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Modified AODV Based ISEP to Improve Lifetime of Heterogeneous WSN for IOT Based Application

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Abstract: The creation of an energy-efficient WSN routing system is a monumental challenge. Clustering is a novel technique for increasing the quality of a sensor network. In heterogeneous protocols, two or three node energy levels are commonly created; however, in heterogeneous WSNs, a wide variety of energy levels is now available. Energy management and energy efficiency have been tremendously hot and hard study topics for WSNs for many years. Because there are so many sensor nodes in such a hostile environment, the sensor batteries cannot be replaced. It is proposed to employ the AODV-ISEP protocol that is based on clustering. The fundamental aim of this study is to create the I-SEP protocol on the basis of a low-energy WSN protocol. The study suggests energy-efficient ways for selecting cluster heads with high energy efficiency. The final findings are reached by differentiating network efficiency based on average remaining energy, no. of alive or dead nodes as well as network throughput. As per the simulation findings, the chosen method surpasses the prior technique. On the basis of packet loss rate, the results reveal that the suggested AODV-ISEP beats the existing approach.

Keywords: AODV, Sensor Networks, Internet of Things, Clustering, Energy Efficiency, SEP.

I. INTRODUCTION

Since WSNs are a backbone to IoT networks, improving their lifetime is of utmost importance. Authors in the existing work [1] used the concept of clustering to improve the energy consumption of the sensor nodes. They have worked upon a heterogeneous network where the nodes have different energy levels and they have given preference to the nodes having higher energy to become cluster heads. However, these nodes have may be located far away from the base station and it may cost remarkable amount of energy by them when they transfer data to the base station over a longer distance.

The main issue with the WSN is the energy inefficiency in its network [2] and the shorter life of the network because the sensors are not efficient. Small sensors and power generating systems, which are typically utilised in inaccessible settings, provide tiny batteries. Battery replacement is not an option. Based on the battery, it does not only restrict the life of the sensor but also poses a real challenge to the successful design and management of WSNs. However, there are substantial research on all layers of the WSN due to the limitations in energy supply. The uniformity of its service parameters, like latency, throughput, jitter, availability, reliability and even safety, are also measured in a network. In terms of energy consumption (EC), however, it's often hard to evaluate and optimise a system using an entire model that incorporates the EC.

Another thing to be noted in the research work was the use of single hop communication from cluster head to BS. Direct data transfer is another cause of more power consumption. If energy in WSN is not conserved then the cost of IOT network would also go up since the IOT devices will no longer be receiving any data from the sensors. This will lead to failure of entire application for which the IOT network has been deployed.

In order to address sensory network scalability, energy and life problems, the research community has widely advocated clustering in sensor nodes [3]. Cluster algorithms govern local domain communications, which are only disseminated to the rest of the internet via transmission nodes. CH and local interaction between cluster nodes establish a community of cluster nodes. Cluster members often engage with the cluster's leader, and the information obtained is consolidated and combined with energy conservation by the cluster's leader [4].

Cluster-based routing is a method for selecting high-energy nodes that saves energy. A cluster-based routing protocol function plays an important role in achieving these application objectives. Energy performance, scalability, defect resistance, node distribution and quality of service are the main limitations of WSN. There is various energy-efficient clustering protocol used in the field of wireless sensors that focus on optimal cluster head selection.

Several clustering techniques are presented for maximising energy usage of system. Two hierarchical clustering-based routing protocols [5] are primarily used to broaden the life of the network, which are efficient clustering algorithms. One suggested energy efficiency algorithm is SEP. SEP is an extension of LEACH protocol, a heterogeneous protocol that extends the interval of time before the first node dies, which is essential for a variety of applications. The SEP provides a longer stability time and higher average output. The grouping of EP is identical to the grouping of LEACH.

There are five sections in this study. Section I concentrates mainly on issue of energy efficiency and the technique used in order to optimize the cluster head selection and data transfer process. Section II discusses review of literature. Section III outlines the structure and approach for the relevant work. Section IV gives the details of the results of proposed approach using MATLAB. Section V winds up the overall work done in this research.

