Estimation of Life Time of WSN cluster based Network through Grey Wolf Optimization

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Abstract: Energy performance has become a big problem in wireless sensor (WSN) networks. The sensor networks are operated by batteries, and so they turn out to be dead after a certain interval. The improvement of energy-efficient data dissipation is however much more challenging to increase the communication cycle of network. The clustering strategy has already proven to improve or prolong WSN's life cycle. However, the main issue addressed the collection of optimum CH which allows the network service prompt. Bearing in mind various limitations thus far, further theoretical research on solving this issue has been published. Under this situation, this study aims to create a new clustering model with optimal selection of the cluster head by taking into account four main parameters such as capacity, time, distance and security. In addition, this work introduces a cluster head selection optimization model for selecting the optimal CHs in wireless sensor networks (WSN). It applies the grey wolf optimization. Optimization of the WSN cluster heads significantly affects the life span of the network. Grey Wolf Optimization (GWO) is a newly proposed optimizer which has many successful applications. The Sensor nodes sense the ambient atmosphere shifts and transmit the data to other network nodes named sink node or base station (BS). The proposed Grey Wolf Optimization (GWO) enhances the life cycle of the sensor network. The energy based GWO solution ultimately enhance the cycle of the network.

Keywords-WSN**,** Grey Wolf Optimization, Base Station, Life Time of WSN.

1. Introduction

1.1 Simplified WSN

Efficient wireless network architecture of sensors has been a key research area in recent years. A sensor is a device that reacts to physical and environmental stimuli (such as friction, temperature, light, etc.), and measures inputs. The sensor is normally an electrical signal, sent to the device for further activity.

Wireless Sensor Network (WSN) in General

WSN network uses wire free connection with information gathered in a surveillance area to monitor the physical area. Information is distributed through several nodes, and information is linked to other networks, such as wireless Ethernet gateways. WSN is a cellular network containing base stations and non-serial (cellular) numbers. Such networks are used for tracking physical or environmental factors such as noise, heat, temperature and sending data across the network to a central location as seen.

1.2 WSN Arrangement for Network

The radio networks' WSN structure comprises diverse arrangement such as those given below.

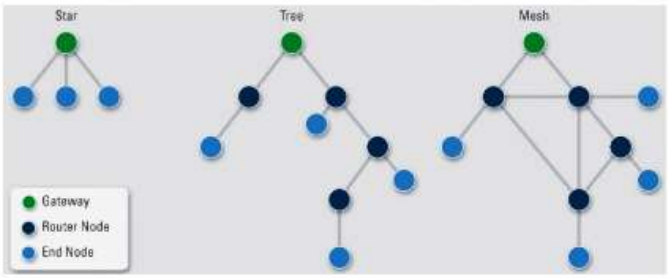

Figure 1: General structure for the wireless set up under some geometrical patterns.

Star Topology

This is a topology of communication, where each node is connected directly to the gate. A single portal can transmit messages to many distant places and may accept messages as well. Instar topology does not allow nodes to transmit messages one to another. It allows for contact inside a short latency area amid the remote position and the gateway (Channel Routing).

Since it is based on a single network management framework, the gateway will be inside the transmission range of all nodes. The downside of that is that it will allow quick and simple use of the checked remote tools. The network size depends on how many links it have built to the hub.

Topologies of the Arbores

Often called topology for the tree is a topology that lowers light. The node in the topology of the tree is connected to the process found above the concrete, further reaches the door. So it's usually possible to detect faults. The downside to this system is that they depend deeply on bus cables. If the entire network fails, so it fails.

Topologies on wire

When the node decides to transmit the message to another mode outside the range of the transmission connection, the communication center will be asked to transmit the message to the desired location. The advantage of mesh topology is that errors in the network can be quickly isolated and traced.

2. Clustering Introduction In WSN

In Wireless Sensor Networks (WSNs), clustering is one of the key strategies for expanding network life. It includes organizing sensor nodes into clusters for both clusters, and naming cluster heads (CHs). CHs collect data from the respective cluster nodes and forward the aggregated data to the base station. The graph indicates the lifespan of wireless sensor networks according to the recommended procedure due to the low power consumption.

