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ABSTRACT

***Average lifetime improvement of a critical application sensor network is always a promising research area where** lot **of scope for applying technique like cross layer approach, energy aware routing, load balancing etc. Due to the heterogeneous nature of sensor network and dynamic situation static solutions always fail to give an optimal solution. The performance of network like average lifetime, throughput, packet delivery ratio, overhead due to routing etc can be improved through an optimised load balanced network. Optimisation technique like simulated annealing, genetic optimisation and particle swarm optimisation yield a time varying performance due to its operation of principle. The various network parameters can be used to represent chromosome in genetic algorithm (GA) and similarly these parameter can be represented in particle swarm optimization (PSO) optimisation. The performance of GA and PSO is measured in dynamic environment but testing is done in a standard environment**.*

Keywords: *Lifetime Sensor Network, Load Balancing, GA, PSO, Cross Layer Approach.*

1. INTRODUCTION

Wireless sensor network (WSN) is used for gathering various spatially scattered information from a variety of ecosystem through dedicated sensors for the purpose of monitoring and processing at a central location. The various environmental conditions like temperature, vibration, sound and so on can be measured using the specialized sensors in WSN. A WSN framework consolidates data through data aggregation for gateway that enables remote monitoring [6]. As the sensors are distributed to remote locations through some difficulty procedure hence recharging is almost impossible. So only lifetime of wireless sensor is very crucial. For an effective monitoring and sensing coverage of sensor is very important but this coverage adversely affect the lifetime of a sensor [8]. As all the sensor devices like embedded devices computational power of a sensor also a restriction here. Hence an energy improving scheduling has been implemented through a distributed strategy of applying genetic algorithm or particle swarm optimisation. Even though genetic algorithm and particle swam optimisation operates on different strategy both yield ultimately an optimal solution respective of intermediate performance.

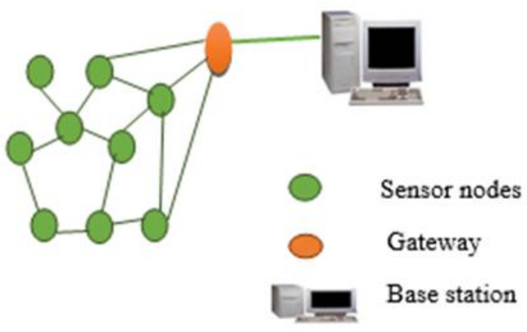

Fig 1: Wireless sensor network

Genetic algorithm (GA) is evolutionary optimization technique based on the principle of natural genetic system. The main advantage of the GA is its ability to obtain optimum result through number of generations.

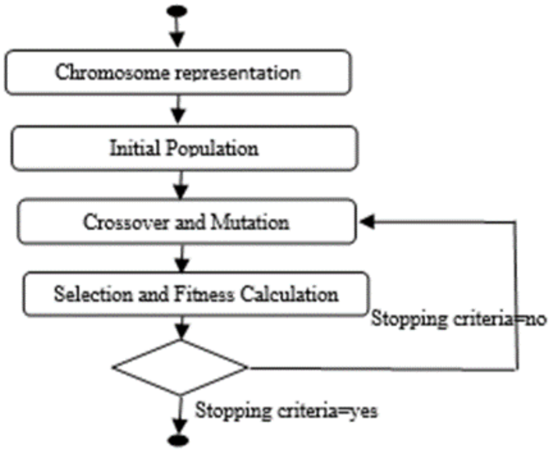

Fig 2: GA flow chart

Particle swarm optimization (PSO) is inspired from the flocking of birds and the main idea is to simulate the unpredictable choreography of bird flock.

The algorithm of particle swarm optimization is as follows.

1. Initialize an array of the population of particles with random positions and velocities in D dimensions in the problem space.
2. Evaluate the fitness function in D variables for each particle.
3. Compare each particle's fitness evaluation with its pbest. If current value is better than the pbest, then save the current value as the pbest and its location correspond to the current location in D-dimensional space.
4. Compare the fitness evaluation with the populations overall previous best. If the current value is better than gbest, then save the current value as gbest to the current particles array index and value.
5. Modify the velocity and position of the particle according to the following equations:

$$v_{id}^{t+1} = v_{id}^{t} + c_1 rand()^t \times (P_{id}^{t} - x_{id}^{t}) + c_1 rand()^t \times (P_{gd}^{t} - x_{id}^{t})$$

$$X_{id}^{t+1} = x_{id}^{t} + v_{id}^{t+1}$$

6. If the desired criterion is not met, go to step 2, otherwise stop the process.

2. BACKGROUND

It is notable that both a minimal energy consuming path and balanced communication load among the nodes are fundamental criteria for route assessment. To accomplish worthy execution, these two prerequisites must be very much adjusted. The Improved optimal route evaluation method based on the principal component approach (OREPCA) for wireless sensor networks [1] has been suggested as promising route evaluation technique. OREPCA guarantees a diversified assessment and incite dynamic load adjust in various system observing conditions. Further, the weighting variable of every assessment pointer can be evaluated utilizing the principle component approach. The route is not only selected based on the lowest energy paths may not be optimal from the point of view of network lifetime and long-term connectivity[5].This paper uses a sub optimal path occasionally to provide substantial gains.

