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Routing Strategy of Reducing Energy Consumption for Underwater Data Collection

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ABSTRACT: In the current research, we introduce a novel leach-based routing system for wireless sensor networks. LEACH is being used to boost data throughput. LEACH is a hierarchical protocol in which the majority of nodes communicate to cluster heads, who then compile and pass the data to the base station (sink). Each node employs a stochastic method to predict whether it will become a cluster head in this round at the beginning of each cycle. LEACH assumes that each node has a radio capable of directly connecting to the base station or the nearest cluster head, but that continually utilising this radio at full power would be energy wasteful. For P rounds, where P is the desired percentage of cluster heads, nodes that have previously been cluster heads cannot become cluster heads again. The likelihood of any node becoming a cluster head in a subsequent round is $1/P$. Each node that is not a cluster head chooses the closest cluster head and joins that cluster at the conclusion of each round.. The cluster head then develops a transmission schedule for each node in the cluster. Only the cluster head can connect with all other nodes through TDMA, and only on the schedule that the cluster head establishes. They simply have to keep their radios on for the duration of their time slot, utilising the least amount of energy necessary to reach the cluster head.

KEYWORDS: Routing Algorithm, LEACH, Cluster Head, TDMA, Hierarchical Protocol

I. INTRODUCTION

A wireless sensor network system includes sensor node, sink node and management node. A sizable number of sensor nodes are installed in the monitoring region, creating a network through a process of self-organization. The data collected by the sensor nodes is relayed along other nodes one at a time until it reaches the sink node through a multi-hop routing and then travels through the wired and wireless Internet to the management node. WSN nodes are divided into groups through the process of clustering, and each group selects a central node, known as the Cluster Head (CH), which is in charge of storing and transmitting to the base station all sensory data from the group members (BS). A useful topic of research in wireless sensor networks is cluster-based routing. The classical LEACH technique provides significant benefits in terms of data aggregation, energy efficiency, and other factors. A-LEACH stands for Assisted-Leach Protocol. The majority of clustering protocols entrust cluster leaders with the complete burden of data gathering and data routing. The base station receives aggregated data from cluster heads directly via the LEACH protocol. This shortens a network's lifespan. We use the idea of "Helper Nodes," wherein each cluster's cluster heads handle data aggregation while a node located closer to the base station is given the task of routing. For the assistance nodes to create a route to the base station, we provide a fresh idea. Each helper node selects the node closest to the base station from among all of its nearby helper nodes. In addition to lowering the energy consumption of the sensor nodes, effective clustering algorithms also reduce communication interference and boost the effectiveness of the MAC and routing protocols. It is therefore suggested that the problem now requires a very effective and reliable rational method to be solved immediately. In this paper, an improved adaptive layered E-LEACH algorithm based on the LEACH algorithm is presented, taking into account the residual energy for each node. At the beginning of each round of LEACH-C, all nodes will transmit their locations as well as their remaining energy values to the base station. Upon

receipt of this data, the base station determines the average energy value of all nodes, identifying any nodes with residual energy above the average as candidates, and selecting a subset of cluster heads from the candidate using simulated annealing to minimise the objective function. According to this q leach sensor nodes are inferred in the region. We divide the network into four sections to get better clustering. By performing this kind of segmentation, the entire network is better covered. Moreover, the precise distribution of nodes. Moreover, it offers a concept for an effective clustering technique that considerably improves network coverage.

