Abstract—The WSN is the network of sensor in which each node can collect and forward data to his neighbor node or to sink node say base station. The genetic algorithm formally used for creating and re-initiating the cluster based WSN in which it optimizes the network while network establishment. Optimization done in such way that the networks itself find his cluster head and leaf node of network by using fitness function. The dormant parameters, connectivity parameters and energy parameters play precise role to form fitness function to validate WSN. The optimization stages of WSN are node placement, network coverage, clustering, data aggregation and routing can be optimized by using artificial intelligence techniques such as genetic algorithm and particle swarm optimization. In advance to the genetic algorithm for forming energy-efficient network particle swarm optimization computational method came into picture. Particle swarm optimization internally uses candidate solution to find optimize solution to get strengthen particle out of all swarm particle say node to establish WSN. Particle swarm optimization is the most efficient way of optimizing the stages of WSN.

Index Terms—APTEEN Protocol, Clustering, Data Aggregation, Genetic Algorithm, Network Coverage, Node placement, Particle Swarm Optimization, Routing, Wireless Sensor Networks.

I. INTRODUCTION

A wireless sensor network is the network of sensor node without wired communication between the nodes. A wireless sensor network (WSN) typically consists of a sink node sometimes referred to as a base station and a leaf node say small sensor node. The base station is assumed to be secure with unlimited available energy while the leaf nodes are assumed to be unsecured with limited available energy. The sensor nodes including cluster node, leaf node monitor a geographical area and capture data say Sensory information. Same information is communicated to the sink node through secure wireless mesh networks. To conserve energy this information is aggregated at intermediate sensor nodes say cluster head by applying a suitable aggregation function collected data across from whole network. Intension behind aggregation is to reduce the amount of network traffic which helps to decrease energy consumption on sensor nodes. Providing security to aggregate data in wireless sensor networks is known as secure data aggregation in WSN. We can optimize the wireless sensor networks stages such as node placement, network coverage, clustering, data aggregation and routing by using genetic algorithm. And by using particle swarm optimization these stages gives optimized results with efficiency, accuracy and speed.

A. Domain Introduction

Wireless sensor networks (WSN), sometimes called wireless sensor and actuators networks (WSAN), are spatially distributed autonomous sensors to watch physical or environmental conditions, like temperature, sound, pressure, etc. and to hand and glove pass their information through the network to a main location. The lot of trendy networks square measure bi-directional, conjointly facultative management of sensing element activity as shown in I-A. The event of wireless sensing element networks was actuated by military applications like parcel of land surveillance; these days such networks square measure utilized in several industrials and shopper applications, like process observance and management, machine health observance, and so on.

The WSN is made of nodes from many to many tons of or maybe thousands, wherever every node is connected to 1 (or typically several) sensors. Every such sensing element network node has generally many parts: a radio transceiver with an enclosed associate degreetenna or affiliation to an external antenna, a microcontroller, and associate degree electronic circuit for interfacing with the sensors associate degree embedded-
ded style of energy gathering. A sensing element node would possibly vary in size from that of a shoe box right down to the dimensions of a grain of mud, though functioning bits of real microscopic dimensions have nonetheless to be created. The price of sensing element nodes is equally variable, starting from many to many green-backs, counting on the complexities of the individual sensing element nodes. Assessing the vitality restrictions in WSN, genetic algorithm are utilized to advance the WSN. The foundation of this project is to open pit incline recognition, as the components of the application prerequisites, correspondence requirements, and vitality sparing, etc. This paper exhibits the outline of vitality enhancement by advancing the system nodes working mode.

