RESEARCH ARTICLE OPEN ACCESS

Ameliorated Clustering protocol for WSN assisting IOT

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ABSTRACT
The Wireless Sensor Network (WSN) is a system of sensor nodes made up of energy-constrained small devices. The systematic use of the energy source in a SN is one of the most essential indicators for extending the lifespan of a wireless sensor network. The implementation of effective routing for energy reduction is thus critical. Cluster-routing methods for wireless sensor networks (WSN). LEACH is used in round where sensor node clusters are established with a single node acting as a cluster head (CH) for every cluster. Current study was on the R-LEACH technique, is used in this paper to recognize cluster heads based on energy, with the drawback that if the higher energy node is far away from the base station, it consumes more energy. To resolve the energy-efficient cluster head selection, GR-LEACH was installed, which proposed various variables such as fitness function, computational cost, and so on, which instantly chose a better cluster head that exhausted less energy. The simulation results show that, when compared to the existing method R-LEACH, the dynamic cluster head selection method, GR- LEACH, offers higher energy efficiency and a huge amount of information in terms of the set of alive nodes, dead nodes, throughput, and node residual energy.
Keywords: Wireless sensor Networks (WSN), IOT, Clustering, R-LEACH, Gravitational search algorithm.

I. INTRODUCTION

The Internet of Things (IoT) is a system of Internet-enabled objects that interact with web applications. It is a technology that enables objects in our environment to communicate with one other in the network[1]. The Internet of Things will create a place in which all objects are linked to the Internet as well as interact with one another with minimal human intervention in order to maximize resource use, raise the quality of service provided to people, and reduce service operational costs.

In recent years, investigators in both theoretical as well as technological sectors have centered on WSNs , as they are efficacy way of tracking and monitoring applications. Furthermore, considerable classifications for WSNs are feasible in a variety of applications like classification, health care, and military [2]. These signals are analyzed collaboratively as well as distributed to the BS in order for appropriate decisions to be implemented. Even so, once placed in the field of interest, the sensors are inaccessible in most applications. As a result, it is not able to recreate their batteries & provide extra energy resources. As a result, optimizing the energy conservation of sensor nodes in the network is a major challenge in WSNs [3]. There are many methods that can be used to extend the lifetime of WSNs [4]. Clustering is a popular method to achieve energy efficiency in WSNs.

Clustering is the method for extending the life of a sensor network by lowering energy consumption. Data transfer requires a high level of connectivity. Clustering could also help to improve network scalability. Researchers in all areas of WSN believe that nodes are homogeneous, but some nodes maybe of different energy to enhance the lifespan of a WSN as well as its dependability. A distributed algorithm to evaluate if a sensor in WSN is a CH to fulfill the preferred connectivity requirements [5]. Cluster based routing in WSN is used to achieve system capacity as well as maximize lifetime.

In [6], the LEACH was presented as a well-known team building. In this procedure, most SN transfer the signal to the CHs, & the CHs aggregate & encode the information as well as forward them to the BS. In every round, each node employs a stochastic system to calculate whether it would become a CH in that round. Nodes that have previously been CH are not allowed to become CH again for P rounds, where P is the required proportion of CH. The LEACH method, on the other hand, does not identify the appropriate set of clusters. So, for the existing paper, a secure solution for LEACH called RLEACH has been presented, in which clusters are established dynamically as well as consistently. Because the arbitrary pair-wise key system causes the node issue in RLEACH, they used an improved arbitrary pair-wise key solution to predict it. To present security in the LEACH Hierarchical routing algorithm, RLEACH utilized a one-way hash chain, symmetric & asymmetric cryptography. RLEACH opposes numerous attacks such as spoofing, altering, and replaying information, sinkholes, wormholes, selective forwarding, HELLO flooding, as well as Sybil attacks.

The rest of this article is structured as obeys. Section II describes the GSA the suggested approach. Section III presents the Literature survey . Section IV represents the proposed objectives and methodology in WSNs. Section V shows the proposed findings outcomes . Section VI shows conclusion.