II. LITERATURE REVIEW

Many scholars have investigated and published their findings in the form of research papers on different energy efficient clustering procedures such as AODV, SEP, LEACH, and others. This section discusses the research on various different clustering algorithms in the history.

Babar Shah et al. [6] concentrated on the critical problem of ensuring the longevity of IoT networks under coverage and connection limits. Each Sensor lifetime is broken down into separate time-based cycles of no more than 24hrs for every Internet - of - things based WSN. The authors presented a novel centralized technique for improving node duty cycles by analyzing a network's energy use. To preserve their lifetime, the source node connects the residual power, current total time, and potential transmission range to provide every node an active/sleep function for another networking phase.

Thangaramya et al. [7] For Internet of things based Wsn applications, a novel neuro fuzzy rule based cluster generation and routing method has been proposed. Proposed protocol learnt the network by taking four crucial factors into account: existing energy amount of CH, range among CH and sink node, space shift between nodes in the cluster and CH because of mobility and CH's degree. In addition, authors used a fuzzy reasoning approach to quickly form clusters and carry out cluster-based routing. The authors also proposed that by maintaining cluster size uniformity, proposed FLCFP minimizes energy consumption and enhances Quality of Service and that power utilization becomes optimal after applying rules and by following guidelines.

Premkumar Chithaluru et al. [8] An Improved-Adaptive Ranking based Energy-efficient Opportunistic Routing protocol (I-AREOR) based on regional densities, distances, and residual energy has been created to optimize energy usage and extend system longevity. The researchers also found that there can be three significant hurdles for enhancing energy efficiency: first node death, half node death and last node death. The proposed method provides a solution for extending the time of FND by considering region densities and distances as well as residual energy. For each round, the I-AREOR protocol examines energy properties using a dynamic threshold. The authors provided findings demonstrating that the I-AREOR clustering approach outperforms current techniques in terms of maximizing network lifespan.

Anthony Jesudurai et al. [9] To transmit data collected via a power routing algorithm, the Improved Energy Efficient Cluster Head Selection protocol (IEECHS-WSN) was developed. The study looks into ch selection with in LEACH methodology that is based on data fusing techniques that group twin cluster heads. According to the researchers, the CH selection method selects two cluster heads in every cluster to perform a variety of activities that can be utilised to prolong the system lifetime and minimise the energy usage of Iot devices. The suggested method is based on clustering dual CHs for data entropy during the data fusion process, and this data entropy is then employed for fusion and classification, resulting in efficient data transfer.

Bharathi et al. [10] built an outstanding EEPSOC-ANN forecasting model grouping and early disease diagnosis using Iot systems The proposed paradigm is built on three major modules, as per the researchers: the client module, the cloud module, and the alert module. The studies show how to group Iot systems and select appropriate CHs using the EEPSOC approach. The information obtained from Iot nodes may then be transmitted to doorway gadgets and then to internet module using CHs. Finally, the disease detection procedure is done out in the cloud module utilising ANN, that predicts sickness risk rating and offers an alert. The EEPSOC-ANN method is found to be a cost-effective and energy-efficient diagnosis model. In terms of generating reliable students perspective health information, the study puts this methodology to the trial. It predicts the student degrees of sickness severity using the UCI dataset and pharmaceutical sensing devices.

Amrita Ghosal et al. [11] devise a unique clustering technique that forms clusters dynamically to solve the challenge of maximizing lifespan in WSNs. By regulating power usage across cluster heads, the study examines the system lifetime maximization issue and suggested an effective clustering technique that uses the alternating direction multiplier method to estimate the cluster radius. The researchers created an On-demand optimal clustering approach for WSNs. The authors then conducted extensive simulation tests to evaluate OPTIC algorithm under actual conditions. Simulation findings demonstrate that the OPTIC algorithm may greatly enhance network lifetime while maintaining network performance measures such as throughput and end-to-end latency.