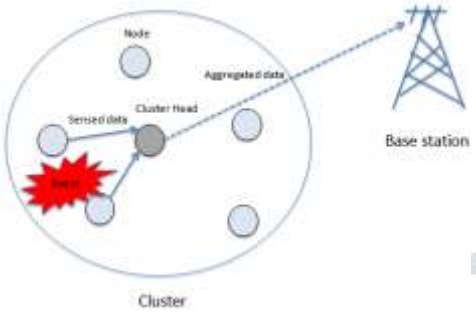

Figure 2: Developing a cluster comprises nodes and base station

In the following figure the clustering strategy reduces the difficulty of connecting with maser node nodes within a group. Now the prime obligation for contacting the base station rests with the Master node.

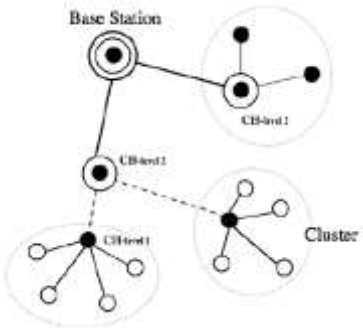

Figure 3: A sample of cluster based WSN.

3. Optimization of grey wolf

GWO is a potent algorithm for optimizing meta-heuristics. The gray-skinned animals are known for their modes of social life. The amount of each party is generally elected in 5 to 12 places, though, and each group is arranged strongly based on the status established by the society. Each wolf in the group plays a very special role according to their level of authorization. Each group has three main wolves levels; Alpha, Beta, and Omega. The lower wolves listed here are called deltas. Alpha Wolf is an extremely potent member. This placed the gray wolf shape within it. They are the ones who make the choices for the squad. They usually determine and control the activities of all groups. Alpha wolves are male or female wolves trainers, accompanied by a crowd [10]. Beta wolves are inferior wolves, and are useful in making decisions about Alpha. In the future it is usually the next dog to pick. Beta plays a role in welfare inside the organization. The key role is to help the decision of Alphas to serve as a leader and to advise other team leaders to improve the decision of Alphas. Omega wolves are among the smallest in this grouping, but quite significant in the calculation of the group's royal makeup. They usually serve every other great wolf. Triangular wolves not belonging to Alpha, Beta or Omega are rescue run wolves. The wolf-gray barking model is found primarily in wolf behavior. It describes the following important phases of the wolf cycle in terms in WSN. [11]

4. Methodology

4.1 Grey Wolf Optimizer

Two of the suggested and historically accepted approaches are genetic algorithms (GA), ant colony optimization (ACO) and particle swarm optimization (PSO). Particle swarm optimization (PSO) technique has been proposed to solve the problem of clustering node optimization. This approach operates more like bees or chickens, and sometimes seeks a different direction through community time to address the above issues. Such meta-heuristic approaches assess strategies to that energy usage, focused on real physical activity. Another form of optimization introduced is the Gray Wolf optimizer. The deer-hunting technique affects the process. A gray wolf is usually a routine for 5-12 men. This optimizer really functions close to the gray wolf's group hunting behavior. The pack's hunting behavior can be explained as follows in brief (Fig. 4):

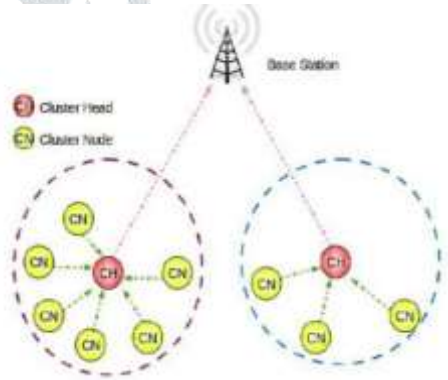

Figure 4: Cluster formation in WSNs

- Tracking, chasing and getting closer to the prey.
- The prey is pursued, encircled and harassed until it stops moving.