II. GRAVITATIONAL SEARCH ALGORITHM

Swarm intelligence as well as meta-heuristic search methodologies are two methods used to handle difficult as well as major problems where traditional methods fail[7]. These heuristic random search methods are now used in a variety of real-world issues, including image processing, robotics, medicine. Newtonian laws of gravity, rotation, and mass communication inspired the GSA. It is one of the most recent meta-heuristic search approaches. The mass of each agent in this method denotes their efficiency. As a result, heavier masses are high appropriate answers to the issues. Objects inspire each other based on GF, so global agents gravitate against the heavier & more suitable agents. Xi = (x 1 I x2 I • • •, xm I) determines the position of the ith agent in the m-dimensional search area. Eq. gives the mass value for the ith object, in which f iti(t) is the measured value for the ith agent in period t as well as worst(t) is the swarm's worst fitness value in this version [8]:

$$M_i(t)=\frac{fiti\,(t)-worst\,(t)}{\sum_{j=1}^{n}(fitj\,(t)-worst\,(t))} \qquad (1)$$

At iteration t, the total center of gravity on the ith agent in the dth dimension is calculated as follows:

$$F_i^d\,(t) =\sum_{j\in kbest, j\neq 1} G(t)\,\frac{Mi(t).Mj(t)}{Rij\,(t)+\epsilon}(x^d_j(t)- x^d_i(t) \quad (2)$$

Here Kbest denotes the collection of K bulkier objects as a time dependent; Rij (t) denotes the Euclidean distance among agents I and j; as well as being a small value. G(t) is the gravitational constant in the t^{th} iteration, mirroring a reducing function of time. G(t) can be calculated as follows:

$$G(t)=G_o\exp\left(-\gamma\,\frac{t}{tMax}\right) \qquad (3)$$

Apply the law of motion, acceleration, velocity, as well as the placement of the ith agent in the d^{th} dimension at time t + 1 are calculated using the following eqs:

$$a_i^d = \frac{Fid(t)}{Massi\,(t)} \qquad (4)$$

$$V_i^d\,(t+1) =ran_i \times V_i^d\,(t) + a_i^d\,(t) \qquad (5)$$

$$X_i^d\,(t+1) == X_i^d\,(t) + V_i^d\,(t+1) \qquad (6)$$

III. LITERATURE SURVEY

Sepehr et al.,(2020) designed a novel user-independent and dynamic formula to measure the optimum number of clusters, to organize clusters and to selecting the optimal cluster heads in every round. In this technique, the calculation of the optimal amount of clusters was regarded to be efficacy energy usage & link standard. A latest version of the GSA was used to fix this objective function. The power distance amounts scaling approach was used in this method to compute the mass values. A FL controller is then utilized to recognize the parameter of this approach to regulate the exploitation and exploration capabilities of the technique during the application's computational process[9].

Behera et al.,(2019) In comparison to other CH locations, this one concentrates on an efficient cluster head option approach that spins between greater energy nodes. In comparison to the LEACH protocol, the Simulation analysis shows that the updated version performs good with a 60 percentage improvement in output by 66 percent and 64 percent in the amount of residual energy. More CH selection parameters could be expanded by taking into account in a network with mobile nodes which frequently change its location. The suggested approach can also be tested for a WSN based IoT framework on various practical scenarios[10].

Leela et al.,(2020) Using the GSA, a clustered routing methodology is introduced to achieve energy savings . GSA is used to allocate SN to a suitable CH in a load-balanced manner, reducing power consumption and therefore improving lifespan of the system. The suggested algorithm superior on famous clustering techniques, such as LEACHC, DEEC, (ACH) 2 , HCCRFD, and GSA-EC, relating to various performance parameters, like network lifetime, energy dissipation and the number of packets sent to base station[11].

