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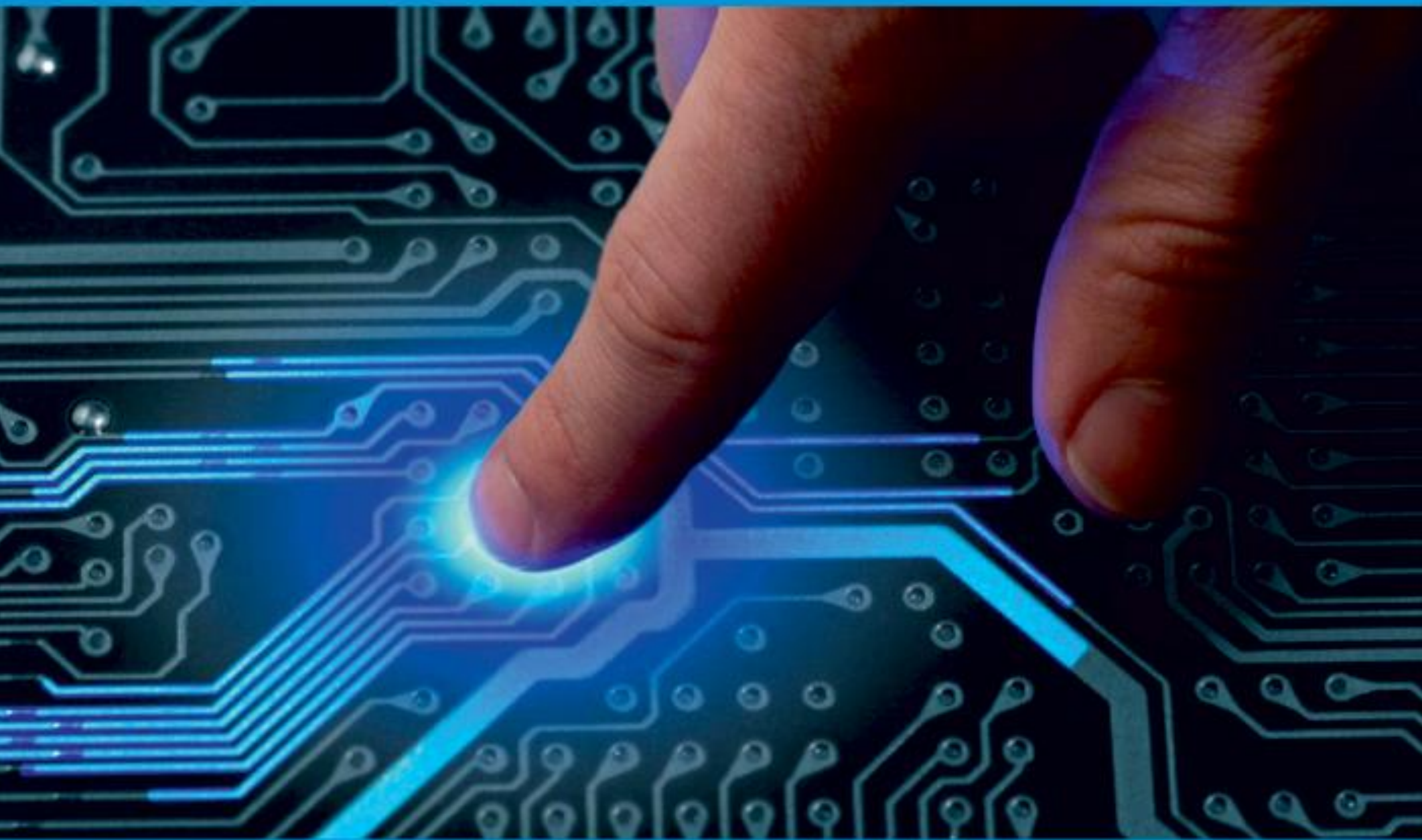

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An Investigation on High-Performance Optimization Algorithms to Improve the Lifetime of Wireless Sensor Network

