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A Survey on Various Routing Protocols for Heterogeneous Wireless Sensor Networks

Mrs. Kavitha Narayan.B.M[1],Varshini.J[2], Neha.M[3], Swapna.S.N[4], Kavyashree.N[5]

[1]Assistant Professor, [2,3,4,5] Students (UG) Department of Electronics and TelecommunicationEngineering Dr.Ambedkar Institute of Technology, Bangalore,India

ABSTRACT

Wireless sensor networks are an emerging technology for monitoring the physical world. The energy constraint of Wireless Sensor Networks makes energy saving and prolonging the network lifetime become the most important goals of various routing protocols. Clustering is a key technique used to extend the lifetime of a sensor network by reducing energy consumption.This project surveys different energy efficient clustering protocols for heterogeneous wireless sensor networks and compares these protocols on various points like clustering method, heterogeneity level and clustering attributes.

Keywords-Heterogeneity, Clustering, Energy-Efficient Protocols, WSN, routing protocols, heterogeneous WSN.

I. INTRODUCTION

Wireless Sensor Networks (WSNs) are networks that consist of nodes also called sensors which are deployed in a region. These sensors work with each other to sense various types of physical information from the atmosphere. In various significant fields WSNs are very helpful like environmental traffic, military surveillance, area monitoring, air pollution monitoring, wastewater monitoring, and pressure. All sensor nodes process data and transmit it to base station also called sink. A cluster head is a node which is responsible for maintaining clusters, collecting data from nodes in the cluster and communicating with sink. By using clustering methodology, it has been observed that there is a large amount of energy that has been saved.[1]

High-end sensor node under heterogeneous WSN helps in longer sensing range or communication with the presence of high process throughput. On the other hand, a low-end sensor node provides low communication or sensing range, but also has a low process throughput. Thus, the heterogeneous WSN models provide the possibility of using combination of these two nodes tend to support the application by having balance between the cost associated with the WSN usage and the performance of WSN.

II. CLUSTERING

Clustering is a technique where nodes are arranged into clusters that are useful in achieving energy efficiency. All nodes belonging to the same cluster send their data to cluster head. The main function of cluster head is to provide efficient data communication between sensor nodes and the base station. So, the cluster head should have high energy as compared to other nodes. Cluster Head aggregates data and sends aggregated data to Base Station where the end-user can access the data.[1]

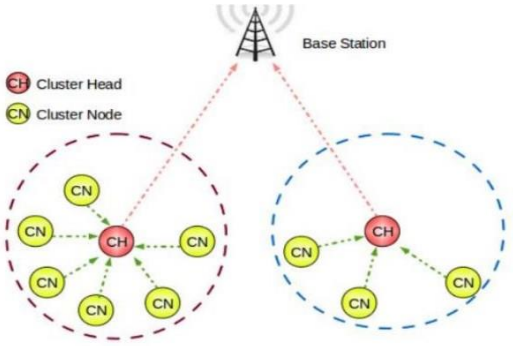

Fig.1 Clustering Technique

In heterogeneous WSNs all sensor nodes have dissimilar energy level and fewer energy nodes died first than the high energy sensor nodes. In a heterogeneous sensor network, two or more different types of nodes with different battery energy and functionality are used.

The motivation being that the more complex hardware and the extra battery energy can be embedded in a few cluster head nodes, thereby reducing the hardware cost of the rest of the network. However, fixing the cluster head nodes means that role rotation is no longer possible. Stable Election Protocol (SEP), Distributed Energy Efficient Clustering (DEEC), Developed DEEC (DDEEC) and Enhanced DEEC (EDEEC) are well known heterogeneous WSNs protocols. Low-Energy Adaptive Clustering Hierarchy (LEACH) is used for homogeneous protocol in which all the nodes have same energy level. There are number of rounds for communication of information.[2]

III. LITERATURE SURVEY

Various algorithms for WSNs are designed to improve the performance of energy consumption, throughput, reduces the delay, and increase the

lifetime of the network.