Shukla et al., (2019) In NS2, presented an energy-efficient GSA-FCR. CHs are chosen from the network's accessible sensor nodes using the GSA method. Then, every selected CH construct a cluster through connecting to another SN within its transmission scale. By using Fuzzy Inference System, the super cluster head was chosen from among the chosen CHs. The information recorded from the non-CH member was recounted to the selected CH either by CH through the use of the most effective path. The hop-count of the CHs was used to determine the most efficient route. The suggested GSA-performance FCR's has been assessed in means of energy efficacy, delivery ratio, delay, drop, as well as throughput, it has been contrasted to current systems like GECR and PSOCR. The simulation shows that suggested method's energy efficiency as well as delivery ratio were better to that of the existing work[12].

Motameni et al. (2020) presented a GSA depend on learning automata (GSA-LA) for constant problem optimization . The gravitational constant G(t) is a important criterion that is utilized to modify the search's accuracy. Learning capability is used in this work to pick G(t) predicated on spontaneous actions. To assess the effectiveness of the proposed technique, experimental evaluation is performed on a number of well - modeled test functions, as well as the outcomes are contrasted to the initial GSA as well as other evolutionary-based approaches. The findings outcomes show that the gravitational search approach focused on learning automata is high helpful

in identifying optimum answers & outclasses the current methods[13].

Banka et al. (2016) GSA-MSP is a GSA-based strategy for multi-sink location in SN. The method has an appropriate encoding technique and a new fitness function. The energy, Euclidian distance between gateways as well as sinks, & gateway data rate are all considered characteristics for the optimum organization of GSA-MSP. The GSA-MSP has been rigorously tested on different WSN scenarios using a differing set of devices, gateways, as well as sinks[14].

Abdelhay et al., (2018) The issue of choosing CHs in WSN was developed as a single-objective optimization issue. The GSA methodology was utilized to resolve this issue with the goal of minimizing energy usage, increasing stable regions, increasing lifespan of the system. The fitness function was designed to account for intra-cluster distance, distance to BS, as well as residual energy for SN. The challenge was fixed utilizing both the GSA as well as PSO algorithms, or the outcomes indicated that the GSA method provided the best fitness value. To test the protocol's efficiency, the suggested approach was designed and tested in a variety of realistic network scenarios. The method was applied in various BS positions, as well as the findings show that the GSA method keeps the scheme stable for a longer period of time and increases throughput more as compared to the PSO and LEACH. The suggested procedure GSA also minimizes the network's average energy consumption[15].

IV. PROPOSED METHODOLOGY

WSN are made up of nodes that are powered by smaller batteries. These systems are distributed in human-inaccessible regions, so if the nodes run out of battery, replacing them is an expensive process. As a result, numerous studies have extensively done experiments aimed at increasing the life span of sensor nodes. One such approach that enhances the lifespan of the system is clustering of the nodes. Authors in "Residual Energy Based Cluster-head Selection in WSNs for IoT Application" explained a clustering approach in which the CH have been selected based on the energy of the node and number of optimal cluster heads. The limitation of this strategy is that nodes with sufficient power might well be situated far away from the BS, increasing the CH energy communication overhead. Therefore, the cluster head may die out earlier and it would lead to loss of data from the network. Furthermore, the data transmission in the existing scheme is done according to single hop communication which also causes higher energy consumption in the network. Therefore, a method needs to be designed that selects the cluster heads in an optimal way and reduces the energy involved in data transmission process.

Objectives:

1. To study various approaches for energy efficient clustering techniques for WSN-IOT.

2. Modify cluster head selection in R-LEACH by using gravitational search optimization.

3. To implement the proposed technique in MATLAB and Contrast the presentation of current & proposed technique depend on set of alive nodes, set of dead nodes & throughput of the system.

Research Methodology:

In the proposed work, we aim to optimize the cluster head selection process by making use of gravitational search (GSA) optimization. In GSA, the acceleration of the nodes is generally computed which is based on the fitness function of the nodes. The parameters that will be used to compute fitness function will be remaining energy of the node, intra cluster communication cost and communication cost with the base station.

