International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 11s, 2025
https://www.theaspd.com/ijes.php

An Energy Efficient Cluster Based Shortest Path Technique Using Data Transmission In Wireless Sensor Networks

P. Bharathi[1] Dr. G.Vijaiprabhu[2]

[1]Research Scholar, PG and Research Department 0f Computer Science, Erode Arts and Science College (Autonomous), Erode, Mail:bharathimca007@gmail.com
[2]MCA.,M.Phil.,SET.,Ph.D Research Supervisor & Assistance Professor, PG and Research Department of Computer Science Erode Arts and Science College(Autonomous), Erode, Mail: gvprabhu7@gmail.com

ABSTRACT

Energy Efficient Data Transmission paramount in the deployment of multiple sensor nodes in WSN where prolonged network lifetime and sustainability are critical objectives. This research explores energy efficiency strategies within sensor networks through a comprehensive analysis of existing challenges and the development of innovative solutions. The proposed Cluster based Shortest Path algorithms, such as CBSP, to dynamically organize sensor nodes, minimizing energy consumption through periodic cluster head rotations. Additionally, energy-aware routing protocols and adaptive algorithms are integrated to optimize data transmission and reduce energy overhead. The research emphasizes adaptability to dynamic environmental conditions, ensuring resilience and longevity in the face of varying network demands. Through simulation and practical implementation, the effectiveness of the proposed CBSP Achieves more Effective process of Cluster head elected by a probability based on distance and energy of each node. Finally, the result of CBSP achieves less energy and more effective message by data transmission.

Keywords: Sensor nodes, Clustering Techniques, All pair shortest path Algorithm, WSN.

I. INTRODUCTION

Wireless Sensor Networks (WSNs) are increasingly being adopted in intelligent transportation systems due to their efficiency and real-time monitoring capabilities. Sensor is a device it will sense or ducted a change of Physical Environment. in a different parameters like Temperature, Pressure, Force, Noise, Light, etc,. And it will convert a Radio frequency in the Process of micro controller and send to base station with the help of transverse. A sensor node is a small electronic gadget built to gather and transfer the sensory data concerning the surrounding either in the environment or the immediate area. it normally consists of a sensor, micro controller (Processor), transmitter, receiver, tiny memory store, non-rechargable battery. A sensor node is composed of three main components: the sensing unit, the communication module, and the data processing module. The huge filed of networks is separated into a number of clusters. Every cluster is headed by cluster header. Every single cluster is addressed by means of its cluster header. The transfer of cluster aggregation data into the base station occurs. The sensor network has smart sensing and radio transmitting gadgets and energy is extremely restrained. The network of sensors has a limited power supply and new methods which enhance energy consumption to make the network survive longer are highly demanded. These technologies offer significant benefits by reducing deployment costs and enabling the use of compact, intelligent sensor nodes in various environments such as workplaces, supermarkets, streets, plantations, and oceans for effective environmental monitoring.

There could be numerous sensor nodes in a network wireless sensor. Every one of these sensor nodes possesses a sensing, computing and communicating capability with limited energy source. The nodes are connected via the medium communication which is a wireless communication and the organization of nodes

is taken to be self-organize when ad hoc fashion is implemented within it. As the sensor nodes constrained by the non rechargeable energy of the resources and the energy efficiency is termed to be of very important issue on the designing protocol because it is a factor which greatly influences the life of network in the sensor system. Thus, in order to enhance effectiveness of energy and reduce transmission delay time, there must be a mixture of nodes that constitute numerous small groups referred to as clusters. The clustering technique of combination of the sensors nodes is known as clustering and the preferred node in each cluster is referred to as cluster head. Sensed information by the other sensor nodes of the cluster is being collected and merged by the Cluster Head (CH) then relayed to the base station (BS). A cluster head is regarded as the node which is more capable and more energy as compared to other sensor nodes. Besides, the cluster head is also mitigating the use of energy and offering the capacity to have large node numbers.