In [3], S. Zhang, X. Xu, Y. Wu, and L. Lu proposed MAC mechanism for user-centric scheduling technique. Wireless communications have been evolved from GSM system (2G) to LTE-A networks (4G) with the major interest focusing on the throughput related criteria. 5G communication networksextend to a 3-D performance metric cube based on throughput, number of links and delay simultaneously.5G networks confronts a wider range of future applications, including person-to-person, person-to-machine, or machine-to-machine .The paper shed some lights on the novel 5G communication system design, and further pave the way towards energy efficient, low latency and high reliable communication networks.

In [4], authors M. Elappila, S. Chinara, and D. R. Parhi proposed Survivable Path routing protocol for WSN.This protocol is supposed to work in the networks with high traffic because multiple sources try to send their packets to a destination at the same time, which is a typical scenario in IoT applications for remote healthcare monitoring. For selecting the next hop node, the algorithm uses a criterion which is a function of three factors: signal to interference and noise ratio of the link, the survivability factors the path from the next hop node to the destination, and the congestion level at the next hop node. Results suggest that the proposed protocol works better concerning the network throughput, end-to-end delay, packet delivery ratio and the remaining energy level of the nodes.

In [5], the authors S. Fu, L. Zhao, Z. Su, and X. Jian proposedthe technique unmanned aerial vehicles (UAV) based relay in WSN .Relay is one of the most significant issues in smart industrial wireless sensor networks (WSN) due to the low transmitting power of sensors.The placement of the super sensor is static, which leads to the instability of performance in WSN under the time-varying wireless environment..UAVis employed as the relay in WSN, which can move in three-dimensional space to possess a better position to minimize the system power consumption. We use a simple case study to demonstrate the effectiveness of UAV in WSN.

In [6], Y. Zhao, K. Liu, X. Xu, H. Yang, and L. Huang proposedthe technique Distributed dynamic cluster head selection and k-means.. The cluster head uses the LTE-M protocol, and the intra-cluster uses the low-power wide-area network (LPWAN) self-networking protocol in the wireless sensor network.The detailed analysis of the messages exchanged between the device and the base station, describe the causes of overload and the steps of data aggregate combined with the physical channel. The paper explore the cluster head quantity and the optimal scale in the intra-cluster under the traditional K-mean algorithm. When K is 30 under specific resources, the results show that the system's access success probability and resource utilization are optimal.

In [7], authors C. Jothikumar, K. Ramana, V. D. Chakravarthy, S. Singh proposed Optimal Cluster based Routing Protocol(Optimal-CBR). Internet of Things (IoT) allows physically existing things to see, hear, think, and perform a significant task by allowing them to interact with one another and exchange valuable knowledge when making decisions and caring out their vital tasks. The fifth-generation (5G) communications require that the Internet of Things (IoT) is aided greatly by wireless sensor networks. The nodes are clustered using the basic k-means algorithm during the cluster phase and the highest energy of the node nearest to the centroid is selected as the cluster head (CH). The CH collects the packets from its members and forwards them to the base station (BS). During the chaining phase, since two-thirds of the nodes are dead and the residual energy is insufficient for clustering, the remaining nodes perform multihop routing to create chaining until the data are transmitted to the BS. This enriches the energy efficiency and the network lifespan.

In [8], authors T. Behera, S.Mohapatra, M.Khan, A.Gando mi proposed Efficient cluster head selection scheme Technique. There are two main reasons for energy heterogeneity. The first one is that nodes in the network are equipped with different initial energies to undertake corresponding work, the other is that the network will cause unbalanced energy consumption of nodes during operation, which will also lead to different energy consumption of each node. E-BEENISH that uses single-hop communication for four-level heterogeneous WSNs, improving the lifecycle of the WSNs, the number of stable regions and throughput, through an improved new threshold algorithm. Moreover, in order to make full use of the network energy, the ratio of the remaining energy to the global average energy and the ratio of the distance from the member node to the BS and the CH to the BS are weighted as a scheme for selecting the CH.