The package maintainer is called alpha. Either male or female, you will make choices about fishing, wake up time, where to sleep and so on. Other places / groups must comply with Alpha's rules / orders. Alpha is therefore the maximum level in the lowest category. The next command is Beta for the Grey Wolf pack. Beta Wolf, before issuing another low-level package, is responsible for advising Alfa decisions as well as making Alfa decisions. Beta may be masculine or feminine. Within the pack he / she is responsible for maintaining discipline. In the case of death by alpha or equivalent conditions, beta becomes the best nominee to assume the role of alpha.

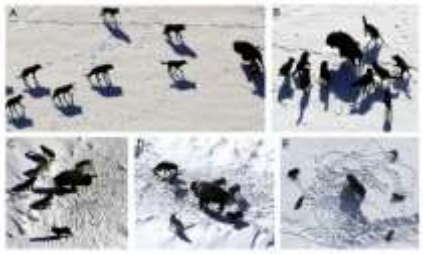

Figure 5: Hunting behavior of the pack

The lowest gray wolf number is alpha. This wolf is governed by all the other wolves, and the ruling wolf must conquer. Omega wolves must follow all instructions given by superior wolves. They were only permitted to feed, after all the other wolves had killed them. Omega wolves are not as relevant in this regard as other wolves. The level of advancement to senior positions is another point. Delta wolves are smaller than those of Alpha and Beta but stronger than those of Omega. Between alpha and beta, the delta wolves had to give up however they ruled Omega. This form of wolf involves careers, parents, hunters and scouts. The ultimate interest thus rests in securing the package and paying attention to labeling and consumer safety. The hierarchy of grey wolves is shown in Fig. 6.

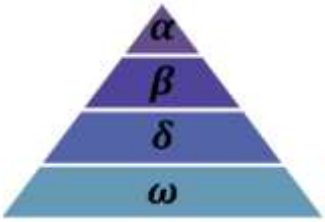

Figure 6: Grey Wolf Hierarchy

The best way to reflect the location of a wolf while modeling a medium-scale medium system (GWO) is α"α. The second and third options, respectively, are "β" and "ÿ." The choice to kill is decided by the α- , β- and taken-wolves, while the wolf "approximately" (approximately) is smaller than three dogs.

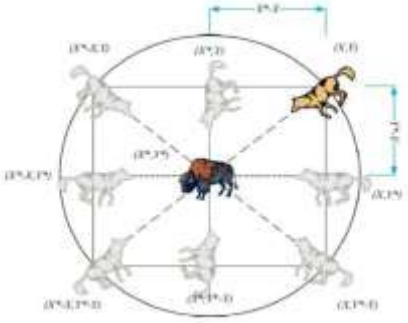

Figure 7: Possible hunting locations and encircling behavior of wolves

The wolves' ambient actions around their targets can be mathematically described as follows:

$$\vec{D} = \left|\vec{C}.\vec{X}_p(t) - \vec{X}(t)\right|$$

$$\vec{X}(t+1) = \vec{X}_p(t) - \vec{A}.\vec{D}$$

5. Simulation And Result

A MATLAB guide has been initiated to construct the GWO optimization. The layout has two button with one has existing and optimization. This simulation estimate the impact of grey wolf optimization on WNS cluster formation and lifetime.

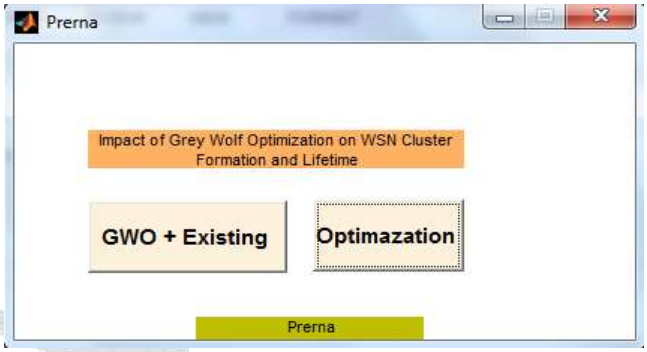

Figure 8: first layout of the proposed work.