II. LITERATURE REVIEW

Literature review in the paper is that section which shows the sundry analyses and research made in the field of your interest and the results already published, taking into account the sundry parameters of the paper and the extent of the paper. The paper offered by the Zhen-Lun Yang, Angus Wu, and Hua-Qing Min in 2016 distributes us through the deployment quandary of WSN for authentic time oilfield monitoring in authentic world. Here need to install all network including sink and cluster node. The major concern of the manufacture of the monitoring system is the optimum placement of data distribution sub system to certify the full connectivity of the sensor nodes while keeping the construction cost as low as possible, with the least construction and maintenance intricacy. Due to perplexed land form network creation is intricate task. The deployment quandary is answered there utilizing the approach of multi objective discrete binary particle swarm optimization to engender optimal solutions from the minor financial cost to the minor invocation of construction and maintenance [1]. Hence routing should be done in mobile sensor network form. So by visually perceiving above elucidation particle swarm optimization lifetime prognosis algorithm for route recuperation exposed. This technique prognosticates the lifetime of link and node in the available bandwidth predicated on the parameters like relative mobility of nodes and energy channel rate etc. Utilizing presages, the parameters are fuzzified and fuzzy rules have been composed to decide on the node rank. This information is made to exchange among all the nodes. Thus, the rank of every node is verified afore data transmission. Even for an impassivant node, the performance of a route recovery mechanism is made in such a way that equipollent routes are diverted to the vigorous nodes so communication overhead get decrease rapidly [6]. The paper offered by the Mohammad Reza Sabeti Baygi, Mostafa Razavi Ghods, Gelareh Veisi in 2015, Sensor Clustering and Base Station Mobilizing in Wireless Sensor Networks Utilizing Genetic Algorithms. It enhances the lifetime of the network and reduces the energy consumption. But clustering is quite arduous in major aspects of the WSN [7]. The author Kanika Goel, Suveg Moudgil in 2015 explicating an energy efficient routing algorithm for wsn utilizing pso approach where it increments the lifetime of the network and energy consumed by nodes is reduced.

The average throughput is less [8]. In the paper offered by Omar Banimelhem, Moad Mowafi, Walid Aljobjy tell us about Genetic Algorithm Predicated Node Deployment in Hybrid Wireless Sensor Networks where it overcome sthe coverage holes by integrating mobile sensor nodes and optimize the network coverage in terms of the overall coverage ratio [9]. The author Deepak R Dandekar, Dr. P.R.Deshmukh in 2012 describes about the paper Relay Node Placement for Multi-Path Connectivity in Heterogeneous Wireless Sensor Networks. It describes that PSO place optimum number of energy constraint relay nodes to achieve desired connectivity between heterogeneous wireless sensor networks [10].

III. EXISTING SYSTEMS

WSNs are contained an arrangement of wireless sensors with assortment of abilities and constraints, which make them reasonable for particular applications. There are a few conceivable applications for WSNs in military, business, and restorative fields. Thinking about the recent technological advances, use of these networks in everyday life is expanding. Of the primary constraints of WSNs is energy consumption and lifetime of the network, which are basic concerns nearly for any WSN application. By and large, the operational stages of WSNs incorporate node placement, network coverage, clustering, data aggregation, and routing. A specialized overview was led on these operational stages. By finding the disadvantages and enhancing them, ideal parameters of the network were accomplished. At long last, utilizing genetic algorithm, a wellness work with optimum formula was obtained and the exhibit conventions were optimized. It is additionally recognizable that the graphs acquired from the reenactments demonstrated a change in energy consumption parameters and lifetime of the system; this implies more perfect WSNs.

A. Genetic Algorithm

Genetic Algorithms (GAs) are in no way, shape or form arbitrary; rather they abuse authentic data to coordinate the inquiry into the area of better execution inside the hunt space. The essential procedures of the GAs are intended to mimic procedures in common frameworks important for advancement, uncommonly those take after the standards first set around Charles Darwin of survival of the fittest. Since in nature, rivalry among people for meager assets brings about the fittest people ruling over the weaker ones. GAs reenacts the survival of the fittest among people over continuous era for tackling an issue. Every era comprises a populace of character strings that are similar to the chromosome that we find in our DNA. Every individual speaks to a point in an inquiry space and a conceivable arrangement. The people in the populace are then made to experience a procedure of development. GAs depends on a relationship with the genetic structure and conduct of chromosomes inside a populace of people utilizing the accompanying establishments: People in a populace go after assets and mates. Those people best in
every opposition will create more posterity than those people that perform inadequately. Qualities from good people spread all through the populace so that two great guardians will in some cases deliver posterity that is superior to anything either parent. Along these lines each progressive era will turn out to be more suited to their surroundings. Genetic Algorithms (GAs) are versatile heuristic pursuit calculation in view of the trans-formative thoughts of regular determination and hereditary qualities. All things considered they speak to a keen abuse of a haphazard pursuit used to take care of improvement issues. GAs reenacts the survival of the fittest among people over continuous era for tackling an issue. Every era consists of a populace of character strings that are similar to the chromosome that we find in our DNA. Every individual speaks to a point in an inquiry space and a conceivable arrangement. The people in the populace are then made to experience a procedure of development.