In [9], authors Yinghui Zang, Xiaolu Zang, Shang Ning, Jing Gao, Yang Liu, proposed Multi level Heterogeneous Routing protocol technique. An enhanced balanced energy efficient network-integrated super-heterogeneous (E-BEENISH)Routing protocol, by analyzing communication energy consumption of the clusters and a large range of Energy levels in heterogeneous WSN E-BEENISH that uses single-hop Communication for four-level heterogeneous WSNs, improving the lifecycle of the WSNs, the number of stable regions And throughput, through an improved new threshold algorithm. Moreover, in order to make full use of the network Energy, the ratio of the remaining energy to the global average energy and the ratio of the distance from the member node to the BS and the CH to the BS are weighted.

In [10], Mengjia Zeng, Xu Huang, Bo Zheng, and Xiang xiang Fan proposed E-CRCP Energy Coverage Ratio Clustering Protocol technique .The Low-Efficiency Adaptive Clustering Hierarchical (LEACH) protocol, a hierarchical routing protocol, has the advantage of simple implementation and can effectively balance network loads. The optimal number of clusters is determined based on the principle of "minimum energy consumption", and the cluster head selection is based on the principle of "regional coverage maximization". This method has some advantages in terms of longer network life, load balancing, and overall energy consumption in the environment of a heterogeneous energy wireless sensor network.

In [11], SeyyedAbbasi, F.Kiani proposed Routing protocol based on colony optimization technique. Efficient energy consumption is one of the main problems in wireless sensor networks routing protocols. Since the sensor nodes have limited battery level and memory space, it is important to manage these resources efficiently. Although there are studies in this subject in recent years, it is lacking in concurrent and real-time environments with multi-agents.for the generation and analysis of big data. The author proposes an efficient routing model with balanced consumption resources in the whole of the network. As such this method not only chooses the path according to some parameters such as energy or short paths but also pays attention to traffic density on the routes, queue availability of the nodes and data reliability. In order to achieve these goals, resources are used carefully and in a balanced manner.

In [12], Srilakshmi Uppalapati proposed Energy efficient Heterogeneous optimization Routing protocol for WSN .The Implementation of routing protocols of energy-efficient (EE) is one of the significant jobs of Sensor Networks (MC-SSN) and Mission Critical Sensors. In Hierarchical routing protocols, higher EE can reach when compared to the flat routing Protocols. The network's scheduling process doesn't support enhanced balanced Energy efficient network-integrated super-heterogeneous (E-BEENISH), which discusses earlier. An Energy efficient Time scheduling based particle swarm optimization unequal Fault tolerance clustering protocol (EE-TDMA-PSO-UFC) is proposed.

In [13], authors Amir Salah Elsafrawey, Fathia A. Mohammed, Emad Hassan, M.I Dessoukty proposed three new protocols to extend the heterogeneous WSNs life-time. The proposed protocols are proactive routing protocols and named; CZSEP, CZSEP-HN, and MCZSEP-HN. Both CZSEP and CZSEPHN consider one circle zone in the centre of the network field for deploying the normal nodes, while the advanced nodes are deployed around this circle zone. CZSEP-HN considers the addition of helper nodes to further improve the performance of CZSEP.

In [14], authors Xiaoqiang Zhao, Shaoya Ren, HengQuan and Qiang Gao proposed a technique called Routing Protocol for Heterogeneous Wireless Sensor Network based on a modified Grey Wolf Optimizer. This GWO mimics the
leadership hierarchy and hunting mechanism of grey wolves in nature. The authors use this technique to determine the residual energy of the protocol. Four types of grey wolves such as alpha, beta, delta, and omega are employed for simulating the leadership hierarchy. The technique is advantageous as it extends the life cycle and balances the energy consumption of the network.

