of sensor type elect themselves into close by clusters with apperaing of single element because of base station (BS).It does not assure range of CH that are selected and cluster heads aren't frivolously located across the community. A new protocol has been developed known as LEACH-C.

In LEACH-C, there is cluster formation at the beginning by using one of the advancement of centralized algorithm by the BS. There is station that is located down that efficiently use the data obtained from every node throughout. There is the the quantity of cluster heads and divide and configure into clusters called Set up phase. Cluster groups are then selected and reduce the electricity energy that is mainly required for non-cluster head nodes that is used for transmission of data or records.

LEACH-C is more advantageous compare to LEACH after knowing the results and performance.

#### WSN Types

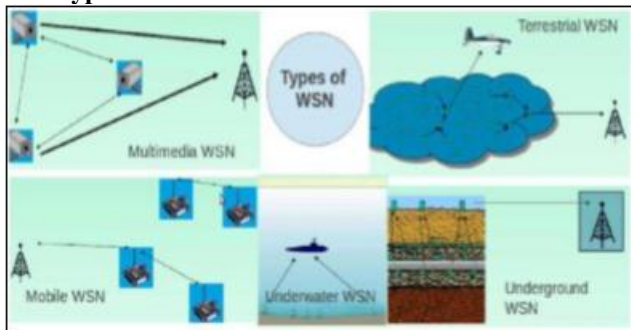


Fig:4 WSN Types

- A. **Terrestrial WSN:** Mainly contains a wide variety of lowcost of nodes that are deployed on land in particular area, also normally deployed in advert-hoc way.
- B. **Underground WSN:** Consists of some of sensor nodes that are deployed in underground in order to reveal the details of underground conditions.
- C. **Underwater WSN:** In this sensors are deployed in underwater, and also deployed into the environment of sea such nodes that are highly being price tagged, gather information from them from underwater.
- D. **Multi-media WSN:** Mainly contains low price tagged sensor nodes that are mainly present or located in cameras and microphones, and gathers information for processing video, audio and so on.
- E. **Mobile WSN:** Contains the phone sensor nodes that can move randomly and interact with physical environment.

#### VI. THE WSN APPLICATION



FIG: 5 WSN APPLICATION

- A. **Used in Military:** In part of navy command for, managing the information, for interacting with each other etc..
- B. **Used in Environment:** Tracking the motion of birds, for observation of environment conditions such as in agriculture like crops.etc
- C. **Health:** monitoring and diagnosis of problems of health diseases.
- D. **Home:** for smart houses like automatic control of home appliances.

#### RESEARCH GAP

##### Issues of Research & Challenges in WSN

**Energy:** Mainly for locating or tracking of structures. Nodes of sensor are low valued, weightless and also have battery operated strength. It is one of important component for increase of lifetime and also used for sensing operations.

**Self-controlled:** Nodes are randomly deployed in nature. When the nodes get failed, modification can be done. Nodes are redeployed and new structure can be organized.

**Hardware, Software problems of program:** Overall performance of CPU can be affected due to small length of node and restricted energy resources.

**Security:** One of the key problems in time crucial applications, tracking etc. Confidentiality, integrity of statistics needs to be maintained in proper manner.

#### VII. CONCLUSION

At its growing segment and environment, and there are various troubles want to be identified. WSN is applicable to wide variety of packages, and research is needed. WSN has emerged as lively studies area, related to numerous hard topics such energy intake, routing algorithms, deployment

and localization issues. Numerous advanced techniques like ACO, FFO, PSO, GA used for optimization in community. The present swarm intelligence based totally on routing protocols can reduce the trouble in energy consumption. Energy consumption and reliability have been completely gained using advancement techniques.

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