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ABSTRACT: A wireless sensor network (WSN) is used for a variety of data collection purposes. The finite energy of sensor nodes is a significant bottleneck in wireless data collection systems.Here, Lifetime is one of the most important Quality of Service considerations. By reducing node energy usage, the network lifespan can be expanded to a sustainable time period.Clustering is a significant approach for getting better energy effectiveness and lengthening the longevity of a network.To improve energy efficiency, hierarchy modeling-based clustering is proposed, in which nodes with greater transmission power are grouped to gather data and transmit it to the ground station.By adopting Map Reduction for controlling maps and lowering complications in routed mechanisms for removing duplication and overlaps, an enhanced clustered technique is expected to achieve energy efficiency.To use an optimal method to solve critical routing difficulties, a multi-objective optimization technique is used to map the routing range and speed up the process related to traveling.It focuses on a variety of goals, including distance, energy, mobility, latency, and node lifetime. The hybridized technology maps the route with the Teaching task and reduces the workload by learning the route-building challenges.

KEYWORDS: Wireless Sensor Network (WSN),Lifetime,Clustering,Energy Efficiency,Multi-objective Optimization.

I.INTRODUCTION

The use of sensor networks for diverse applications, particularly health care and medical applications, has increased dramatically in recent years. Sensors have a variety of distinguishing features, which makes this possible.Sensors are essentially very small machines that are capable of sensing, processing, and delivering the necessary data.Wireless Sensor Networks (WSNs) are rapidly evolving as a foundation for widely dispersed and widely used applications such as dermal fillers, environmental sensing, habitat research, and surveillance cameras, among others.

The trickiest problem with WSNs is energy usage, which must be meticulously organized by the network's sensors and communication standards.Both energy efficient grouping and routing are two well-known optimization algorithms that have been actively learned to increase WSN lifetime.The Wireless Sensor Network (WSN) is a collection of sensors used to collect and track the physical state of the environment, as well as manage the collected data from a central location. WSNs evaluate environmental conditions like temperature, sound, pollution level, moisture, wind, and so on.

Every sensor central node contains a number of elements, such as a radio transceiver with an internally or externally antenna connector, a microcontroller, an electronic system for interacting with the sensors, and a form of energy, which is typically a battery or an integrated architecture of energy storage.In this project, the liveliness state in sequence of adjacent sensor module for cluster head decision is used to describe the efficient energy clustered and routing methodologies for WSNs in particular.Even though “nodes” of authentic multi-objective function have been allocated to be produced, the sensor networks size ranges from that of a small to any size based on requirement.

II. RELATED WORKS

Previous research has explored strategies for extending the lifetime of WSNs by optimizing energy consumption, emphasizing the importance of lifetime as a Quality of Service metric. Clustering Techniques: Various clustering approaches have been investigated to enhance energy efficiency and network longevity, such as hierarchical modeling-based clustering, which organizes nodes with varying transmission power for improved data gathering and transmission efficiency. Map Reduction Integration: Prior work has considered the integration of Map Reduction techniques to manage data maps effectively and reduce complexities in routing mechanisms, addressing challenges related to duplication and overlaps in clustered networks. Multi-Objective Optimization: Research has utilized multi-objective optimization techniques to tackle critical routing challenges, focusing on objectives like distance, energy consumption, mobility, latency, and node lifetime. These approaches aim to optimize routing paths and expedite data transmission.

III.EXISTING METHOD

Due to poor Cluster head selection, the lifespan of a WSN with traditional network architecture was extremely short. The node that is elected as CH has a considerable computational cost and uses more battery power.Existing protocols utilize a probabilistic technique to choose the cluster head, which may reduces the high trusted node, must become CH, reducing network life time.Single-objective heuristics optimization methods take longer to determine the optimal CH that minimizes power loss.Heuristic objective functions may fail to identify the global best cluster head. Due to the vertical techniques, you may find yourself stuck at the local optimal point of a minimization problem.

IV.PROPOSED SYSTEM

Enhance WSN lifetime by optimizing energy use as a critical Quality of Service metric.Implement effective clustering methods, like hierarchical modeling, to improve energy efficiency and data transmission.Integrate Map Reduction techniques to streamline data management and address duplication issues in clustered networks.Utilize multi-objective optimization to optimize routing for factors such as distance, energy, mobility, latency, and node lifetime, expediting data transmission.Enhance WSN Quality of Service through a holistic approach that ensures efficiency and sustainability. Prioritize energy-efficient practices to extend network lifespan.Design the system to be scalable and robust for diverse WSN scenarios, maintaining reliability in various conditions.