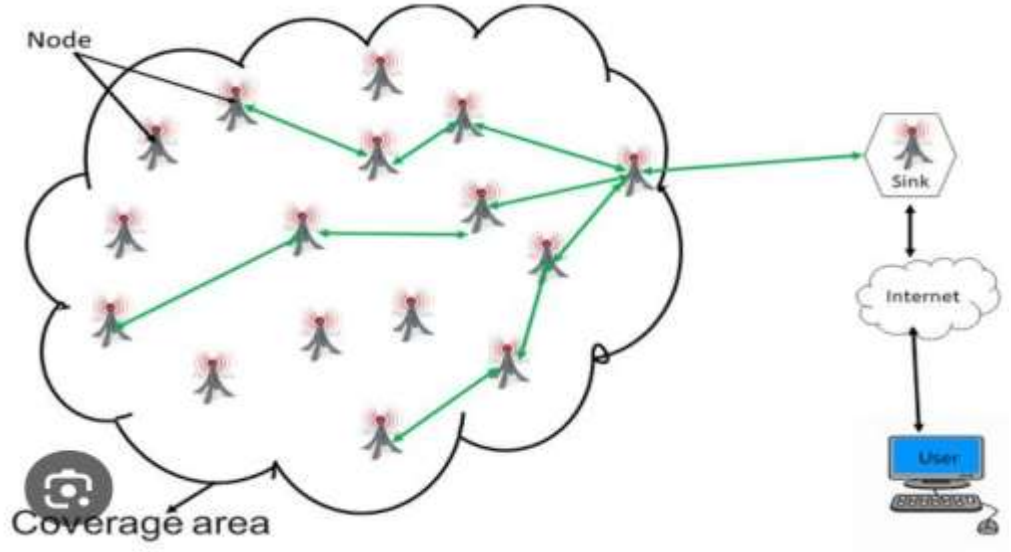


Fig:1 Wireless sensor network (WSN)

Dense self deployment: WSN involves a gargantuan distributed computing system. The former is and large amount of the sensing sensor scattered and dense random sensing sensor deployment in the network scenario. Sensors are deployed independently, as each sensor manages its own communication within the network. These battery-powered, autonomous sensor nodes have limited processing power and storage capacity, making them suitable only for lightweight tasks. Due to the challenging environments in which Wireless Sensor Networks (WSNs) operate, replacing or recharging the batteries of these nodes is often difficult or impractical, highlighting the critical issue of limited energy resources.

II.RELATED WORK

A Related work on energy-efficient multiple sensor networks encompasses a diverse array of research, addressing challenges and proposing solutions to optimize energy consumption. Here is a concise literature review highlighting key contributions.

Zongshan Wanget.al[2020]introduced the latest “advancements in energy-efficient routing protocols” examining their strengths and limitations in the context of wireless sensor networks.

Salim EL Khediri et.al[2018]Present the "Distance Energy evaluated DEE algorithm approach" Targeting Cluster Head CHs, through Probability voting based on ratio of the distance to residual energy of the individual nodes. DEE delivers more successful messages and increased system life with respect to the existing critical clustering protocols in Homogenous setting. AWANGet.al[2020]The "Hybrid Energy-Efficient Distributed algorithm" is proposed; incorporating both centralized and distributed mechanisms for cluster head selection to optimize energy usage in sensor networks.
Heinzelman et al[2018] "Stable Election Protocol (SEP) introduces a stable election protocol for clustered heterogeneous sensor networks" aiming to balance energy consumption among nodes with diverse energy levels and capabilities.
Manjeshwaret.al[2019]"An energy-efficient communication protocol for wireless micro sensor networks" emphasizing the importance of adaptive duty cycling to conserve energy during communication.
Seyedsalaret.al[2020]A comprehensive survey that provides an overview of various energy-efficient strategies in wireless sensor networks, encompassing clustering algorithms, data aggregation techniques, and communication protocols.