II. RELATED WORK

In [1] Energy Efficient Homogeneous Clustering Algorithm for Wireless Sensor Networks by Shio Kumar Singh, M P Singh and D K Singh in 2010, an innovative strategy for an energy-efficient homogeneous clustering method for wireless sensor networks is described. The algorithm extends the network's life by assuring a homogenous distribution of nodes inside the clusters. By choosing cluster heads based on (i) the residual energy of current cluster heads, (ii) holdback value, and (iii) the nearest hop distance of the node, this clustering technique distributes energy efficiency and improves network performance. The suggested clustering technique evenly distributes the cluster members, extending the network's life. In [2] A Classification of Solutions for the Energy Limitation in Wireless Sensor Networks by M. Popa, O. Prostean and A.S. Popa in 2013, the development of Wireless Sensor Networks (WSNs) has been phenomenal and exacerbated in recent years. The energy of the sensors has a significant impact on the lifespan of a WSN since in practically all applications the sensors must be autonomous. As battery replenishment or replacement is challenging or impossible, the fundamental obstacle to designing and building a WSN is the energy issue. A summary of the energy constraint solutions is provided in this essay. It lists the sources of energy consumption. In [3] Energy Efficient Clustering Based on LEACH by M. Ben Salah, A. Boulouz in 2016, applications for wireless sensor networks (WSN) include remote environmental monitoring and target tracking. The optimization of energy usage is extremely important due to the limited energy resource of sensor nodes. In order to minimise energy consumption and increase network lifetime, several clustering-based techniques are used. In this study, a better method for wireless sensor network-based LEACH for homogeneous networks is provided. The suggested technique employed a CH selection by taking the remaining energy of the sensor node into account in the likelihood of becoming CH. Simulation findings demonstrate that, in comparison to LEACH, the proposed algorithm increases network lifetime and offers reduced energy usage with greater network stability.

III. PROPOSED ALGORITHM

The LEACH algorithm is divided into three phases. Cluster formation is the initial stage. At this step, the cluster's formation will be identified. The building of the route is the second step. At this step, we choose the best chain between the CHs. The third step is the data transmission phase, which marks the start of data transmission.

A. Cluster Creation Phase:

1. Election of cluster leaders;
2. Clusters and Ch are determined;
3. Planning of transmission plan of each ordinary node by the CH;

Each cluster head allots the cluster members a specific amount of time during this phase to establish a communication link, allowing the nodes to enter sleep mode for the remainder of the period. The CH creates a transmission plan (TDMA schedule) and assigns to each node the precise window of time within which it must send the data it has acquired.

This enables the nodes to enter a sleeping state and switch off their radio antennae, which will conserve more energy. Moreover, employing the TDMA scheduling will enable us to prevent issues with collusion and interference between cluster nodes.

B. Cluster Head Determination Phase:

When the clusters have been fixed, the BS uses the kangaroo technique on the CHs to find a quicker path to it and provides organisational information (chain) to all CHs (successor and predecessors of each CH). The proposed protocol's goal is to decrease the number of nodes that communicate directly with the base station by building a chain of cellular hubs (CHs), which decreases the CHs' distance from the BS for data transfer.

The way of data transfer to BS is where our protocol differs from the LEACH protocol; this transmission is accomplished by a series of jumps establishing a chain linking all the CHs using an optimization technique (roughly heuristic approaches) called kangaroo. Because the base station constructs the data paths between the CHs, it should be noted that the proposed protocol is centralised.

C. Data Transmission Phase:

1. Turn on the radio in the CH and the Nodes you wish to send data to;
2. Turn off the radio on the other regular nodes.
3. Communication from ordinary nodes to cluster heads, then from CHs to the base station via the best path.

Advantages:

- Higher data transfer throughput
- Higher quality
- Overhead Reduced
- High Efficiency and Through