Flowchart of Genetic Algorithm:- The flowchart of Genetic Algorithm is given below in fig III-A. Genetic Algorithm works as:–

Start: Generate irregular populace of n chromosomes (appropriate answers for the issue)
Fitness: Evaluate the fitness f(x) of every chromosome x in the populace
New population: Create another populace by rehashing taking after strides until the new populace is finished
Selection: Select two parent chromosomes from a populace as per their fitness (the better fitness, the greater opportunity to be chosen)
Crossover: With a crossover probability cross over the parents to form a new offspring (children). In the event that no crossover was performed, offspring is a precise of parents.
Mutation: With a mutation probability mutate new offspring at each locus (position in chromosome).
Accepting: Place new offspring in another populace

B. Optimization of wireless sensor network

The optimization of wireless sensor networks can be done in 5 operational stages - node placement, network coverage, clustering, data aggregation and routing including energy consumption.

The operational stages of WSN can be achieved in the following ways:–

1) Node placement in WSN:- Among the fundamental aspects of improvement of performance for wireless sensor networks, node placement is most important aspect. Here, we examine design optimization of wireless sensor networks (WSNs). All the sensor nodes situated in the environment should have a connection with high energy level nodes. For transmitting collected information, the nodes transfer from environment to base or ground to a satellite. Sensor nodes are not proficient decision for long haul transmission as their energy consumption is a super linear function of the distance the data that is transmitted. In this part, we accept that communication range of the sensor is settled and the new Intelligent Node Placement Protocol in Wireless Sensor Networks utilizing genetic algorithm is presented. The two contending goals - total sensor coverage and lifetime of the network, are optimized in the proposed system for WSNs.

2) Network Coverage in WSN:- Coverage of WSNs has gotten incredible arrangement of consideration in late inquiries about. The term is generally characterized as a measure of performance of lifetime of the sensors in noticing the physical space. The coverage is also a critical factor for connectivity of sensor network. By definition, network is the ability of the sensor nodes to communicate with data sink. To manage the issue of coverage, in light of genuine WSN application, a set of hypothetical parameters (A, B, C) were accepted in a 2-D field. The small sensors are highlighted with restricted power, constrained range of transmission, and sensing mode alternative (three operating modes) in light of capacities and condition. With lower density of the parameter A; sensor is highlighted with the longest transmission range and C with the shortest range. To accomplish optimum energy consumption, a clustering solution, with clusters comprising, one particular abutting sensor of and the same operating mode known as cluster-in-charge, was formulated. Every one of the clusters may utilize multihop to communicate to the base station (BS) or sink. Here, the multi-objective algorithm competent to optimize the three principle parameters (network, consumption of energy, and coverage (ECEP)) of observing.
3) Clustering in WSN:- As we know that, increment of lifetime and extension also, load balance is the fundamental needs of WSNs applications. Proper clustering using optimized techniques of clustering is a choice to understand these objectives. For the most part, the cluster based strategies suit observing applications highlighted with need of constant stream of data from sensors; this calls for diminishing the expenses of opportune data message delivery by routing protocols. The Low Energy Adaptive Clustering Hierarchy (LEACH) protocol, for example, utilizes a hierarchical approach for clustering the network. There is an adopted cluster head for managing each cluster. The cluster head is responsible for a several tasks; first it is involved collecting data provided from the members of a cluster on periodical premise. It aggregates the data after gathering them, so that redundancy among correlated values is dealt-with. The following primary task assigned to a cluster head is to directly transmit the accumulated data to the base station. The transmission is led by means of a single hop. The aggregated data are transmitted from several clusters by means of CHs toward BS.

4) Data Aggregation and Routing with energy consumption in WSN:- The motivation behind data aggregation is to gather the very basic data provided by the sensors and to forward the data to the sink. Effective energy consumption and diminishing data latency however much as could reasonably be expected are two main concerns. The last is crucial for some applications including environment monitoring where fresh data are imperative. Accomplishing higher energy efficiency in data aggregation algorithm guarantees longer network lifetime. Neglecting to share the load of data among the members of a network by the data aggregation tree eventuates in utilization of total energy by some nodes that are allotted with heavy load of data. Failure of nodes prompts to failure of the network. Using GA, this section explores the data collecting spanning trees with higher energy efficiency.

