International Journal of Research in Advent Technology, Vol.8, No.10, October 2020
E-ISSN: 2321-9637
Available online at www.ijrat.org

Modified Leach Protocol for Improving Network Lifetime in Wireless Sensor Network

Amol Bhosle, Dr. Sachin Sakhare

Abstract—In various applications, such as industrial facility observation, medical treatment, and fire track, one of the most commonly known procedures is Wireless Sensor Network. The proposed approach where cluster head selection also channel selection approach and dynamic fuzzy logic and modified versions of Grey wolf optimization and modified particle swarm optimization reduces energy consumption. By choosing the right channel and arranging time slots, the improvement can be seen in data transmission hence it results in energy saving, hence improvement achieve in network lifetime. The proposed approach will be compared with existing TTDFP and PSO methods. We will use performance parameters such as remaining energy, alive nodes, packet delivery ratio, throughput.

Index Terms: WSN, LEACH, PSO, GWO, TDMA, TTDFP, Dynamic Fuzzy

I. INTRODUCTION

A wireless sensor network is a network of vitality-dependent sensing nodes that communicate over a large area. Even though WSNs have made significant progress in many areas, optimizing the network's lifetime remains a significant challenge. To overcome this disadvantage, several protocols and techniques are used.

Enhancing the point at which sensors are placed in the grid layout is one of the ways [1]. Sensor nodes are often made up of sensors, actuators, memory, and a processor, and they communicate over wireless media. WSNs are used for a variety of tasks, including ecological monitoring, animal habitat monitoring, acoustic monitoring, and conflict zone surveillance. In any event, these applications provide several challenges, such as extending the network lifetime by allowing sensor nodes to operate for a longer time duration.

Manuscript revised on October 1, 2020, and published on October 10, 2020
***Amol Bhosle**, Research Scholar Department of CSE, SSSUTMS, Sehore, India*
***Dr. S. R. Sakhare Professor**, Department of Computer Engineering, VIIT, Pune, India*

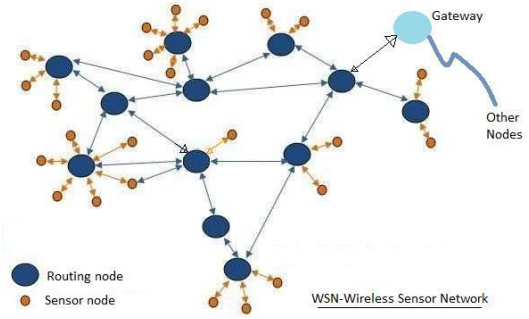

Fig. 1: A typical wireless sensor network

Fig.1 shows a typical WSN[23]. The information bundle transfers from sensor nodes (SN) to the cluster heads (CH).

A) LEACH (Low Energy Adaptive Clustering Hierarchy)

It is the most common leveled cluster-based wireless sensor network guiding protocol. Nonetheless, LEACH requires modification to address the disregard for lingering energy, area, and non-consistency conveyance in the cluster head determination. It also describes modification in single-hop transmission. LEACH protocol improves the Cluster head determination technique. Whether the nodes changing CH after the initial transformation or not identified by few parameters. The sink also calculates the average node energy to guarantee that energy stacks are spread fairly across all nodes by detecting whether any nodes have energy below the average.

Clustering divides the network into many clusters, Clustering techniques are the LEACH protocol. The LEACH method has two stages: setup and information transmission. Clusters are shaped and the cluster head is generated at random during the cluster formation step. The information is passed to CH in the first stage; the CH combines the information and delivers it to the sink to overcome the insufficiency of the LEACH in disregarding residual energy, the suggested LEACH considers both the remaining energy and are. The network is divided into clusters regularly.[11][15]

In the setup phase, every node selects a value between 0 and 1 and then calculates an edge condition. If the selected value is less than or equal to T(n) then that is The limit number T(n) appears in Eq.1

$$T(n) = \begin{cases} \dfrac{P}{1-P\times\left(r \bmod \frac{1}{P}\right)} & if\ n \in G \\ 0\ otherwise \end{cases}, \quad (1)$$

P is assuming rate, the current round is r and G is another node.
In the second phase, every node transmits information. [4].

B) Advantages Of Leach Protocol

- Cluster formation is fluid, dispersed, and self-sorting.
- Information exchange is controlled locally, with hubs sending data to respective CHs rather than the BS.
- Because nodes deliver information to their own CHs, they use less power while transmitting.
- After approving the information, CHs can total it according to the application's requirements.

C) OBJECTIVES OF THE RESEARCH

- To notice the limitations of existing group-based routing protocols, approaches are developed in this exploratory study that achieves greater energy savings by forming optimum clusters.
- To employ a few group-based routing methods to maximize energy efficiency.
- To develop approaches that will aid in the creation of optimum clusters, which will save even more energy.
- To notice various clustering difficulties
- To address the LEACH protocol's issue with bunch head tally fluctuation.

II. LITERATURE REVIEW

Sert, S. A. et al [13] provides a system to extend the life of a network, with a focus on fuzzy implementation. An energy-efficient data aggregation system for multiple hop wireless sensor networks is the Two-Tier Distributed Fuzzy Protocol. When selecting CHs, the proposed TTDFP method takes into account the position of the base station, the associated node connection, and the remaining energy parameter.

S.G.Santhi et al [20]As a result, the CHs' vitality usage is completely corrected, and the system's lifespan is increased. The induction of an effective molecular encoding strategy, as well as wellness work for guiding and grouping separately, are required for these computations. Comparison for various parameters.