Nafaâ Jabeur et al. [12] developed an innovative firefly-based clustering method which includes a micro clustering stage wherein real world things compete and arrange into clusters. As per experts, throughout a macro-clustering stage inside which they battle for absorbing tiny neighbouring groups, these groupings are polished even more. The authors improved the strategy by hiring and firing RWTs depending on various occurrences and their predicted impact on the system and its present installation zone. The authors introduced a technique dubbed ASFiCA in which spatial contextual data are used to alter cluster sizes depending on parameters such as continuous occurrences, as well as the susceptibility of physical areas to such occurrences. Based on the performance, the results achieved in terms of cluster dispersion are encouraging; nevertheless, several performance concerns still need to be addressed.

Kalaivanan Karunanithy et al. [13] To assure that CH utilizes power uniformly, a wait period cluster head with remaining energy was developed. The information were gathered from CHs utilising UAVs and Geometric basis Traveling Salesman Problem, which purifies adaptability in case of network size and iot nodes count. The suggested Effective Scaling Data Capture Strategy (ESDCS) uses NS2 and well-known protocols like REEDCM and DL-LEACH to gather information efficiently. The authors developed an automated sprinkler system for sugarcane plantations using the specified ESDCS protocol. The authors said that the suggested intelligent system's performance was evaluated in terms of agricultural productivity and water usage.

Nivedhitha et al. [14] characterized cluster formation as being based on a network model, with the suggested model determining the roles of CH and SCH to increase system lifetime. The investigators concluded that after the cells have been launched for surveillance, they cannot be charged and have been subjected to a large number of environmental variables. The goal of this study was to find the optimum way of balancing the route reliable ratios and power usage when using multiple high-speed transmitters or electric subsea cables. In case 2, the path reliability ratio was predicted in order to route packets quickly while in the third segment, a simulation depending on the input capacity was established, with the goal of decreasing network congestion. The modeling analysis was conducted using ns2 simulator version 2.33 in packet delay, network lifetime, flow of data, energy usage, path consistency ratio, routing overhead and delay, and other factors.

Tanvi Sood et al. [15] presented Lines of Uniformity based enhanced threshold for delivering power coverage in 3 tier non homogeneous network, which considers the node's residual power effect and closeness from either of the routes of homogeneity to decrease the overall isolation nodes counting . Rotating epoch-based LUET variation that incorporates a stationary epoch for initial grouping cycles till first node death to prevent a sudden breakdown when first node ends. The model illustrates the benefits of LUET and its modifications over some other existing schemes in terms of resilience, power, net risk of mortality, averaged separated nodes and performance.

Behera et al. [16] developed the notion of energy saving in a heterogeneous environment by introducing the concept of threshold value to determine whether or not to keep the cluster head in the following cycle. If the cluster heads are rotated every round, then the cost of advertising the packets in cluster formation process increases; this comes at cost of lessened network lifetime. The authors have compared the results with other schemes and proved that by reducing the cluster head rotation, the network lifetime can be improved.

Based on these experiments, [17] fuzzy cluster analysis value index depending on spatial tightness and division was constructed that would include a penalty feature to ensure that the value of the clustering index was not monotonously reduced and that the number of clusters was almost zero when the data items bordered and, as a result, robustness and decision-making functionality were lost.

III. PROPOSED METHODLOGY

Cluster heads should not be selected based on their energy levels only; such a selection may lead to scenario where the optimal cluster head is located far away from the base station or it does not have enough neighbouring node to form cluster. In either of the case, energy consumption will be more in the network leading to degraded network lifetime. Therefore, for the better selection of cluster head, its communication cost will be considered with the base station. The communication cost is amount of node energy that will be consumed while transferring its data to another entity in the network.

Therefore, the cluster head in the proposed work will be the one that has enough energy, lesser distance to the base station and enough neighbours as well to form a cluster in the network. Once the cluster heads have been selected, they will form clusters with the nodes in their communication range.