In [15], authors Rowayda A. Sadek, Doha M.Abd-alazeem, Mohammed M. Abbasay used a technique called Energy-efficient Multi-hop Routing Protocol based on GWO protocol. GWO is an intelligent algorithm that simulates the hierarchy and hunting process of the wild wolf packs. Wolves have a four-tiered social structure. The primary goal involves optimizing routing by reducing the energy consumption of the sensor nodes, extending the lifetime of WSN's and increasing network throughput. The suggested GWO-TSA satisfies QoS requirements such as network scalability.

In [16], authors Kenza Redjimi, Mohammed Redjimi, compared The DEEC and EDEEC heterogeneous WSN protocols, EDEEC increases significantly the network performances. Wireless sensor networks supply remote processing centres with information collected at the level of the environments in which the evolve, also make it possible to establish interactions between distant objects in ubiquitous and instantaneous ways. EDEEC is more efficient than DEEC in terms of the network lifetime and the number of the transmitted packets to the Base station. The EDEEC protocol principle is based on the DEEC functioning protocol.

In [17], authors Zain Ul Abidin Jaffri, Muhammad Asif, Md. Sadek Ali proposed the protocol called Threshold based energy aware zonal efficiency measuring hierarchical routing protocol (TEZEM). The main purpose is to enhance network efficiency by improving the CH selection process by distributing the entire network division into several zones. TEZEM is a very effective and efficient method for CH selection as it guarantees an equal number of CHs in each round. The proposed protocol maximizes the lifetime of a network keeping in view the quality of service and enhances network efficiency by improving the CH selection process by distribution the entire network division into several zones. The drawback is that the efficiency of protocol is still to be validated in real scenario.

In [18], authors Salam Mahdi Azooz, Jaber. Majed, Raed Khalid Ibrahim, Adnan Hussein Ali proposed optimum clustering in multi-path and multi-hop protocols as a feasible option for reducing energy consumption and extending the lifetime of wireless sensor networks. The authors compared the low energy adaptive clustering hierarchy (LEACH) clustering method, with the new technique, optimal real time clustering (ORTC) and from the analysis, LEACH should only be favored in cases of small network where the whole number of nodes is lower than fifty nodes. ORTC should be chosen for application in a large network. The ORTC also affords greater probability percentage for a cluster head to be elected among nodes, which reduces energy consumption, extends network lifetime while at the same time improving packets transmission rate. The newly proposed technique works efficiently depending upon a dead node.

In [19], authors Uzam Majeed, Aqdas Naveed Malik, Nasim Abbas, Wasseem Abbas presented an energy-efficient distributed congestion control protocol for wireless multimedia sensor networks (DCCP). The main feature of proposed DCCP protocol is that, it improves the performance of numerous videos sent over a network. In DCCP, buffer occupancy change rate and buffer occupancy were used to deal with congestion at each node. The traffic congestion map was used to calculate the best path. Therefore, the traffic was balanced on different routes, which reduces the end-to-end delay.

In [20], authors Trupti Mayee Behera, Umesh Chandra Samal, Sushanta Kumar Mohapatra, Mohammad S. Khan, Bhargav Appasani surveyed LEACH-based classical and bio-inspired protocols which helps researchers to understand routing protocols with diverse architectures, novel strategies, and enhanced performance. The authors conclude that the LEACH-MAC protocol can be used in networks where life is a major issue. I-LEACH protocol can be beneficial in large scale as well as small networks. Similarly, the LEACH-KH protocol yields a high packet-delivery ratio and can be adopted in networks where reliability is the prime factor. The primary issue is that the frequent updating locations of the sensor nodes and BS's position deplete the network energy.