After selecting the optimal cluster head, clusters are formed. In the formed clusters, cluster members sense the data from the environment and aggregate it at the CH. In the sensor network, the nodes normally sense the redundant data from the environment, which can lead to unnecessary energy consumption. Therefore, in order to avoid transmission of redundant data, we propose that 10% of the nodes in the cluster which have shortest residual energy will be put to sleep mode. This will not only avoid the transmission of redundant data but also help in elongating their lifetime. The energy consumption in the network depends upon the packet size and distance between the communicating nodes. The length of communication between cluster heads & the BS can further be reduced when cluster heads use multi hop communication to send data to the base station. As a result, during the data transmission process, the CH would send information to the BS via the closest CH.

V. RESULTS

The results of the proposed LEACH gravitational search algorithm are presented in this section. The power efficiency and clusters transmitted to BS are chosen as output parameters to validate the proposed algorithm. In the above sensor area, all sensor nodes are uniformly distributed and BS is expected to be located within the sensor region. In the MATLAB setting the proposed protocol is implemented. The set of alive as well as dead nodes defines the energy conservation variable. Four cases were generated from 100 randomly distributed nodes in the network for simulation. The network's performance was evaluated based on the amount of average residual energy consumed, the set of alive nodes, the set of dead nodes, & the network's throughput.

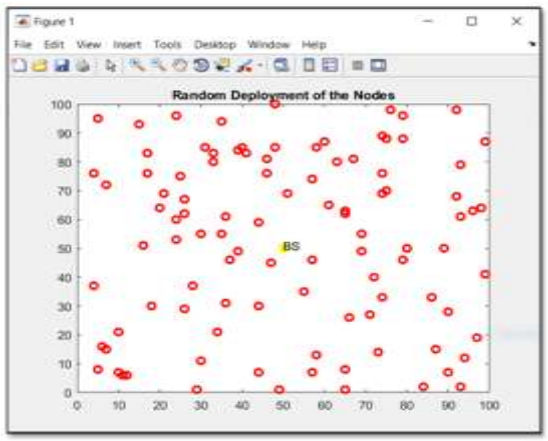

Figure.1:Random Deployment of Nodes

- **Number of Alive Nodes:** The amount of alive nodes was determined for every round to determine the system's energy consumption. For the proposed work the set of rounds consists is [500,1000,1500,2000,2500,3000].

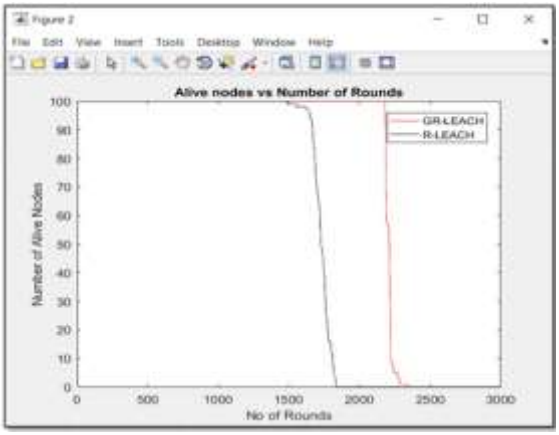

Figure 2:Alive Nodes Vs Set of rounds

Table 1: Alive Nodes

Technique	Set of Rounds
R-LEACH	1489
GR-LEACH	2181

From figure 2 demonstrate that , for existing work first node dead immediately on 1489 round and for proposed work first node dead on 2181 round. As a result, it is evident that system reliability is improved in the suggested technique since CH are chosen correctly utilizing suggested technique GSA.

- **Number of Dead Nodes:** The amount of dead nodes was determined for every round to determine the system's energy consumption. For the proposed work the set of dead rounds consists is [500,1000,1500,2000,2500,3000].

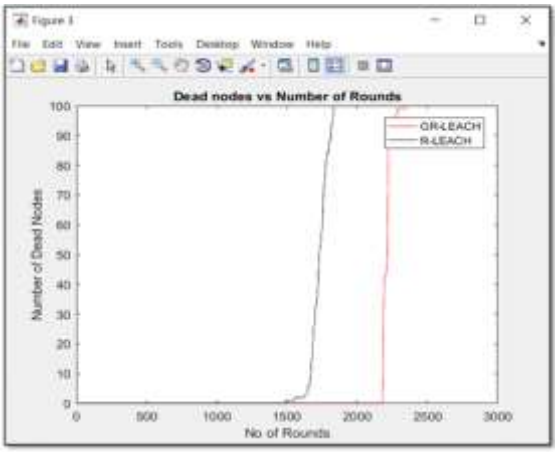

Figure 3:Dead Nodes Vs Number of Rounds

Table 2: Comparsion of Dead Nodes

Technique	Number of Rounds
R-LEACH	1832
GR-LEACH	2345

From figure 3 demonstrate that , for current work network dead on 1832 round and for suggested work network dead on 2345 round. So, it is clear that network lifetime is better in suggested GSA approach.