Next step is data aggregation where all the cluster members will forward their data to the respective CH. All CHs need to transfer their aggregated information to the base station. For this to be done in an energy efficiency way, we will use energy efficient AODV protocol to build multi hop route from cluster head to base station. Each cluster head will form routes to base station using the AODV protocol in a modified way; the modification comes in the form of selecting the intermediate node from cluster head to base station based on energy rather than distance (as is the case with traditional AODV protocol). Therefore, each cluster head will send data to base station using energy efficient AODV protocol.

Table 1 lists the network parameters utilised for simulation.

Table 1. Simulation Parameters

Parameters	Values
Total energy	50 J
Size of the packet	4000 bits
Distance	87 meters
Energy dissipation (aggregation)	5nJ/bit
Power amplifier	100pJ/bit//m^2

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IV. RESULTS AND DISCUSSION

The hybrid energy-efficient clustering strategy for networks is described in this findings and discussion section. By dividing the network's throughput, average residual energy, alive nodes, dead nodes by no. of rounds, network efficiency was calculated.

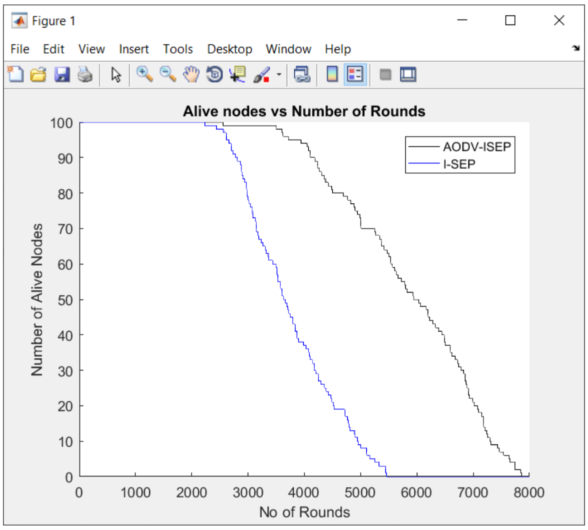

Figure 1. No. of Alive Nodes

Figure 1 show outcome scenario for effect of variation in the network area in I-SEP and AODV-ISEP based on alive nodes. As network area increases, the performance of each protocol decreases significantly. Comparing the performance of the protocols to each other in such a varied scenario, it can also be seen that AODV- ISEP performs much better than I-SEP.

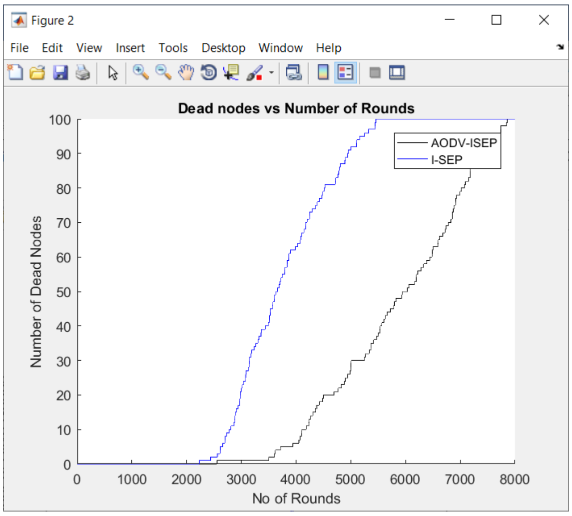

Figure 2. No. of Dead Nodes

Dead nodes in I-SEP and AODV-ISEP per eight thousand rounds are depicted in figure 2. As area of network maximizes, dead nodes maximizes. This results in efficiency of protocol deteriorating. AODVI-SEP continues to provide better performance than others by contrasting the performance of each protocol.