V.BLOCK DIAGRAM

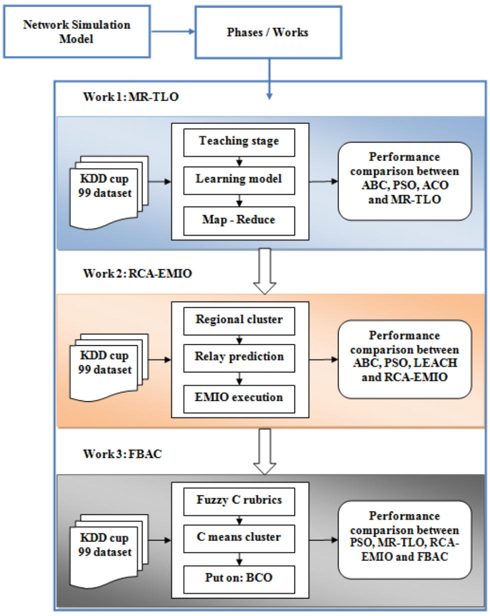

Fig 1.Block diagram of proposed system

The following are the key contributions of the recommendedresearch methods:

- Map Reduction based Teaching Learning Optimization (MR- TLO) is being introduced to increase network lifespan and reduce redundancy.
- EMIO introduces a Regional Clustering Scheme based on group trust level for effective and reliable data gathering in wireless sensor networks.
- Asymmetric Clustering with Fuzzy C-means and Bee Colony Asymmetric Clustering (FBAC), a meta-heuristic approach is proposed to optimize energy utilization.

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An enhanced clustering technique is expected to achieve energy efficiency in the initial stage suggested work by applying Map Reduction for controlling mapping and lowering complexity in routing mechanisms to eliminate duplication and overlaps. This study analyses intelligent behaviors to adjust with network changes and to incorporate computational intelligence capabilities in order to enhance network performance.

The second paper presented On Regional Clustering Algorithms, which are used to compress the issue and break it down into smaller groups known as clusters. These networks form a cluster around with another node thanks to cluster heads.

The cluster head acts as a natural coordinator for its come together to conduct multi routing, packet forwarding, and other duties. The Root Node is picked from the networks that have the highest level of trust(CH). Using the Enhanced Monkey Induced Optimization (EMIO) method and a knowledgeable confidence replica, the cluster head(s) were discovered.

Finally, Fuzzy Logic is utilized to determine the competition radius of networks and to pick cluster - heads in each group. The Bee Colony Optimization technique is applied to a subset of relay nodes. Relay nodes are selected using Fuzzy C-means and Bee Colony Asymmetric Clustering (FBAC) depending on block size, network lifespan, and node distances from the base station.

VI. EXPERIMENTAL RESULTS

The simulation of the proposed model requires the MATLAB-2022 simulator and the PC with certain system configurations.The entire simulation of the proposed RCA-EMIO is done in a PC with the 4GB RAM, Windows 10 OS, and the Intel I3 processor.The default values for the simulation parameters. The dimension of the network extends to an area of 100 m × 100 m, and the coordinates of the base station are [50.50].The scenario-1 includes N =1 00 nodes, the sensing region as 100*100m2, Ei =0:5J and Kopt = 5. The BS has been placed outside the sensing region, i.e., at (150, 100) m for this scenario assuming the center of sensing region at (50,50)m.The simulations have been done for evaluating the network lifetime, residual energy and coverage of the network.

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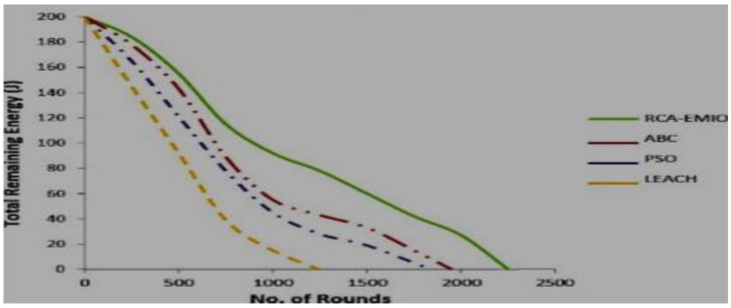

