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Wireless Sensor Network Optimization

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Abstract- Progressions in silicon innovation, micro-electro-mechanical frameworks (MEMS), wireless communications, and digital gadgets have prompted the expansion of wireless sensor networks (WSNs) in a wide mixture of use areas including military, health, ecology, environment, industrial automation, civil engineering, and medical. This wide application differing qualities joined with complex sensor hub architectures, usefulness prerequisites, and exceedingly obliged and harsh working situations makes WSN plan exceptionally difficult. One basic WSN outline test includes meeting application necessities, for example, lifetime, reliability, throughput, delay (responsiveness), and so on for heap of application domains. The proposed research work utilizes the firefly system in optimization methods, which forms the efficient WSN communication and reduces the risk of false routing while minimization of delay in path switching. In algorithms introduced for data transmission in such networks up to now, a single route is used for data transmissions that results in decrease in energy of nodes located on this route which in turn results in increasing of remaining energy. In this paper a new method is proposed for selection of data transmission route for splving the issue of the mobile receiver problem. This method is based on the energy usage in the network and dead nodes as parameters and number of nodes to sink. In this method average energy of network will be estimated and the reduction in energy will be noted and compared with previous system. This will result in increased energy conservation in routing of the WSN.

Keywords- Wireless Sensor Network, Routing Protocols, Sensors, Wireless Communication, Optimization technique

I. Introduction

A Wireless Sensor Network is shaped by spatially disseminating small sensor nodes imparting among themselves utilizing radio signals and conveyed arbitrarily or manually to sense, monitor and comprehend the obliged area [1]. Wireless sensor nodes have numerous impediments that make the planning wireless sensor system protocol troublesome. One of them is constrained power supply. In low- power wireless incorporated micro sensor advancements late upgrades have been made to those sensor hubs accessible in extensive numbers, with ease. They are utilized in an extensive variety of utilizations in military, medical, environmental monitoring and numerous different fields. In this manner energy efficient clustering algorithms have turn into a key part in the system lifetime of WSNs.

WSN is a standout amongst the most ordinarily specialized apparatuses utilized as a part of numerous regions at the life, in both regular civilians and militaries. These systems composite from an expansive number of small gadgets called sensor nodes [2]. The sensor convey together by numerous wireless techniques. These communication procedures administrated by routing protocols. There are distinctive sorts of routing protocol. The first inspiration for WSN exploration originated from the vision of Smart Dust in the late 1990s. This vision involved a coordinated computing, communication, and sensing stage comprising of numerous small gadgets, empowering applications, for example, dense environmental monitoring and shrewd home/office [3]. A normal WSN experienced in the exploration literature comprise of a substantial number of small, shoddy, and asset compelled sensor and also a couple base stations or sinks. In most WSN settings sensors gather information from environment and forward it hop by hop to the sink. A sink is an effective element that may serve as a door to another system, an information preparing or stockpiling focus, or an entrance point for human interface. WSN sending can be ad hoc. The WSN may be frequently arrangement on a substantial scale all through a geographic area in antagonistic situations.

II. Challenges in WSN

The wireless sensor system has its fundamental elements and specialized difficulties. A percentage of the elements of WSNs are restricted memory, node failure, and mobility, low computing capability and obliged assets like bandwidth, power and communication resources [4]. WSN are occupied

with a variety of real time fields like military, disaster, agriculture, medical and so forth particularly in the areas of requirement for proficient procedures, protocols and intellectual algorithm. Some potential issues and difficulties exist when we are outlining the systems and algorithms. Some of them are examined beneath.