MOR4WSN [2] is the algorithm for choosing the best sensor dissemination and in addition a component for streamlining of result. The MOR4WSN approach demonstrates the formation of target works that permit to advance diverse criteria in the meantime.MOR4WSN permits discovering tree topology that surpasses the life span of standard calculation Tree Routing utilized by ZigBee. Similarly MOR4WSN is free of the quantity of nodes in the system. Adjustment of NSGA-II permits to infer that genetic operator must be tuned precisely to WSN conditions. iMASKO [3] presents a generic GA based optimization framework to optimize the performance of metrics of wireless sensor networks. The testing and assess the structure by utilizing it to investigate a SystemC-based re-enactment procedure to tune the setup of the unslotted CSMA/CA calculation of IEEE 802.15.4, planning to find the most accessible trade-off answers for the required execution measurements.

The coverage algorithm for the WSN can be improved through the valid position of PSO's computational nodes [4] .The work nodes covering the monitoring zone are chosen according to the network coverage quality. It provides an improved version of PSO. With the help of improved version of PSO WSN are deployed based on coverage objects, node deployment methods and network working status. [10] Investigated PSO for energy efficient clustering and routing using a multi-objective function which can improve the QoS. The choice of PSO parameters determines the accuracy and convergence of PSO algorithm, which is very important [9]. In [7] current residual energy, the energy consumption and end-to-end delay is taken into account in the clustering process to improve the energy-efficiency.

3. PROPOSED SYSTEM

Life time of a network can be improved through variety of techniques like load balancing and energy aware routing etc. Computational overhead and overhead due to scheduling is a key factor here. Applying good optimization technique by considering multiple parameters may solve the problem either locally or globally. The optimization technique like GA to identify the optimum route from large number of available route will enhance the overall network life time and throughput as the system guarantees possible load balancing. Chromosome representation is going to be key challenge here as the system is operating on live parameters. The selection crossover and mutation technique will further improve the system performance.

The network consists of various nodes and each node is operating with multiple parameters based on the ecosystem it belongs to that affect average lifetime of network. From each source to destination large no of routes are available but the same will yield different average lifetime and system performance. GA is applied to these available routes to obtain the optimal path by considering local and global parameters. Each route is represented as chromosome input for GA. Genetic operators such as crossover and mutation is applied to these routes and next generation is created. This new route information is passed to the network and the same is applied as a feedback to the network and this process is repeated again and again to produce an optimal route.

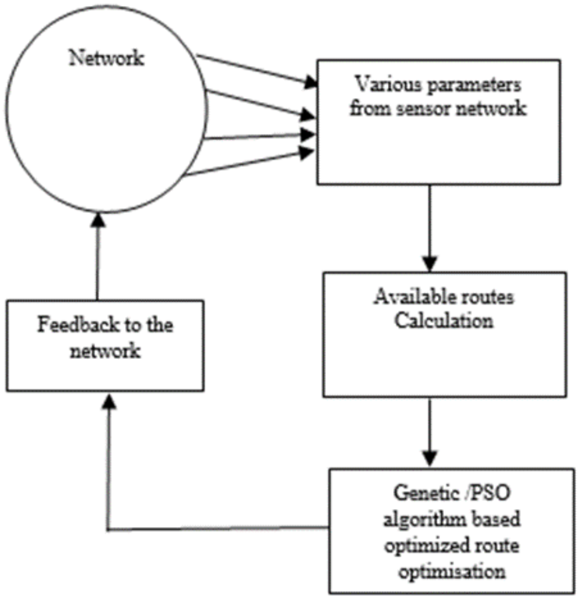

Fig 3: System Architecture

Instead of GA if we apply PSO as an optimization technique which will produce a different but interesting result. The PSO is initialised by a population of particles and particle indicates the routes that are created for a particular source to destination. Each particle keeps track of its energy and load in the network. After certain iteration the particle which has highest value of energy is considered as the optimal result.

4. RESULT ON DISCUSSIONS

Testing is done in a standard environment using NS2, mannasim patch is used for identifying route, and LEACH is the routing protocol initialised. Based on the parameter value the GA and PSO implemented in JAVA and corresponding output is simulated in NS2. The below table shows the typical configuration used in NS2 to trace file. Based on these configurations the network is simulated.

Table 1: Configuration of NS2

Network Parameter	Value
Antenna type	Omni antenna
Channel	Wireless Channel
Energy unit	Joule
Queue type	Drop Tail
Address type	Hierarchical

The fig 4 shows the three different routes for a particular source and destination drawn against the time and throughput.

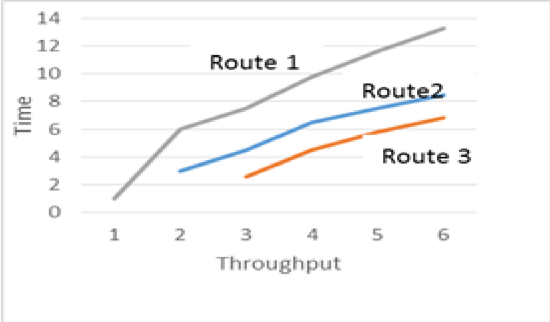

Fig 4: Three routes for same source and destination

The fig 5 indicates that with the help of PSO and GA throughput is increased considerably

Fig 5: Using GA and PSO

5. CONCLUSION

The overall performance of wireless sensor network in a heterogeneous environment can be only effective if it yield good lifetime and throughput performance. As there is a trade-off between life time and coverage optimizing, other parameter is necessary in a sensor network to improve the lifetime and throughput. The application of genetic optimization and PSO produced good optimized performance through load balancing and usage of optimal route. The performance of GA shows that it is very suitable for short time application or a time varying application. PSO seems to be a reliable technique where algorithm used significant amount of time to coverage into an optimal solution in a standard testing environment. The role of optimizing multiple parameters further shows the scope of future research in this area

6. REFFERENCE

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