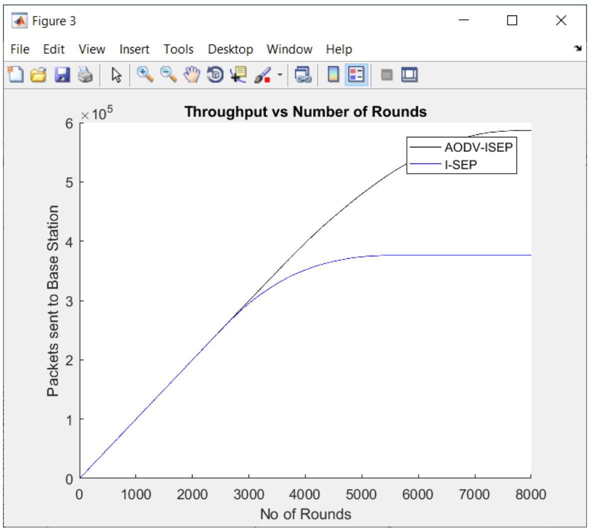

Figure 3. Throughput

Another important measure of performance of the network is throughput. The quantity of packages successfully received by BS within the network is specified. From figure 3 it is seen that packets sent to BS for 8,000 rounds also decreases in all protocols as network area increases. However, the throughput of proposed technique is greater than that of I-SEP because it supports three level of heterogeneity and thereby selects more optimal cluster heads.

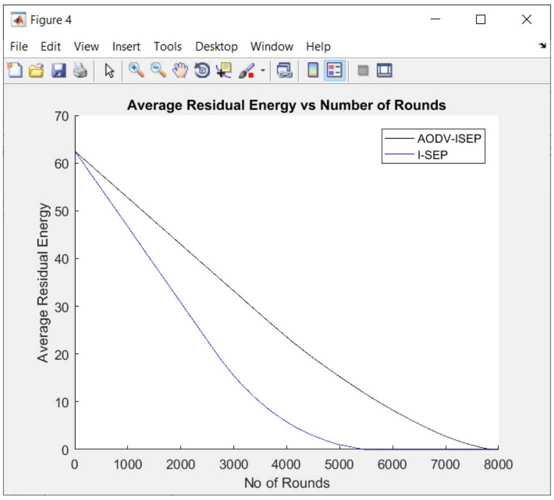

Figure 4. Average Residual Energy

Figure 4 depicts average residual energy of proposed and current schemes in relation to number of rounds. AODV-ISEP outperforms conventional I-SEP in terms of performance since it uses less energy to transport packets from one station to another.

V. SUMMARY

A highly energy-efficient method for selecting and transmitting information to the CH is the cluster-dependent routing protocol. This work discusses various energy-efficient clustering protocols used in WSN. Energy efficiency is major issue for mobile WSNs which are clustered. The paper examines several energy efficiency algorithms, such as I-SEP and AODV-ISEP. These algorithms are ultimately aimed at reducing energy usage and optimizing network life. The first objective discusses different energy efficient clustering protocols used in the field of wireless sensors which focuses on optimal selection of CHs. The performance of the two protocols, I-SEP and AODV-ISEP, was evaluated based on no. of living and dead nodes, network throughput, and average residual energy. The simulation conducted using MATLAB is used in implementing the energy efficient clustering protocols.

REFERENCES

[1] T. M. Behera, S. K. Mohapatra, U. C. Samal, M. S. Khan, M. Daneshmand and A. H. Gandomi, "I-SEP: An Improved Routing Protocol for Heterogeneous WSN for IoT-Based Environmental Monitoring," IEEE Internet of Things Journal, vol. 7, no. 1, pp. 710-717, Jan. 2020.

[2] Semente, R. S., Oliveira, F. D. M., Lock, A. S., Melo, T. A. C., Junior, S. N., & Salazar, A. O., "Energy-Efficient WSN Systems," Sensing Technology: Current Status and Future Trends III, pp. 111–132, 2015.