IV. SIMULATION RESULTS

A. Basic Leach

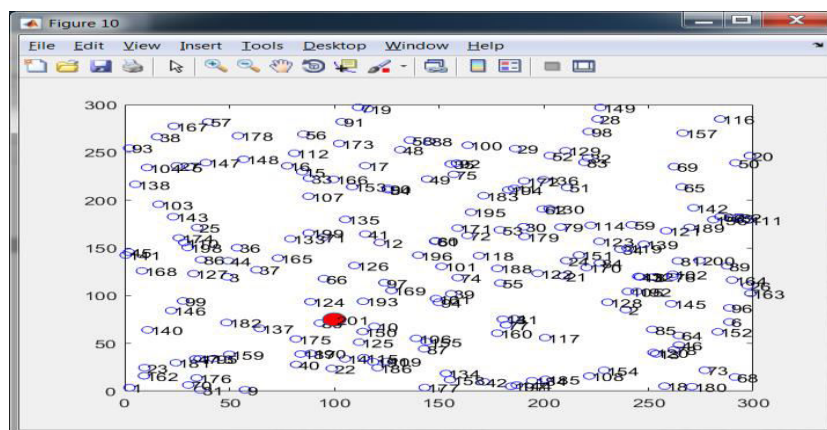


Fig 1. Basic LEACH

When compared to LEACH for a 100m*100m network, the overall amount of data received at the base station over time was almost 1.2x times higher.

B. . Clustering of LEACH

| Parameters | Value |
|-------------------------------------|------------------------------|
| Network area (meter) | 150 x 150 |
| Number of nodes (N) | 100 |
| BS location | (75, 170) |
| Forwarder location | (75, 65) |
| Initial Energy (E_0) | 0.5 J |
| E_{TX} | 50 nJ |
| E_{RX} | 50 nJ |
| E_{amp} (cluster to BS/forwarder) | 0.0013 pJ/bit/m ⁴ |
| E_{fs} (cluster to BS/forwarder) | 10 pJ/bit/m ² |
| E_{amp1} (intracluster comm.) | $E_{amp}/10$ |
| E_{fs1} (intracluster comm.) | $E_{fs}/10$ |
| E_{da} | 5 nJ/bit |
| Packet size | 4000 bits |
| Number of rounds | 3000 |

Table 1 Clustering of LEACH

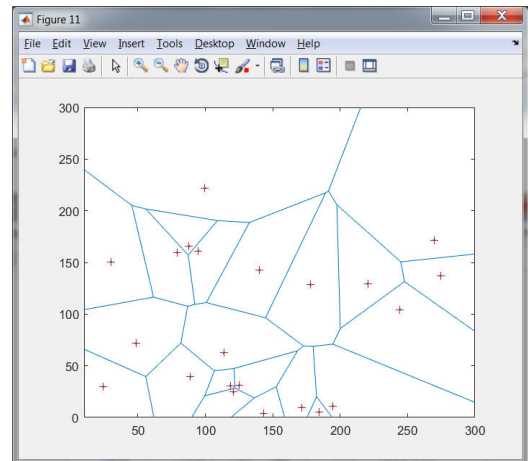


Fig 2. Clustering of LEACH

Nodes submit their candidate messages to be Delivered to the sink, which gets these candidate messages, based on the number of nodes in the area we need to cluster the nodes in particular area when receiving a start message from the sink..

C. Dead Nodes

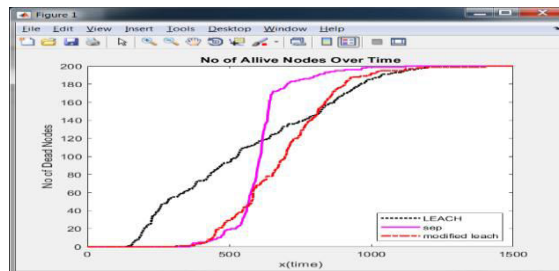


Fig 3. Dead nodes

The ratio of dead nodes to rounds. The LEACH routing protocol is shown to have a shorter stability period and a shorter instability period than the other two routing protocols.