III.PROPOSED WORKS

The proposed work aims to enhance energy efficiency in wireless sensor networks (WSNs) by introducing innovative Creating Cluster based Shortest Path (CBSP) Algorithm multiple sensor node cluster-based strategies. By optimizing the organization of sensor nodes into clusters, we intend to minimize energy consumption, extend network lifetime, and improve overall system performance. The research encompasses a comprehensive investigation into existing challenges, a development of CBSP cluster-based Shortest Path algorithms, and a rigorous evaluation of their impact on energy efficiency

3.1 CLUSTERING IN WSN

A clustering is regarded as the separation of the sensor nodes in small groups with the reference to the attribution and certain parameters whereas the loose definition of the clustering can be referred to as the division of the organized objects into groups in which the members are similar in the same manner A wireless sensor network may contain a number of sensor nodes. All these sensor nodes are endowed with the sensing, computation, communication, and limited source of energy. The medium communication of the nodes is wireless communication and it is self-organize when ad hoc fashion is implemented. Energy efficiency can be seen as very essential problem in designing protocol as it impacts the networks of the sensor life many times because of the limited and non-rechargable resources of the sensor nodes energy. Thus, many small groups have to be created through a combination of nodes to enhance the efficiency of energy and lower the rate of transmission lag which is termed as clusters. The clustering method of combination of the sensor nodes is referred to as clustering and the selected node in each cluster is referred to as cluster head. It is in this that the Cluster Head (CH) is joining and combining the sensed data of the other sensor nodes in the cluster and sending it out to the base station (BS). A cluster head is deemed as the node with more ability and greater supply of power than other sensor nodes. Furthermore, the cluster head is minimizing the energy usage and availing the scalability to large number of nodes.

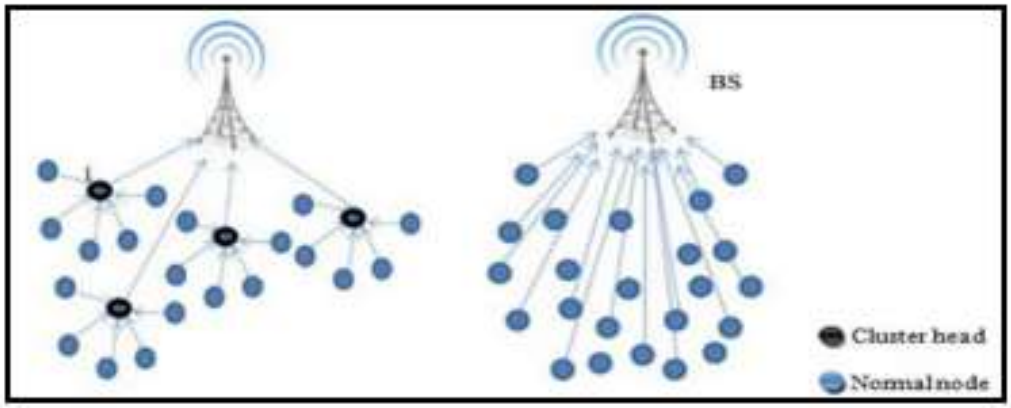


Figure 3: Clustering and Non-clustering.

Figure 2: Cluster Based Shortest Path Algorithm

WSN Computes The radios of the cluster head through its distance from base station. CBSP technique cluster head algorithm is classified into every data transmission**.** Every time cluster node decides to become a cluster head according to the threshold value of the entire network

3.2 SHORTEST PATH ALGORITHM IN WIRELESSNETWORK

Shortest path algorithms can be divided into two categories: single-source as well as all-pairs. These two have algorithms which are optimized uniquely. Thanks to such complexity, all-pairs algorithms are slower in execution. All shortest path algorithms provide a value that may be used to track down the shortest path, though the type or form of this value may differ among algorithms.

$$T(n)= \frac{p}{1-p(r \bmod \frac{1}{p})} \quad ,n\epsilon G$$

Creating Cluster based on Shortest Path(CBSP)Algorithm:

Step 1: Deploy Sensor Node (Sn) and Base Station (Bs) to Form WSN.