IV. PROPOSED WORK

Proposed the work i.e. particle swarm optimization which gives better results from the existing system. PSO also provides simplicity, fast convergence and ease of implementation in hardware and software. The WSN in which each node can collect and forward data to his neighbor node or to sink node say base station. The genetic algorithm formally used for creating and re-initiating the cluster based WSN in which it optimizes the network while network establishment. Optimization done in such way that the networks itself find his cluster head and leaf node of network by using fitness function. The dormant parameters, connectivity parameters and energy parameters play a precise role to form fitness function to validate network. In advance to the genetic algorithm for forming energy efficient network particle swarm optimization computational method used. Particle swarm optimization internally uses candidate solution to find optimize solution to get strengthen particle out of all swarm particle say node to establish WSN. The operational stages of WSN are node placement, network coverage, clustering, data aggregation and routing can be achieved by using particle swarm optimization in less time and with speed. PSOs dont change the populace from generation to generation; however keep a similar populace, imperatively redesigning the places of the members from the population (i.e., particles). PSOs have no administrators of mutation, recombination, and no idea of the survival of the fittest. Then again, likewise to GAs, a vital component of PSOs is that the members from the populace interact, or influence each other. Particle swarm optimization algorithm is used in this concept as our proposed system because of the following reasons:-

- It gives simplicity, high quality of solution.
- It also provides fast convergence, insignificant computational burden.
- PSO solves the problems of static deployment, localization burden.
- It gives ease of implementation on hardware and software. Hence, due to the above advantages, PSO is developed in our system.

A. Particle Swarm Optimization PSO is swarm intelligence meta-heuristic inspired by the gathering conduct of creatures, for instance bird flocks or fish schools. Thus, to genetic algorithms (GAs), it is a population-based strategy, that is, it speaks to the state of the algorithm by a populace, which is imperatively altered until a termination criterion is fulfilled. Flowchart of Particle Swarm Optimization Algorithm:
The flowchart of Particle Swarm Optimization Algorithm is given in fig IV

Particle Swarm Optimization Algorithm works as:-

- **Initialization:** Including swarm size N, maximum number of iterations n, initial velocities v and positions x, c1 and c2.
- **Loop Evaluation:** Evaluate each particles position according to the fitness function Termination criterion check: If a criterion is met, exit loop. Find the personal

![Flowchart of Particle Swarm Optimization Algorithm](image-url)
is properly done the rest stages can be easily implemented. Cluster members are playing the important role; if once this heads and cluster members. Mainly the cluster heads and communication is going held in between the cluster i.e. Base Station (BS). Using this base station, the further communication is going to start from the sink node and routing. In above diagram, we can easily know that the placement, network coverage, clustering, data aggregation system which includes the 5 stages of WSN i.e. Node placement, network coverage, clustering, data aggregation and routing. In above diagram, we can easily know that the main communication is going to start from the sink node i.e. Base Station (BS). Using this base station, the further communication is going held in between the cluster heads and cluster members. Mainly the cluster heads and cluster members are playing the important role; if once this is properly done the rest stages can be easily implemented.

V. System Architecture

The literature survey tells us about the brief idea of the given approach. After going through each and every reference papers it is proved that the two separate artificial intelligence algorithms works in their own way. This also tells us about the different advantages of genetic algorithm and different advantages of particle swarm optimization algorithm. But when we use these both algorithms in one approach then our system is going to be developed. The architecture diagram of the system given below in Fig.8 helps us to understand the system.

![Fig. 4. System Architecture](image)

The above system architecture describes about our whole system which includes the 5 stages of WSN i.e. Node placement, network coverage, clustering, data aggregation and routing. In above diagram, we can easily know that the main communication is going to start from the sink node i.e. Base Station (BS). Using this base station, the further communication is going held in between the cluster heads and cluster members. Mainly the cluster heads and cluster members are playing the important role; if once this is properly done the rest stages can be easily implemented.

The advantages of particle swarm optimization over genetic algorithm are described as follows:-
1) PSO has turned out to be a speedier and more versatile arrangement contrasting with GA.
2) In multi-objective optimization the solution strategies are more natural and the forefront of research on PSO is more dynamic contrasting with GAs that is by all accounts fading away.
3) PSO does not have genetic operators like crossover and mutation. Particles overhaul themselves with the inner speed.
4) They additionally have memory, which is important to the algorithm.
5) Compared with genetic algorithms (GAs), the data sharing component in PSO is essentially distinctive.
6) In GAs, chromosomes share information with each other. So the entire populace moves like a one group towards an optimal area.
7) Compared with GA, all of the particles have a tendency to focalize to the best solution immediately even in the local version in most cases.