Fig 2.Number of round with residual energy

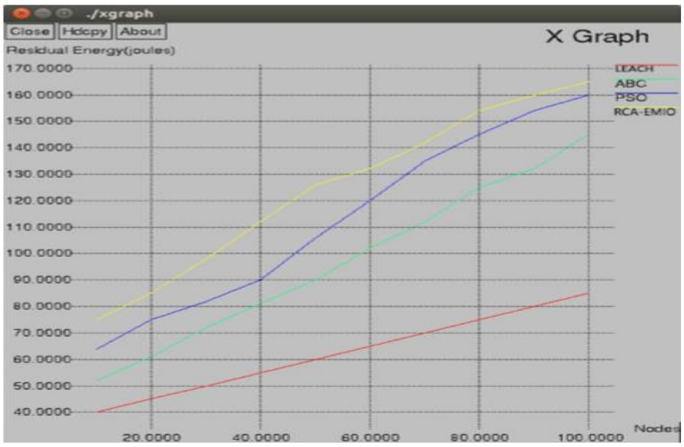

Fig 3.Residual energy

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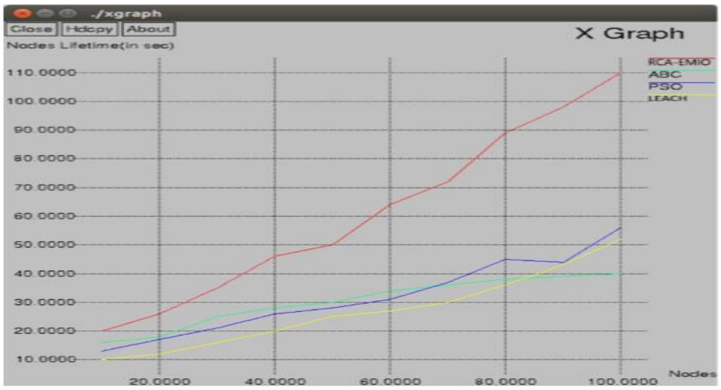

Fig 4.Network Lifetime

VII. FUTURE SCOPE

Machine Learning Integration: The project can explore the integration of machine learning algorithms to enable WSNs to adapt and optimize their operations dynamically, based on changing environmental conditions and network demands.
5G and IoT Integration: With the rise of 5G networks and the Internet of Things (IoT), there is potential for the project to expand its scope to leverage these technologies for even more efficient and rapid data transmission and collection.
Energy Harvesting Solutions: Investigate the feasibility of energy harvesting techniques, such as solar or kinetic energy harvesting, to further enhance the energy efficiency and lifespan of sensor nodes.
Real-World Deployments: Move from theoretical research to real-world deployments, possibly in smart cities, industrial automation, or environmental monitoring, to validate the project's findings and assess its practical impact.
Security and Privacy: Extend the project to address the critical aspects of security and privacy in WSNs, ensuring that data collected and transmitted remain secure and compliant with privacy regulations.
Cross-Domain Applications: Explore how the project's findings and techniques can be applied to diverse domains, such as healthcare, agriculture, and disaster management, to address specific data collection challenges.
Edge Computing: Investigate the integration of edge computing in WSNs, enabling data processing and analytics closer to the data source, reducing latency and enhancing efficiency.

VIII. CONCLUSION

This project focuses on improving the performance and longevity of wireless sensor networks (WSNs) for data collection. It addresses the challenge of limited energy resources in sensor nodes and emphasizes the critical importance of extending the network's lifetime as a key Quality of Service metric. To achieve this, the project explores various strategies.First, it investigates clustering techniques, with a particular emphasis on hierarchical modeling-based clustering.

This approach organizes sensor nodes with varying transmission power, leading to more efficient data collection and transmission, ultimately enhancing energy efficiency and network lifespan. The project also integrates Map Reduction techniques to manage data maps effectively, simplifying routing mechanisms, and mitigating issues related to data duplication and overlaps within clustered networks.

Furthermore, it employs multi-objective optimization to tackle complex routing challenges, optimizing paths based on factors like distance, energy consumption, mobility, latency, and node lifetime. This optimization expedites data transmission and ensures efficient network operation. In summary, the project offers a comprehensive approach to enhancing WSNs by improving energy efficiency, extending network longevity, and addressing Quality of Service considerations. Its future scope holds promise for incorporating machine learning, energy harvesting, and real-world deployments, further advancing the field of wireless sensor networks.

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