Step 2: Setup Phase
For Each (Sn) 1ton do

$$D(S,R)= \sqrt{(x1-x2)^2+(y1-y2)^2} \ldots 1$$

If CHsn > IEsn , 1<j<m, j≠Sn then

To select the CHsn,

Else if ((r mod $\frac{1}{p}$))=0 then

End.

3.3 ALL-PAIRS SHORTEST PATH ALGORITHMS

Following this definition all other pairs of vertices inVVGiven a graph GG, the vertices VV, and edges EE with weigh function w(u, v) = wu, vw(u,v) = wu, vreturn the shortest path between uuto vvfor all (u, v)(u,v) in VVThe FloydWarshall algorithm is the most common algorithm to compute all pairs. The returned matrix

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 11s, 2025
https://www.theaspd.com/ijes.php

of values M M consists of all the distances of the shortest paths between every pair of vertices, M i, j M i, j being the distance of the shortest paths between vertex i i and vertex j j. There is also the possibility to find the Actual path followed to reach that shortest path which is path reconstruction but this is not included in fundamental algorithm.

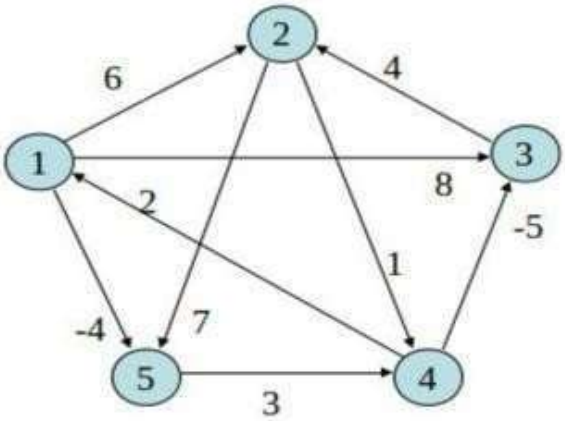


Fig: ALL-PAIRS SHORTEST PATH

5.CBSP Proposed lalgorithm is as follows.

Step1: Label five nodes

Step2: Check information flow between nodes

Step3: Check route between node 0 to node 4

Step4: Check information transfer between nodes

Step5: Check route between node 1 to node 4

Step6: Check overlap between node 2 and node 3

Step7: If path breaks between node 0 and node 2 find novel path,

Step8: Novel path between node 1 to node 2 , If novel path fails,

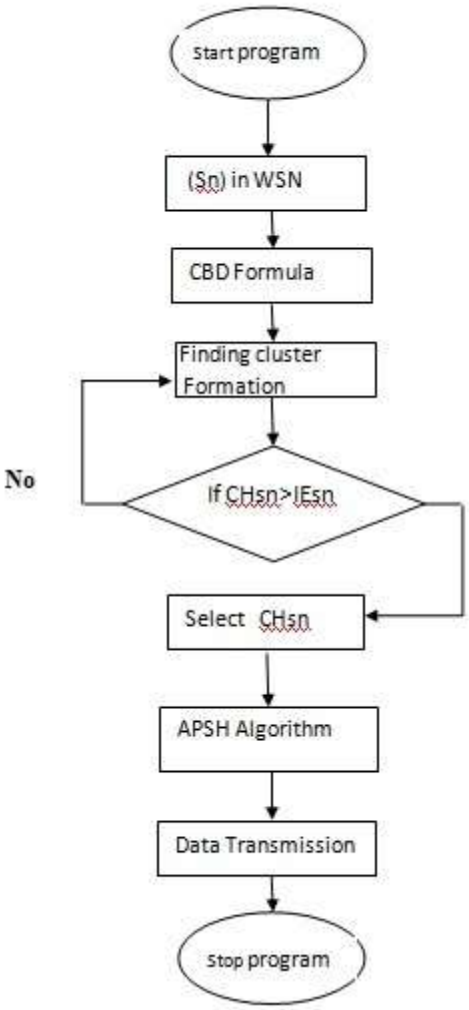
Step9: Ensure again a novel path between node 2 to node 4