Hossam Faris et al,[8] The key GWO techniques, as well as the theoretical basis, are presented procedurally. Furthermore, the most recent GWO versions are carefully investigated, which are classified into modified, hybridized, and parallel variations.

Vimlarani et.al [22] present an energy optimization technique based on particle swarm optimization. To reduce power consumption, this system performs clustering and clustering head selection. To validate the performance measures, the data are compared to a competitive clustering technique.S. Lindsey et al [21] discuss energy is expended in group arrangement in LEACH protocol. In the event of failure of a hub, fasten of nodes should be reproduced to sidestep the dead hub. A token-based approach is utilized for transmitting the data in which the pioneer will pass the token to end nodes. The end nodes will transmit the data to the neighboring hub which thus will send the accumulated data to its neighboring hub. D. Xie, et al [5] proposes a novel bunch development technique is proposed. In this methodology, bunch members can join the group head by choosing both of two options. In the principal choice, bunch members compute the aggregate energy consumption, in the wake of getting the group head commercial. The aggregate energy comprises of energy devoured in sending data to CH by group members and energy expended in getting, totaling, and transmitting data by CH. The nodes unite the CH with the least aggregate energy. In the second choice, nodes join just that CH that builds the co-alive life span. The approach is appeared to enhance the LEACH and DEEC protocols. GA Shah, et al [6] proposes a system that works QoS and works in the cross-layer protocol. Sensor devices with sound and visual data gathering modules may recover media data, store or process data in real-time, connect and interweave interactive media data originating from disparate sources. RM Eletreby et al [17] recommends that a large number of empty channels be used for multi-hop communication, resulting in more energy being used by nodes near the sink. A. Salim, et al [2] presents a methodology for balancing the load of the group head, which includes a pre-steady state phase. During this phase, each group leader selects the bunch members who will act as aggregators for each TDMA plan's edge. These aggregators are chosen based on residual energy, conglomeration load, and transmission load to the BS. Bhat. S et.al, [3] Discussesause the extended lifespan between sensor nodes, it is necessary to make use of skilled clustering calculations. They describe the use of MATLAB to investigate variants of LEACH, namely LEACH-E, MODLEACH, and Distance-LEACH. The results show that three variation procedures outperform LEACH in terms of the parameters under consideration. Nikolidakis et al [13] propose an effective system after energy protection through balanced clustering They discussed the problem with traffic in the network. Cluster size plays an important role in network lifetime also the selection of head node is vital. Roy et al [18], proposes a QoS algorithm for MANET. The system handles the mathematical aspect of the future streamlining issue. Networks feature a high number of edges and nodes, resulting in a big and computationally complicated DTR advancement issue. ACO was chosen as the best approach for dealing with problems.

Cong et al [4] discuss problems with the ACO method. Modified ACO is proposed To find the best routes, use a location-based routing algorithm and neighboring requests.

III. PROPOSED METHODOLOGY

Proposing three approaches for regulating energy usage in a WSN to complete the research job. In the first, a new cluster head determination algorithm based on LEACH is suggested. The suggested approach will enable sensor nodes to consume energy in a more balanced manner. The cluster head and channel selection technique, as well as dynamic fuzzy logic, modified versions of Grey wolf optimization, and modified Particle swarm optimization, all help to save energy.

A) Proposed Algorithm

In the proposed work following steps are proposed.
Step1:LEACH application on WSN
Step2:Helper Function
Step3:Cluster head function-Selection of CH
Implementing parallel approach for CH formation and CH HCH selection using GWO and PSO modifications
Step4:Distributed cluster set up function
Step5:Receiving function-
Step6:Sending function
Step7: Recalculate the CH- Residual Energy

B) Performance Metrics

The improvement in data transmission may be observed by picking the correct channel and organizing time slots, which will result in energy savings and an increase in network lifespan. Existing TTDFP and PSO techniques will be compared to the suggested method. The improvements in metrics such as remaining energy, alive nodes, packet delivery ratio, and throughput will be compared. These performance metrics aid in determining the suitability of the proposed method.

C) Proposed Simulation Environment

Using Network simulation environment will be created. Considering simulation area 1000x1000 m^2 square . The nodes will be given the underlying energy. The BS will be stationed at this location. To get the maximum level of assurance in the interim, numerous rounds of simulations are used to create the findings. The proposed protocol improves the cluster head's decision-making method. In the following phase, it creates a few hubs with greater leftover energy to serve as cluster heads.[7][10][11]

IV. CONCLUSION AND EXPECTED OUTCOME

A non-specific cluster head selection technique is provided in this study effort, which will generate the best clusters by managing cluster head variances. The randomness shown in the cluster head selection process will be controlled using this method.

The cluster head and channel selection technique, as well as dynamic fuzzy logic, modified versions of Grey wolf optimization, and modified Particle swarm optimization, all help to save energy. Based on the improvement in parameters remaining energy and number of living nodes, data transmission considered, minimizing retransmission, and energy is conservation, resulting in increased network lifespan. Future studies will include the addition of more parameters to compare the system to another approach for network lifespan enhancement.

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Amol Bhosle, Research Scholar, Sri Satya Sai University of Technology and Medical Sciences, Sehore, MP. India

Dr. S.R.Sakhare, Professor, Head Department of Computer Engineering Vishwakarma Institute of Information Technology, Pune, India