1) A. APTEEN Protocol: The optimization stages such as node placement, network coverage, clustering, data aggregation and routing using particle swarm optimization can be optimized easily. In node placement, the nodes are optimized easily because the nodes are placed as particles. In clustering, the cluster heads are used to optimize and to send the data to sink node i.e. base station, who behaves as the coverage of network, and with the help of cluster members the broadcasting is done easily, the clustering can be achieved by APTEEN protocol. The data aggregation can be used to load balance, passing message from one node to other by using the particle swarm optimization. And the last stage i.e. routing can be obtained in the data aggregation stage where we need to send the data in the minimum distance. The APTEEN (Adaptive periodic threshold sensitive energy efficient sensor network) protocol is the most advantageous protocol to form the clustering with the help of cluster heads. A responsive network protocol called APTEEN is Adaptive periodic threshold sensitive energy efficient sensor network protocol. Hybrid Networks join the best components of proactive and reactive networks, while minimizing their disadvantages. Nodes in such a network transmit information periodically at moderately longer intervals while in the meantime transmitting information when the detected esteem goes past its threshold. In this manner, the sensor energy is utilized effectively by decreasing the number of transmissions of noncritical information. The client can change the periodicity, threshold value(s) and the parameter to be detected in various regions. This network can copy either the proactive or the reactive network by reasonably changing the periodicity or threshold values. Along these lines, this network can be utilized as a part of an application by appropriately setting the different parameters. In any case, this adaptability and flexibility increases the complexity at the sensor. Here a new protocol APTEEN (Adaptive Periodic Threshold-sensitive Energy Efficient sensor Network Protocol)
is presented for hybrid networks.

2) B. System Overview: The following Five steps which shows us actual network creation and network optimization
1) Node Placement- Node placement is the placement of the node in the network to ensure that system keeps running with the most noteworthy practical execution, the nodes are situated on the grounds organizes.
2) Network Coverage -Network Coverage is the term particularly inferred for keeping up and measuring the physical areas of networks. Really Network Coverage intends to associate the network indiscriminately and exactly so all network siblings get associated with Sink node say base station for network message correspondence.
3) Clustering- For making the networks very load balance clustering come into picture. By utilizing fitness function we will accomplish the clustering. Clustering is the stage in which packet forwarding problems are easily solved. When we use packet forwarding method, the time, energy, delay and packet delivery ratio entities are more so to avoid these problems clustering is proposed.
4) Data Aggregation-Data Aggregation makes it simple to gather every single sensible data from all networks including all clusters and his cluster member. Data Aggregation certifications to convey exact information to sink node say base station. Another pour stance is to dole out or choose load to the node in the network. Additionally, help GA to make the load balance network.
5) Routing- At long last from fitness function routing protocol take some parameter to pick the optimum route to travel to every part of the entire WSN. Regularly routing fitness function consider three conditions of energy they are called
a) Low communication range
b) Middle communication range
c) High communication range
Using above range routing algorithm decide route to travel toward sink node. Hence, these are the stages of wireless sensor network which can be optimized by using the particle swarm optimization.

VI. CONCLUSION
Localization of sensor nodes is really important for the performance of WSN as many applications of WSN require localization information. The main objective of this optimization problem is to minimize the error with the help of nature-inspired optimization algorithms. In this paper, node localization using Using PSO -A optimization algorithm like Particle Swarm Optimization (PSO) and is conducted to determine the position of the sensor nodes in WSN. This paper has analysed the localization problem and solved it with different optimization algorithms and provides the summary of results by comparing the algorithm with the each other in terms of error, localized nodes and computing time. The PSO -A based node algorithm shows better localization accuracy in estimating the position than other algorithms. Artificial Intelligence Techniques performs comparative less with respect to error and computation time among the optimization algorithms. These distributed localization algorithms are better than centralized algorithms as the number of transmissions to the sink node is reduced which helps to conserve the energy of sensor nodes. These algorithms further can be implemented for centralized method and can be compared with distributed method for analysis. PSO -A can be hybridized with other optimization algorithm to further minimize the location estimation error. The parameter values can be varied to improve the optimization algorithm to improve convergence rate, localization accuracy and computation time.

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