In [21], authors Muhammad Bilal, Ehsan Ullah Munir and Fawaz Khaled Alarfaj proposed a heterogeneity-aware, threshold-based hybrid clustering and routing algorithm, that significantly improves the lifetime and the stability period of wireless sensor networks (WSNs) as compared to existing routing protocols, such as threshold-sensitive stable election protocol (TSEP), threshold distributed energy-efficient clustering (TDEEC), low-energy adaptive clustering hierarchy (LEACH), hybrid centralized clustering path planning algorithm (HADCC), LEACH-centralized and energy efficient sensor network (TEEN). The main feature is that, the proposed model contains a hybrid approach that provides a cluster head selection at two levels and adds flexibility in cluster formation based on the sensor node's position, initial energy, residual energy, and cluster head selection.

Year	Author name	Technique used	Parameters	Advantages	Limitations
2014[3]	S. Zhang, X. Xu, Y. Wu and L. Lu	MAC mechanism for user-centric scheduling	Delay, reliability	Energy-efficient reduced latency and highly reliable networks	Complexity issues in implementation.
2018[4]	M. Elappila, S. Chinara, D. Parhi	Survivable path routing	Throughput, end-to-end delay, packet delivery ratio, and remaining energy	Minimizes the network congestion, high packet reception rate decreased end-to-end delay	Mac layer designs with transmission power control
2018[5]	S. Fu, L. Zhao, Z. Su, X. Jian	Unmanned aerial vehicles (UAV) based relay in WSN	Power consumption	Maximizes the system performance, decrease the transmitting power	Flightpath selection algorithm for UAV to achieve the best path for data collection
2019[6]	Y. Zhao, K. Liu, X. Xu, L. Huang	Distributed dynamic cluster head selection and k-means	Traffic distribution, throughput, energy consumption	Decreases energy efficiency, uniform density	A large number of devices
2019[7]	S. Nejakar, P. Benakop	Energy management technique in reactive routing protocol	Throughput, packet delivery factor	Improves the network lifetime, increased throughput, decreasing energy efficiency	The burden of high-power utilization
2019[8]	T. Behera, S. Mohapatra, M. Khan, A. Gando mi	Efficient cluster head selection scheme	Throughput, average residual energy, number of dead nodes	The optimal number of cluster heads in the network enhances the network lifetime	Realistic scenarios for a WSN-based IoT
2019[9]	Yinghui Zhang, Xiaolu Zhang, Shuang Ning, Jing Gao, Yang Liu	Multilevel Heterogeneous Routing Protocol	Energy Consumption	Saves Energy and Extends Lifetime.	Does not work for low Complexity algorithm.
2019[10]	Mengjia Zeng, XuHuang,BoZheng, and Xiangxiang Fan	Energy-Coverage Ratio Clustering Protocol (E-CRCP)	Minimum energy consumption	Longer network life, load balancing, and overall energy consumption in the environment.	No limitation was mentioned.
2020[11]	Seyyed Abbasi, F. Kiani	Routing protocol based on ant colony optimization	Energy consumption, network lifetime, remaining energy, buffer size	Finds the optimal path, real time transfer of data on a large scale of WSN and decentralized IoT	Designed for the generation and analysis of big data
2020[12]	Srilakshmi Uppalapati	Energy efficient Heterogeneous Optimization Routing Protocol for WSN.	end-to-end delay, Throughput, Power consumption.	The System provides enhanced throughput of a network. Reduces time slot for the data transmission.	No limitation was mentioned.
2020[13]	AmirSalahElsafraw ey, Fathia A. Mohammed, Emad Hassan, M.I Dessoukty	Clustering technique were used to minimize energy consuming	Total number of nodes, Total initial energy, Initial Energy of normal nodes, Initial energy of intermediate nodes, Message size, Energy for data aggregation	Minimizeenergy consuming, Expand stability, Extend life time.	No limitation was mentioned.
2020[14]	Xiaoqiang Zhao, Shaaya Ren, Qiang Gao	Routing protocol for HWSN'S based on modified grey wolf optimization	Total energy of HMGWO against SEP, DEEC, M-SEP,and FIGWO, Total residual energy of HMGWO relative to SEP, DEEC, M-SEP and FIGWO	Extends the life cycle and balances the energy consumption of the network.	To more properly utilize heterogeneity of nodes energy to lengthen the network life cycle and increase the network throughput.