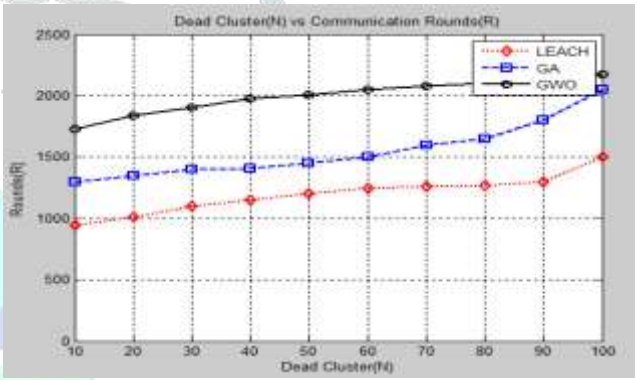

Figure 9: competitive analysis of dead cluster vs. round

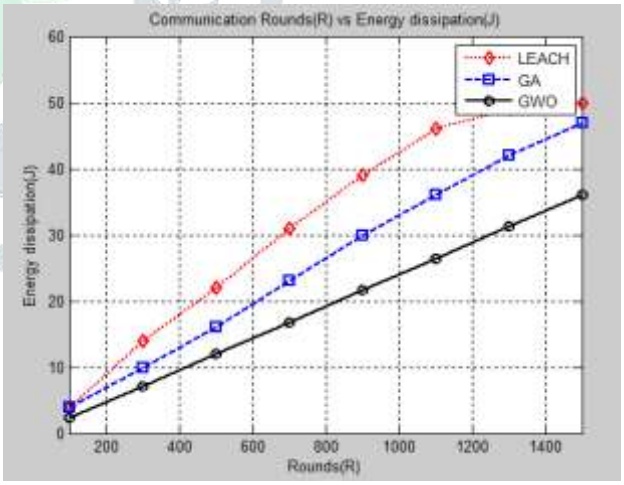

Figure 10: Competitive Analysis of Energy Dissipation vs. Round

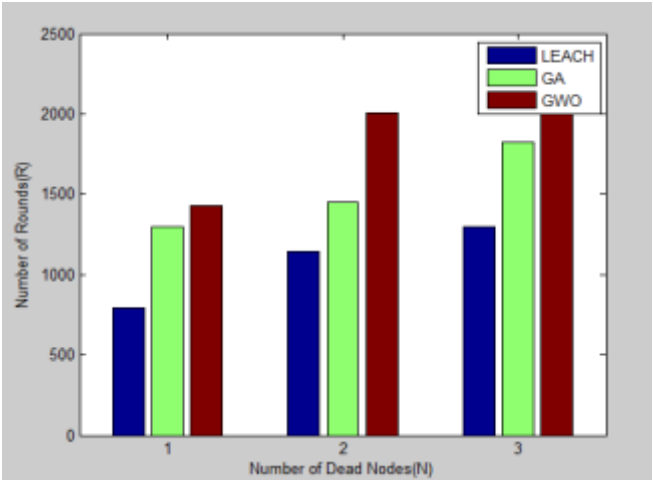

Figure 11: Competitive Analysis of Number of Dead Node vs. Round

As the above figure where the analysis has been graphically presented as dead cluster vs. round , Energy Dissipation vs. Round and Dead Node vs. Round. The outcome is very clear that the result achieved in GWO is very optimized and more longer in the WSN platform. As the same case in the Dead Node where the GWO perform less occurrence of dead node on comparing it to the LEACH and GA.

6. Conclusion And Future Scope

The primary challenge for wireless sensor networks (WSNs) is energy consumption. A battery runs the sensor networks, and after a while it turns out they're dead for communication end. Improving energy-efficient data dissipation remains a major obstacle to increasing sensor products' life cycle. Moreover, this work presents a cluster head optimization model for wireless sensor networks (WSN) to pick optimal CHs. Gray wolf optimization is applied. WSN cluster head architecture has important impact on network life. Gray Wolf Optimization (GWO) is a newly developed optimization approach with a wide variety of effective applications.

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