- **Throughput:** The quantity of successful data transmission in the system is typically characterized as throughput. The mentioned equation is used to determine throughput in this regard:

$$\textbf{Throughput} = \frac{\text{Total Number of packets successfully transferred}}{\textit{Total Number of packets transferred}} \quad (7)$$

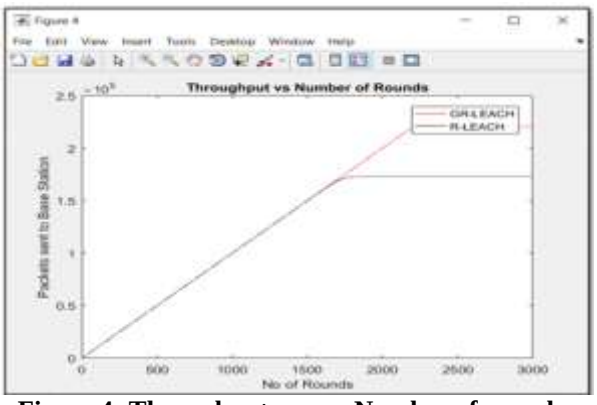

Figure 4: Throughput versus Number of rounds

From Fig 4 , the throughput for a proposed GR-LEACH algorithm increased the total Number of packets successfully transferred is 220671 which is more than existing algorithm R-LEACH where packets transferred is 172950 because if alive nodes exists in the network for a long period it provides a better throughput.

- **Average Residual Energy:** Energy is the main resource of WSN nodes, and it determines the lifetime of network.

From fig 5 is shown that existing R-LEACH shows steeper drops in the average residual energy as contrasted to the suggested GR-LEACH approach, where the steeper drops represent quicker energy depletion.

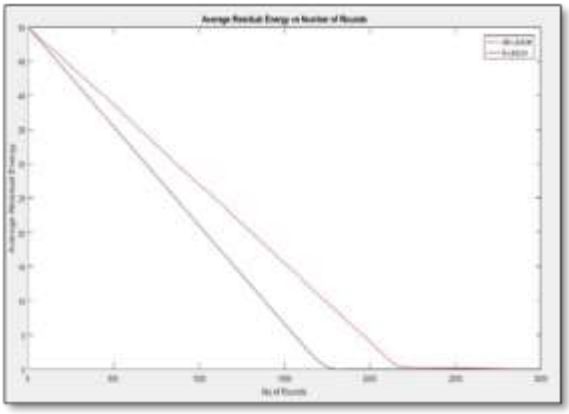

Figure 5:Average residual energy Vs Set of rounds

Above mention tables clearly shows that the proposed GR-LEACH algorithm improves the values for all four parameters like Residual energy, throughput, no. of alive nodes & due to the idea of a single path would not be used, the load on the cluster heads establishing the path would be increased. The CH will forward the information to the BS by neighboring cluster head or directly to the BS (if base station could be extended directly) as compared to existing techniques.

VI. CONCLUSION

An energy efficient Gravitational search algorithm (GSA) for WSN is described in this article. Furthermore, the proposed approach is performed in MATLAB. The GSA technique is used to determine CHs from the network's accessible sensor nodes. Then, each selected CH established a cluster via linking to another SN within its coverage area. The performance of the proposed GSA strategy was described in terms of energy consumed, lifespan, the number of alive and dead nodes, and throughput, and it was compared to that of the existing method approach R-LEACH. The computation results demonstrated that the proposed GR-LEACH method used less energy and had a better performance than the current work.

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