[3] Jan, B., Farman, H., Javed, H., Montrucchio, B., Khan, M., & Ali, S., "Energy Efficient Hierarchical Clustering Approaches in Wireless Sensor Networks: A Survey," Wireless Communications and Mobile Computing, vol. 2017, pp. 1–14, 2017.

[4] Arjunan, S., & Pothula, S., "A survey on unequal clustering protocols in Wireless Sensor Networks," Journal of King Saud University - Computer and Information Sciences, pp. 1-26, 2017.

[5] Tewari, M., & Vaisla, K. S., "Performance Study of SEP and DEC Hierarchical Clustering Algorithm for Heterogeneous WSN," 2014 International Conference on Computational Intelligence and Communication Networks, pp. 385-389, 2014.

[6] Babar Shah, Ali Abbas, Gohar Ali, Farkhund Iqbal, Asad Masood Khattak, Omar Alfandi, Ki-Il Kim, "Guaranteed lifetime protocol for IoT based wireless sensor networks with multiple constraints," Ad Hoc Networks, vol. 104, 102158, 2020.

[7] Thangaramya, K., K. Kulothungan, R. Logambigai, M. Selvi, Sannasi Ganapathy, A. Kannan, "Energy aware cluster and neuro-fuzzy based routing algorithm for wireless sensor networks in IoT," Computer Networks, vol. 151, pp. 211-223, 2019.

[8] Premkumar Chithaluru, Fadi Al-Turjman, Manoj Kumar, Thompson Stephan, "I-AREOR: An energy-balanced clustering protocol for implementing green IoT in smart cities," Sustainable Cities and Society, vol. 61, 102254, 2020.

[9] Anthony Jesudurai, S., and Senthilkumar, A., "An improved energy efficient cluster head selection protocol using the double cluster heads and data fusion methods for IoT applications," Cognitive Systems Research, vol. 57, pp. 101-106, 2019.

[10] Bharathi, R., T. Abirami, S. Dhanasekaran, Deepak Gupta, Ashish Khanna, Mohamed Elhoseny, K. Shankar, "Energy efficient clustering with disease diagnosis model for IoT based sustainable healthcare systems," Sustainable Computing: Informatics and Systems, vol. 28, 100453, 2020.

[11] Amrita Ghosal, Subir Halder, and Sajal K. Das, "Distributed on-demand clustering algorithm for lifetime optimization in wireless sensor networks, Journal of Parallel and Distributed Computing, vol. 141, pp. 129-142, 2020.

[12] Nafaâ Jabeur, Ansar Ul-Haque Yasar, Elhadi Shakshuki, and Hedi Haddad, "Toward a bio-inspired adaptive spatial clustering approach for IoT applications," Future Generation Computer Systems, vol. 107, pp. 736-744, 2020.

[13] Mahdad Khelghatdost, A. Mohsenzadeh and Hesamoldin Pourkarim Dodangeh, "Impact of Agile Methods on Software Project Management," Khelghatdost2013, 2013.

[14] Nivedhitha, V., A. Gopi Saminathan, and P. Thirumurugan, "DMEERP: A dynamic multi-hop energy efficient routing protocol for WSN," Microprocessors and Microsystems, vol. 79, 103291, 2020.

[15] Tanvi Sood, and Kanika Sharma, "LUET: A novel lines-of-uniformity based clustering protocol for heterogeneous-WSN for multiple-applications," Journal of King Saud University - Computer and Information Sciences, 2020.

[16] T. M. Behera, S. K. Mohapatra, U. C. Samal, M. S. Khan, M. Daneshmand and A. H. Gandomi, "I-SEP: An Improved Routing Protocol for Heterogeneous WSN for IoT-Based Environmental Monitoring," in IEEE Internet of Things Journal, vol. 7, no. 1, pp. 710-717, Jan. 2020.

[17] Ren, M., Liu, P., Wang, Z., & Yi, J., "A Self-Adaptive Fuzzy c-Means Algorithm for Determining the Optimal Number of Clusters," Computational Intelligence and Neuroscience, vol. 2016, pp. 1–12, 2016.