- **Routing:** In sensor organize the detected information is to be routed from different sensor hubs to sink, through the most suitable way considering the asset requirements of WSN. In this manner routing is a challenging concern here.
- **Time Synchronization:** so as to fuse information viably, different levels of information combination are alluring at different levels and ought to be synchronized, as information is spread towards the sink.
- **Localization:** For getting the precision in information reception and location, the intricacy increments in extensive scale systems for complex situations. The challenge here is to discover the area of every sensor hub, its information with less communication and handling expense.
- **Security and Privacy:** From catastrophic assaults, wireless joined hubs implanted in the environment can't be guaranteed. Hub system can be adjusted, supplanted with malignant counterpart, and in mentioning objective fact the sensors can be tricked by assailants which don't unequivocally reflect the environment.
- **Scalability:** Are conveyed with hundreds, thousands or more sensor hubs, taking into account the applications necessity and the area to be observed. With such extensive number of remote joined sensor hubs, there is prerequisite of strategies and their reckonings to be sufficiently adaptable to react and work continuously.
- **Energy Conservation:** In WSN, improvement of new secure and vitality proficient routines empowering combination of generally expansive measure of information is the essential prerequisites of data processing [5]. Over a hugely Distributed database with imperative assets, information total/information combination must be performed. The precision reflection of the state of the environment in final, abnormal state detecting results conveyed by the System, the sensors sending event timing, deficiency of vitality and transmission capacity to record all the raw information surety additionally will be considerable.

III. Need For Optimization in WSN

Optimization is the demonstration, procedure or strategy of getting the best result under a given circumstances. The word optimum is taken to signify 'maximum' or 'minimum' contingent upon circumstances. System optimization is a basic segment and the optimization methods are utilized to accomplish outline objectives in systems administration. Vitality effectiveness, expense and application necessity are the difficulties that are to be taken consideration while outlining a WSN.

This obliges optimization of both equipment and software to make WSN proficient. Software locations issue of Network Lifetime [6]. There are a few optimization algorithms to suit the distinctive issues. Picking a legitimate algorithm is essential in any optimization method. With a very little infrastructure for WSN, the arrangement of the sensor hubs is either inside the monitoring region or close to it [7].

Batteries utilized as a part of sensor hubs are difficult to supplant or energize following the sensor hubs are sent in remote/ hostile sensing areas. Therefore, end of a battery life in a hub basically implies the end of system itself. Productive utilization of battery vitality is subsequently urgent to improve the system lifetime. The sensor system conventions need to concentrate principally on power conservation issues. Different issues are, accomplishing top notch QoS, low bandwidth, constrained handling and stockpiling in every hub [8]. These are the issues which are specifically identified with the issue of optimization.

IV. Optimization Techniques

The developmental strategies are contemplated from the environment and are utilized to join comparative conduct in WSN to enhance their Network lifetime, QoS and other coveted WSN properties that need the right decision of streamlining optimizer or algorithm. The conceivable transformative procedures that are embraced are in light of Bio-Mimic optimization methodologies. A portion of the optimization algorithms consolidating developmental model and swarm Intelligence are Particle Swarm optimization (PSO), Ant colony optimization (ACO), BEES optimization Algorithm (BOA), Particle Swarm Frog leaping hybrid optimization algorithm, Elephant swarm optimization, Cuckoo search (CS), Bat Algorithm (BA,), Firefly Algorithm (FA) and Genetic Algorithm (GA).

- **Particle Swarm optimization (PSO):** This is a computational technique to optimize an issue by iteratively attempting to enhance a competitor solution for a given measure of value. PSO algorithm lives up to expectations by having a population called Swarm of candidate's solution called particles. The developments of particles are guided by their own best known position in hunt space and additionally the whole swarm's position which thusly manages the development of swarm and the same is rehashed until an acceptable arrangement is accomplished. PSO is a multidimensional optimization method which is utilized as a part of Node sending, Localization, Energy aware clustering and Data aggregation [9].
- **Ant Colony Optimization:** This is a decent probabilistic procedure to take care of computational issues which can be decreased to discovering great ways through graphs. Foraging conduct of some Ant species is the motivation

for ACO strategy. These Ants leave a trail of pheromone which is an emitted or discharged chemical hormone that triggers a social reaction in individuals from the same species on the ground keeping in mind the end goal to check their ways from the nest to food that ought to be trailed by different individuals from the colony [9]. The food foraging conduct of Ants is as per the following:

- The first ant finds the sustenance source, and afterward comes back to the nest, abandoning a pheromone trail.
- All different ants aimlessly take after conceivable ways, and the reinforcing of the runway will touch base at most brief course.
- Ants take the briefest course and lose their trail pheromones if there should be an occurrence of long courses.