2021	C. Jothikuamar, V. Deeban, S. Singh	Optimal cluster-based routing and k-means	Energy dissipation, packet delivery ratio, end-to-end delay	Energy distribution, maximum transmission, prolonged network lifespan	Security mechanism in the implementation
2021[15]	Rowayda A. Sadak	Energy -efficient Multi-hop Routing Protocol based on GWO-TSA Protocol	Node Deployment, Formation of Dynamic Clusters, NetworkScalability, Network reliability, Network Throughout.	Improve WSN by reducing sensor energy consumption, extending network lifespan, increasing network throughput.	Depending the node's energy and distance to the base station.
2022[16]	Kenza Redjimi, Mohammed Redjimi.	The DEEC and EDEEC Heterogeneous WSN Routing Protocols.	Network size, Number of nodes, Normal nodes initial energy (E_o) Sink position, Fraction of super nodes, Fraction of advanced nodes.	Improve the performance of wireless sensor network.	The main limitation of WSN'S is that the sensor nodes are operating on limited power sources.
2022[17]	Zain Ul Abidin Jaffri, Muhammad Asif, Md. Sadek Ali	Threshold based energy aware zonal efficiency measuring hierarchical routing protocol (TEZEM)	Number of nodes, Distribution of nodes, BS position, Network size, Initial Energy of node, Number of nodes deployed, Data packet.	Maximize the lifetime of a network keeping in view the quality of service, Enhance network efficiency by improving the CH selection process by distribution the entire network division into several zones.	The efficiency of protocol is still to be validated in real scenario.
2022[18]	Salam Mahdi Azooz, Jaber. Majed, Raed Khalid Ibrahim, Adnan Hussein Ali	Multipath and Multihop protocol	Simulation area, Channel type, BS location, Energy Model, Transmitted Amplifier, Data aggregation, Received Energy.	Work efficiently depending upon a dead node.	Based on the finding of the network simulation, Energy consumption has been lowered by adapting the newly suggested protocol on wireless sensor network design.
2022[19]	UzamMajeed, Aqdas Naveed Malik, Nasim Abbas, Wasseem Abbas	Distributed Congestion Control protocol(DCCP)	Number of nodes, Simulation time, Routing protocol, Data packet size	DCCP protocol improves the performance of numerous videos sent over a network. The traffic congestion maps used to calculate the best path.	end – to- end delay of the wireless video transmission.
2022[20]	Trupti Mayee Behera, Umesh Chandra Samal, Sushanta Kumar Mohapatra, Mohammad S. Khan, Bhargav Appasani,NicuBizon, and PhatiphatThounthong	LEACH-based and bio-inspired protocols	Longevity, scalability, and packet delivery ratio.	Extends the network's lifespan also saves energy.	Frequent updating locations of the sensor nodes and BS's position deplete the network energy.
2022[21]	Muhammad Bilal, Ehsan Ullah Munir and Fawaz Khaled Alarfaj	A heterogeneity-aware, threshold-based hybrid clustering and routing algorithm.	Stability in dense and larger network areas.	Improves the lifetime and the stability period of wireless sensor networks. Also provide a better cluster head selection and controlled network traffic.	Practical implementation is still to be conducted.

advance and normal nodes have same probabilities.[22]

IV. HETEROGENEOUS ROUTING PROTOCOLS

A. *SEP (Selection Election Protocol)*

SEP (Selection Election Protocol) in which there are two types of nodes called normal nodes and advance nodes with advance nodes having (1+a) more energy than the normal nodes. Every sensor node in a heterogeneous two-level hierarchical network independently elects itself as a cluster head based on its initial energy relative to that of other nodes.[22]