Step10: Ensure information flow between node 2 to node 4, check information flow again

Step11: The shortest path is verified for information flow

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 11s, 2025
https://www.theaspd.com/ijes.php

4.5Overall Flow Diagram



IV. RESULTS AND ANALYSIS

To provide specific results and analysis for energy-based multiple sensor networks, I would need access to the latest research papers or specific data. However, I can outline the general types of results and analyses that researchers typically present in studies related to energy-efficient sensor networks.

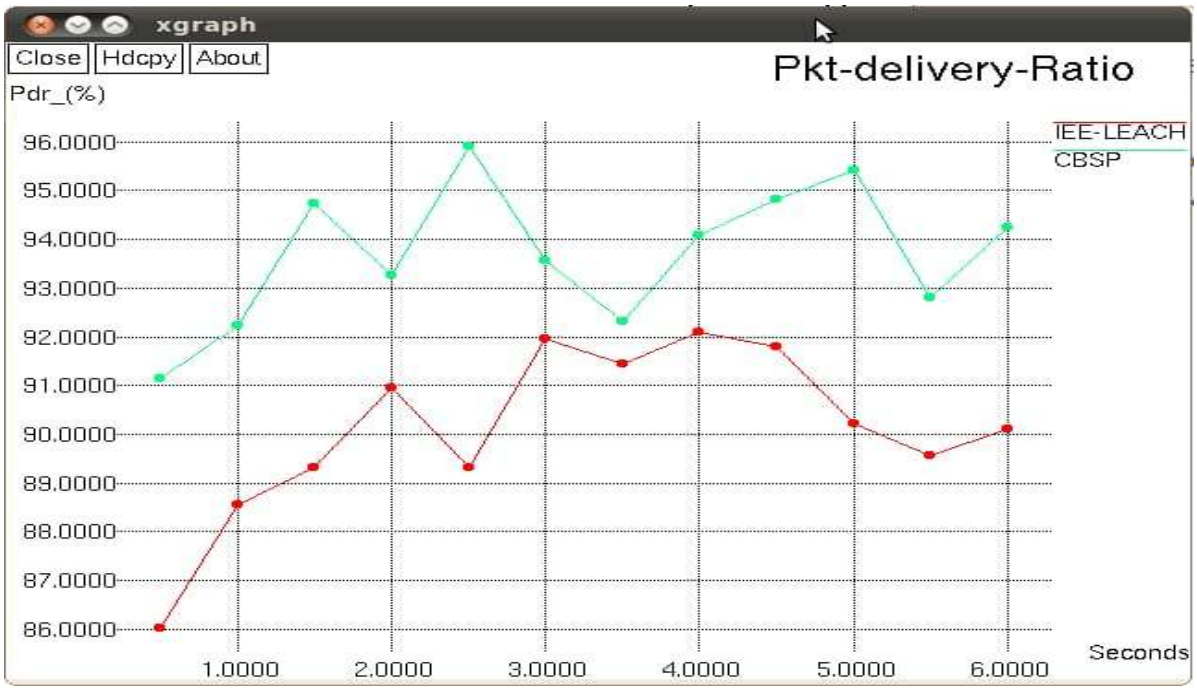
Simulation of Parameters

Parameters	**Value**
Sensor Field	1000*1000
Probability of a node to CH	0.05
Initial energy	0.5j
BS Location	50*50m
Data packet size	500 bytes

Transmitter/Receiver Electronics	50nj/bit
Number of nodes	50

Fig is the output of the Simulation at density of 50 nodes. The CBSP system experiences reduced performance as compared to multipath IEE-LEACH hence the second round occurs after 2.0 and 2.5 Seconds. Therefore a better result in sense that, CBSP is superior to other approaches in all definition of network life time can be done.