This algorithm helps in tackling discrete optimization issues in different areas of Engineering. ACO is more adaptable and decentralized in nature furthermore there is a comparability between Ants foraging and Routing. Consequently the dynamic and dispersed issues of routing in systems can be explained utilizing ACO [9].

BEES Optimization Algorithm: This is a populace based optimization algorithm that mirrors the sustenance foraging conduct of swarm of honey bees. In this algorithm, a sort of neighborhood pursuit consolidated with irregular hunt is performed and can be utilized for both utilitarian optimization and combinational optimization [10]. For the most part Colony of honey bees confronts an optimization issue amid its quest for sustenance since it needs to investigate long separations and additionally distinctive bearings to get a lot of nourishment sources. To execute this errand, the colony sends scout honey bees to hunt down nourishment areas arbitrarily.

In the wake of discovering the area of huge sustenance assets they profit and go for this data to the colony through a dance called Waggle dance. This dance empowers the colony to utilize more honey bees to the huge nourishment assets and less honey bees for the lesser sustenance assets. This methodology prompts a productive searching and harvesting. The settlement keeps on sending scout honey bees to perform arbitrary hunt amid sustenance social occasion season, and accordingly it keeps its opportunity to discover new nourishment assets. Clustering of information, neural systems training and multi-objective optimization are the diverse applications in which this algorithm is connected.

- **BFO (Bacterial Foraging Optimization):** It is a bio-motivated routing protocol. It is an optimization procedure taking into account social foraging conduct of Escherichia Coli (E. Coli) microorganisms, exhibit in human intestine.[11] BFO is a developmental algorithm and can be connected in different optimization issues. Microorganisms attempt to amplify their vitality via looking their sustenance and move starting with one spot then onto the next furthermore maintain a strategic distance from poisonous substances. Energy optimization is accomplished by forming clusters, selecting cluster heads by executing BFO algorithm. BFO gives better execution when contrasted with different protocols like LEACH [12].

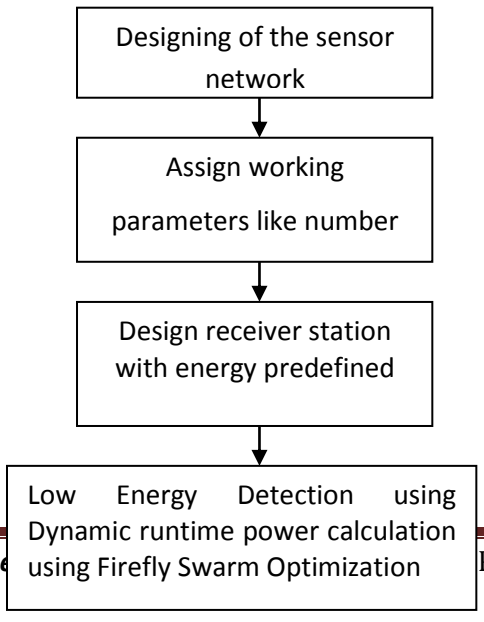
V. Proposed Problem Issue

As per the survey of base and reference approach the routing in wireless network is done for various individual or multi-modal needs and energy conservation is one of the main concerns and here we consider wireless nano-sensors as the field of optimization, as discussed above the approach for routing depends on network type, user service, network planning. The structure of routing on which we focus, will revolve around the assessment of a multipath routing transmission for single cannel system in nanosensor networks, the tuning of the transmission enhancement, also the determination on network overload will be our main concern. The following will be the main points to work on: The routing of efficient path Energy loss during random change in routing path Energy for communication process per node

Objective

In the proposed work we will focus on designing and implementing network routing using nano-sensor architecture in order to reduce the hoping time delay, finding the reduction in energy consumption by detecting non-responsive nodes, to reduce hop-time in network between sensors to increase sleep time efficiency.