B. *DEEC (Distributed Energy-Efficient Clustering)*

This protocol also works at two levels of energy as in case of SEP protocol and has better stability period than SEP protocol. In DEEC, the cluster heads are elected by probability based on the ratio between residual energy of each node and the average energy of the network. The epochs of being cluster heads for nodes are different according to their initial and residual energy. The nodes with high initial and residual energy will have more chances to be the cluster heads than the nodes with low energy. So, the advance nodes have more chances to be cluster heads than the normal nodes.[22]

C. *DDEEC (Developed Distributed Energy Efficient Clustering)*

This protocol was 30% better than SEP and 15% better than DEEC in terms of Network lifetime and Stability period. This protocol also works at two levels of energy and overcomes the drawbacks of the DEEC protocol. DEEC is based on clustering, when the cluster heads are elected by a probability based on the ratio between residual energy of each node and the average energy of the network. The round number of the rotating epoch for each node is different according to its initial and residual energy. DEEC adapts the rotating epoch of each node to its energy. The nodes with high initial and residual energy will have more chances to be cluster heads than the nodes with low energy. Thus, DEEC can prolong the network lifetime, especially the stability period. This choice penalizes always the advanced nodes, especially when their residual energy depletes and becomes in the range of the normal nodes. In this situation, the advanced nodes die quicker than the others. The DDEEC thus balances the cluster head selection overall network nodes following their residual energy. So, the advanced nodes are likely to be cluster heads during initial period but as the energy of the advance nodes depletes and become comparable with the normal nodes, the advance nodes will have the cluster head election probability like the normal nodes.[22]

D. *EDEEC (Enhanced Distributed Energy Efficient Clustering)*

EDEEC protocol which works on the same principle of DEEC but adds a third type of node called super node which has (1+b) times more energy than normal node. Advance nodes have (1+a) times more energy than normal nodes. Due to this third node, the heterogeneity of the network increases from two to three. Traditionally as per previous protocols, in this protocol too, cluster head selection uses the same threshold technique, and the

E. EDDEEC (Enhanced Developed Distributed Energy Efficient Clustering)

This protocol also works at three levels of heterogeneity and overcomes the drawbacks of EDEEC protocol. In EDEEC protocol, the super nodes have more energy than the advance nodes which have more energy than the normal nodes. The probability of the super, advance and normal nodes to be cluster heads shown in above equation clearly shows that super nodes have higher probability to be cluster head than the advance nodes which have more probability than normal nodes. So, after becoming cluster heads again and again, after some rounds, the energy of super nodes will become equal to that of advance nodes because cluster heads consume more energy than the other nodes in the cluster. At this time, as the energies of the super and advance nodes becomes equal, but due to higher probability, the super nodes will again become cluster heads. Due to this, the super nodes will die fast which will reduce the lifetime of the network. This effect is called penalizing effect as in the DDEEC.[22]

F. BEENISH (Balanced Energy Efficient Network Integrated Super Heterogeneous) Protocol

The first ever protocol for four levels of heterogeneity in the wireless sensor network. The fourth type of node introduced in this protocol is called ultra-super node which has (1+u) times more energy than normal nodes. This protocol proved that with the increase in heterogeneity, the stability period increases which is a very important parameter for reliable information. BEENISH uses the same concept for cluster head selection as in previous protocols with the difference only in addition to probability for ultra-super nodes.[22]

V. CONCLUSION

In this survey, we will compare the parameters of the chosen DEEC, DDEEC, EDEEC, EDDEEC and BEENISH heterogeneous protocols for wireless sensor network on - stability period, network lifetime, throughput, time required for packet to travel from source to destination. We have chosen DEEC,DDEEC, EDEEC, EDDEEC and BEENISH heterogeneous protocols for wireless sensor network as they have higher stability and gives more network lifetime as compared to other protocols. The main concern of this project is to examine the stability period, network lifetime, throughput, time required for packet to travel from source to destination and compare the performances of these heterogeneous protocols.

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