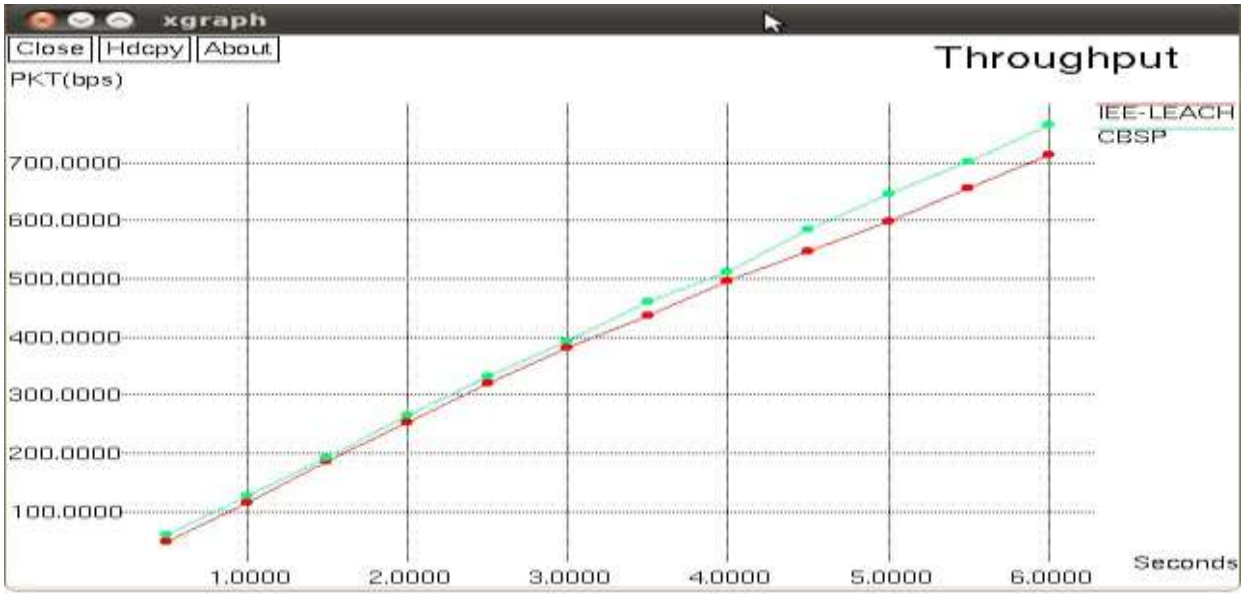
1. Packet Delivery Ratio



This Fig Shows Intrest in Impact of the Number of Packet Delivery.that Propoed Model Delivers Hights Number of Packet data Compare to IEE-LECH Even at Hights Density of Nodes.the Proposed CBSP Algorithm Select a Strong node in term of Energy to Transmit the Packets.