D. Live Nodes

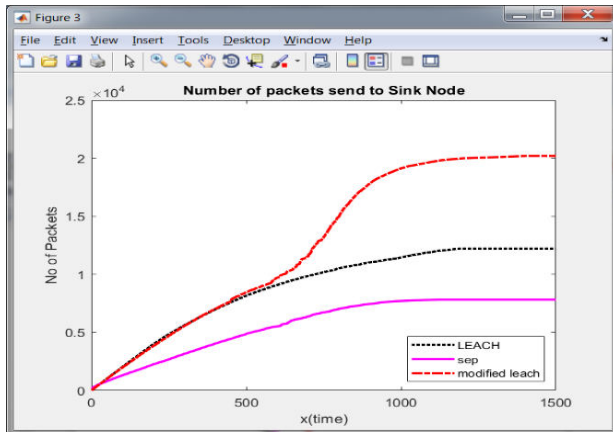


Fig 4. Live Nodes

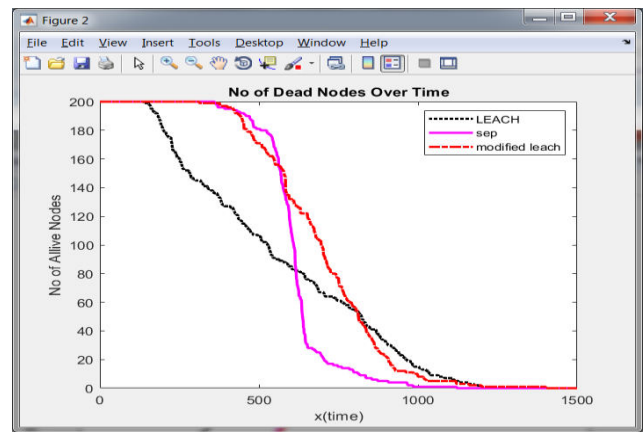


Fig 5. No. Of Transmit Packets

The number of living nodes and their relationship to the number of rounds are shown in this graph. It has been demonstrated that EE-MRP has a comparably longer stability period than LEACH, MODLEACH, and SEP.

E. Energy of Nodes

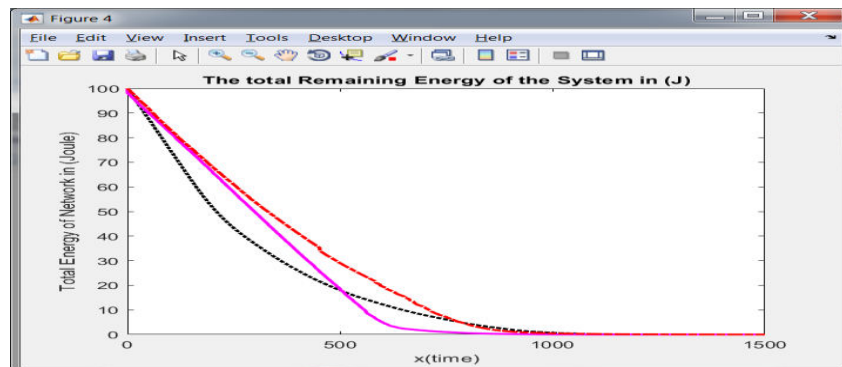


Fig 6. Energy Nodes

The network's average remaining energy after a certain number of cycles. The graph makes it evident that MODLEACH expends less energy than LEACH. SEP beats LEACH and MODLEACH routing protocols in terms of energy dissipation per round.

F. Comparison Graph

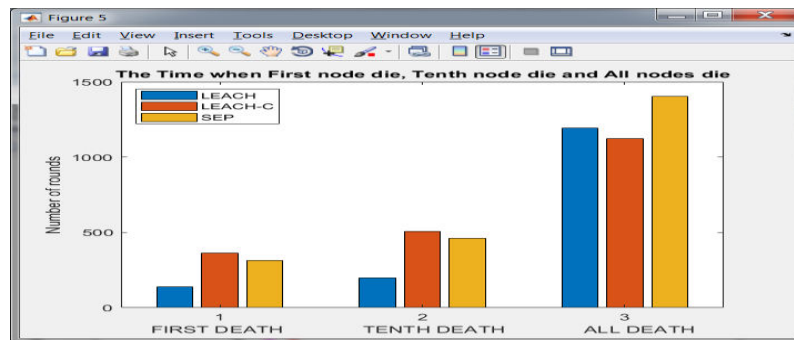


Fig 7. Comparison Graph

The bar chart lists the nodes that are approaching death conditions in each cycle of the SEP technique, with significantly fewer nodes dying.