Block Diagram



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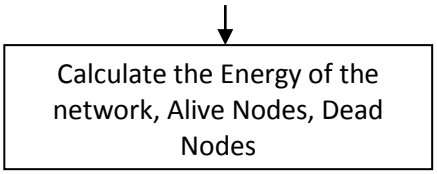


Figure1 shows the block diagram of the main system

Proposed Methodology

- Initialize the area for the nano-sensor network.
- Spread randomly sensors in the given area.
- Detect the optimal path for communication using sensor to sensor hop energy based routing assignment.
- The energy is estimated using Low Energy Detection using Dynamic runtime power calculation using Firefly Swarm Optimization for communication.
- Calculate maximum usage for network energy consumption per node, number of nodes dead or functioning.

After full communication process, calculate the average power dissipation in the network, number of nodes alive or dead.

VI. Results

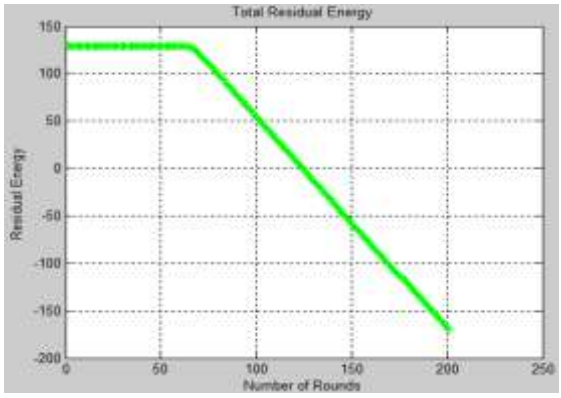


Figure 2 shows the output energy of the proposed system in terms of residual energy

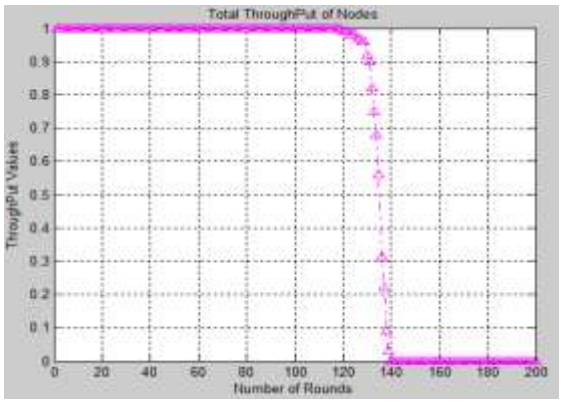


Figure 3 shows throughput of the system for total number

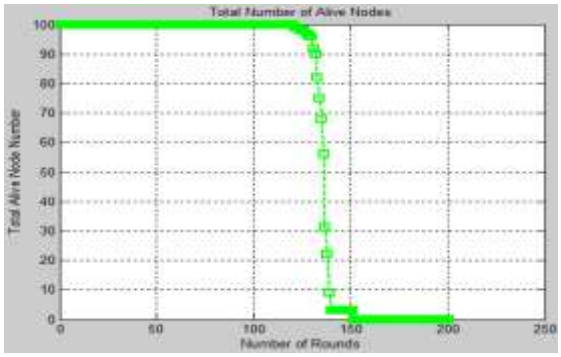
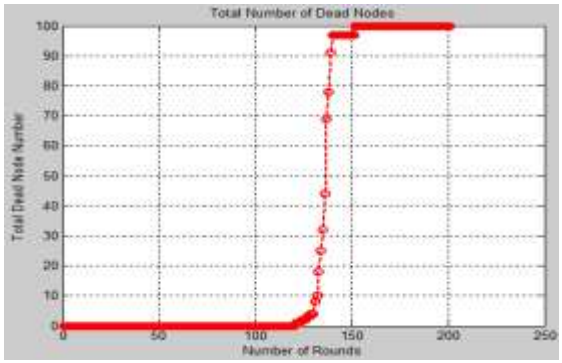


Figure 4 shows the total number



Conclusion

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