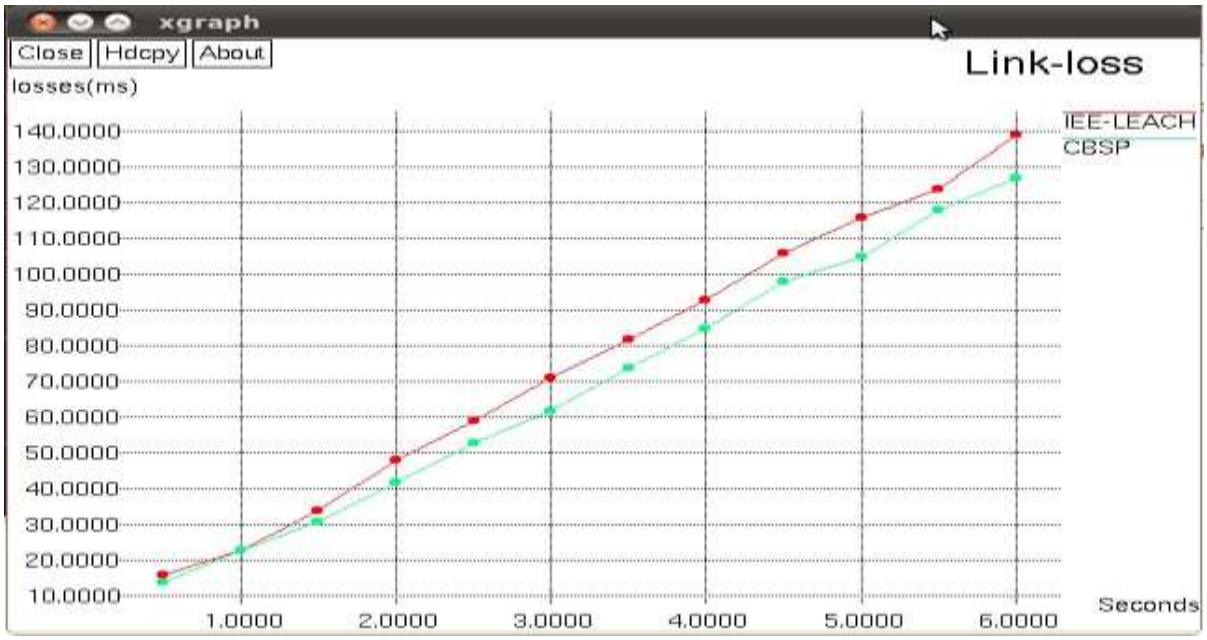
2. Throughput

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 11s, 2025
https://www.theaspd.com/ijes.php



It is defined as the number of Packet Data Received at Particular Point of Time. It Shows the result of Proposed CBSP Which High Throughput Because of Multipath Routing. Proposed CBSP Method Achieves Throughput Value is high Compare then IEE-LEACH Respectively.

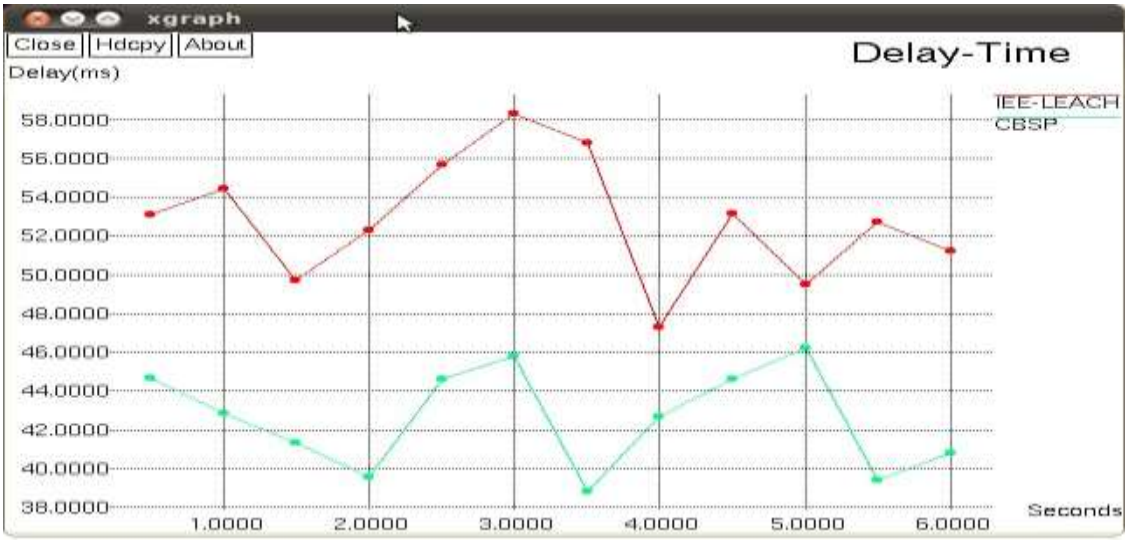
3.Link Loss



The Result is Shown Fig the Link Loss of data Transmission Proposed CBSP Method Achieves is very Low Compare then IEE-LEACH.