V. CONCLUSION AND FUTURE WORK

The usage of wireless sensor networks is widespread in monitoring applications. To increase the network's lifespan, clustering based routing that uses less energy is essential. We have proposed an energy-efficient LEACH-C for wireless sensor networks in this study. This research concentrates on a modified form of the cluster head selection based upon their residual energy in order to increase the lifetime of the network system. Every sensor node in a heterogeneous two-level hierarchical network autonomously elects itself as a cluster head based on its initial energy in comparison to that of other nodes using the SEP (Stable Election Protocol). Contrary to what we do, every election cycle does not require any global energy understanding. Unlike LEACH, which makes assumptions about the distribution of the various energy levels in the sensor nodes beforehand, SEP is dynamic. Also, our study of the SEP is not just asymptotic; tiny networks may benefit from the analysis just as much. As of right now, SEP is being expanded to handle clustered sensor networks with more than two levels of hierarchy and more than two different types of nodes.

REFERENCES

- [1]. H. Khan, S. A. Hassan, and H. Jung, On underwater wireless sensor networks routing protocols: A review, IEEE Sens. J., vol. 20, no. 18, pp. 10371–10386, 2020. J. H. Luo, Y. P. Chen, M. Wu, and Y. Yang, A survey of routing protocols for underwater wireless sensor networks, IEEE Commun. Surv. Tut., vol. 23, no. 1, pp. 137–160, 2021.
- [2]. M. Sharma and M. Gupta, Interpretation of underwater sensor routing, in Proc. of 2019 Int. Conf. Computing, Communication, and Intelligent Systems (ICCCIS), Greater Noida, India, 2019, pp. 139–143.
- [3]. V. Kumar and V. K. Sinha, Underwater wireless sensor network routing protocols: The survey, in Proc. of 2020 2nd Int. Conf. Advances in Computing, Communication Control and Networking (ICACCCN), Greater Noida, India, 2020, pp. 359–362.
- [4]. T. Qiu, Z. Zhao, T. Zhang, C. Chen, and C. L. P. Chen, Underwater internet of things in smart ocean: System architecture and open issues, IEEE Trans. Industr. Inform., vol. 16, no. 7, pp. 4297–4307, 2020.
- [5]. Y. Bayrakdar, N. Meratnia, and A. Kantarci, A comparative view of routing protocols for underwater wireless sensor networks, in Proc. of OCEANS 2011 IEEE-Spain, Santander, Spain, 2011, doi: 10.1109/OceansSpain.2011.6003477.
- [6]. G. Z. Liu and Z. B. Li, Depth-based multi-hop routing protocol for underwater sensor network, in Proc. of 2010 the 2nd Int. Conf. Industrial Mechatronics and Automation, Wuhan, China, 2010, pp. 268–270.
- [7]. M. Y. Zhang and W. Y. Cai, Energy-efficient depth based probabilistic routing within 2-hop neighborhood for underwater sensor networks, IEEE Sens. Lett., vol. 4, no. 6, p. 7002304, 2020.

- [8]. C. Su, X. M. Liu, and F. J. Shang, Vector-based low-delay forwarding protocol for underwater wireless sensor networks, in Proc. of 2010 Int. Conf. Multimedia Information Networking and Security, Nanjing, China, 2010, pp. 178–181.
- [9]. K. M. Pouryazdanpanah, M. Anjomshoa, S. A. Salehi, A. Afroozeh, and G. M. Moshfegh, DS-VBF: Dual sink vector-based routing protocol for underwater wireless sensor network, in Proc. of 2014 IEEE 5th Control and System Graduate Research Colloquium, Shah Alam, Malaysia, 2014, pp. 227–232.
- [10]. C. Wang, G. Zhang, Y. Shao, and L. Zhang, Improvement research of underwater sensor network routing protocol HHVBF, in Proc. of 11th Int. Conf. Wireless Communications, Networking and Mobile Computing (WiCOM 2015), Shanghai, China, 2015, doi: 10.1049/cp.2015.0744.

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