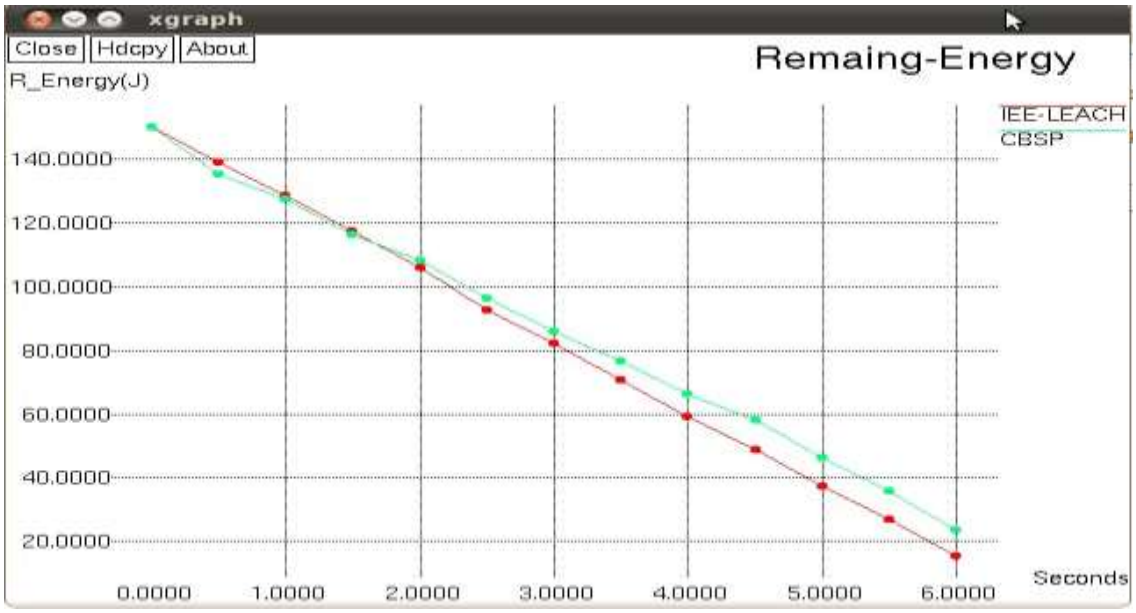
4.Delay Time

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 11s, 2025
https://www.theaspd.com/ijes.php



The Time Delay is Measured the total amount of time taken by a Packet to be transmitted Across a Network from Source to Sink. The Impact of Proposed CBSP on End to End Time Delay is Shown in Fig.The Simulation of Result is Clearly Demonstrate Proposed CBSP is Efficient and also Verified High.

5. Remining Energy



The Reaming Energy Is very High . A Proposed CBSP Method Achieves More Compare then IEE-LEACH Respectively

V.CONCLUSION AND FUTURE WORK

In conclusion, the quest for energy efficiency in multiple sensor networks is of paramount importance for ensuring prolonged operational lifetimes and sustainable functionality. Our exploration into optimizing energy consumption has revealed the efficacy of intelligent clustering algorithms, exemplified by IEE-LECH, in dynamically organizing sensor nodes to minimize energy usage. The integration of energy-aware routing

protocols and adaptive algorithms further contributes to the overarching goal of reducing energy overhead during data transmission. As we strive for energy-efficient multiple sensor networks, this study paves the way for future advancements in the field, encouraging the adoption of sustainable practices and technologies. the proposed CBSP Achieves more Effective process of Cluster head elected by a probability based on distance and energy of each node. Finally, the result of CBSP achieves less energy and more effective message by data transmission. The continued pursuit of energy efficiency in sensor networks holds the promise of ushering in a new era of resource-conscious and resilient systems that can meet the evolving demands of our interconnected world.