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Efficient Routing in ECA Compared with EEHC in Wireless Sensor Networks

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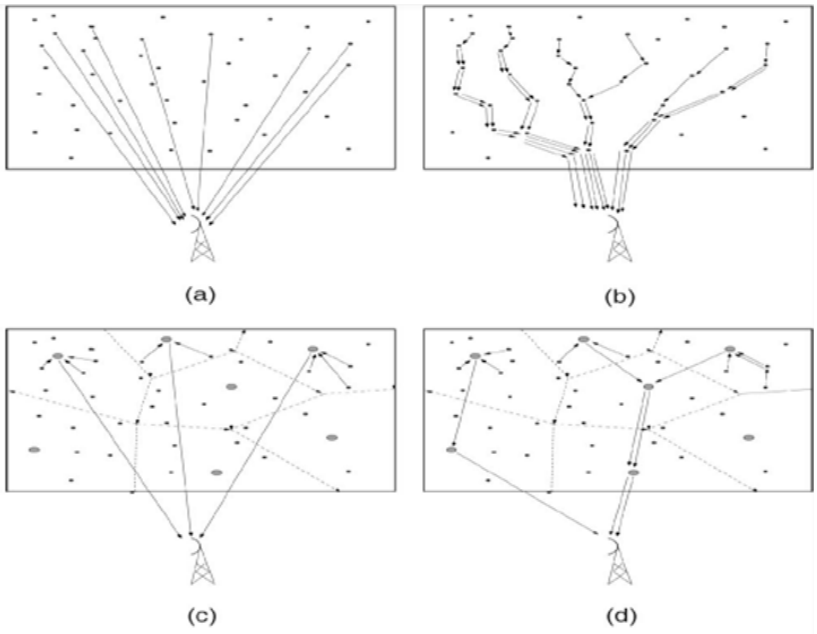
Abstract: Wireless Sensor Networks (WSNs) are the latest approach and the extension of wireless communications, incorporated circuit technologies, Ad-hoc networking routing protocols, allotted the signal processing, and embedded systems. The wide utilization of wireless sensor networks is obstructed by the severely limited energy constraints of the individual sensor nodes. In this paper, our main percept is to deploy much number of nodes at different places. By deploying much number of nodes we are having disadvantages like ambiguity, no scalability, high delay, low throughput etc, to prolong the life time of the sensor nodules, designing the efficient routing protocols are critical. Hence, we introduced clustering concept and implemented the efficient protocol for efficient routing in WSNs. Even in spite of sensor networks are designed for tracking and summarizing actions, which may be application based, a single routing protocol cannot be advanced for the sensory communities beyond all the applications.

Keywords: Routing, Wireless sensor networks, Cluster head, Delay, Throughput.

1. INTRODUCTION

Sensor networks are particularly disbursed networks of small, light-weight wireless nodes, deployed in massive numbers to display the environment or system via the measurement of bodily parameters inclusive of temperature, stress, or relative humidity. Building sensors has been made feasible through the current advances in micro-electromechanical systems (MEMS) generation. Each node of the sensor network consists of 3 subsystems: the sensor subsystem which senses the environment, the processing subsystem which plays local computations on the sensed facts, and the verbal exchange subsystem that's liable for message change with neighboring sensor nodes. While character sensors have confined sensing location, processing energy, and power, networks a big variety of sensors offers rise to a sturdy, reliable, and correct sensor community protecting wider vicinity. The network is fault-tolerant because many nodes are sensing the same occasions. Further, the nodes cooperate and collaborate on their statistics, which results in accurate sensing of events inside the environment. The two most vital operations in a sensor community are records dissemination, that is, the propagation of data at some stage in the community and information accumulating, that is, the gathering of determined statistics from the person

sensor nodes to a sink. Hop is one portion of the path from source to destination. One of the main issues in WSN is increasing in energy efficiency in order to achieve months of node autonomy with a single set of batteries. Such long nodes lifetime is possible by using long periods of inactivity and use of low-power components. Network coverage area is often much larger then radio range of single nodes, so in order to reach some destination node can use other nodes as relays. This type of communication is known as multi-hop routing in wireless mesh networks [1-2]. Figure 1(a) Representing the communication BS to destination in a single-hop distance and Figure 1(b) Representing the communication from BS to destination using multi-hop technique i.e., from BS to their intermediate nodes, from intermediate nodes to further corresponding nodes and finally to destination. This leads to provide the high delay from source to destination The below Figure 1(c) representing the information forwarding with clustering concept in a single hop distance i.e., directly from BS to corresponding cluster head and Figure 1(d) representing the data transferring from BS to destination having cluster head using multi-hop technique.



Sensor information forwarding with and without clustering and aggregation. (a) Single hop without clustering. (b) Multihop without clustering. (c) Single hop with clustering. (d) Multihop with clustering.

Figure 1: Hopping Process with and without Clustering process

2. ROUTING PROTOCOLS FOR ADHOC WIRELESS NETWORKS

Most of the node energy is consumed by radio transmission. Power savings in radio transmission are usually achieved by energy efficient medium access and routing protocols. Provide the maximum feasible reliability - use opportunity routes if an intermediate node fails. Give the nodes the first-class feasible response time and throughput. Every node must have quick access to routes on demand. In traditional wired networks each node is identified by a unique address, which is used for routing. Sensor networks, being information centric do no longer, in standard, require routing among unique nodes. Adjacent nodes might also have comparable data. So its miles perfect to combination these facts and send it. The main factors that complicate the routing protocol design for WSNs can be summarized as [3-5]:

Fault tolerance: the necessity to sustain sensor networks functionalities without any interruption, after a node failure.

Scalability: the possibility to enlarge and reduce the network.

Deployment: given a certain environment it should be possible to find the suitable deploying location for each sensor.

Power management: the network lifetime [6] needs to be maximized.

Mobility: The mobility of nodes results in frequent path breaks, packet collisions, transient loops, stale routing information, and difficulty in resource reservation.

Connectivity: Some sensors may die after consuming their battery power. Connectivity depends on possibly random deployment.

Quality of Service (QoS): The routing protocol should be able to provide a certain level of QoS [7] as demanded by the nodes or the category of calls.

Support for time-sensitive traffic: The routing protocol have to be capable of support both tough actual-time and tender actual-time traffic.

Sensor Networks have emerged as a promising device for monitoring the physical global, making use of self-organizing networks of battery-powered Wi-Fi sensors which can sense, procedure and communicate. In sensor networks, electricity is a vital aid, even as programs showcase a constrained set of characteristics. Thus, there's both a want and a possibility to optimize the community structure for the programs if you want to reduce useful resource consumed. The primary factor of the network is a sensor, critical for auditing. The real world bodily conditions which include vigorous, warmth, Dankness, fervency, shimmy, squeezing, velocity, toxin and so forth at special places. Wireless sensor networks have observed their way right into a huge kind of appliances and structures with vastly various requirements and characteristics. The sensor networks can be utilized in Environmental tracking, Military, Habitat tracking, detecting chemicals in laboratories, organic, radiological, paramount, and stormy goods and so forth.

3. CLUSTERED ARCHITECTURE FOR WIRELESS SENSOR NETWORKS

A clustered architecture organizes the sensor nodes into clusters, each governed with the aid of a cluster-head. The nodes in each cluster are concerned in message exchanges with their respective cluster-heads, and those heads ship messages to a BS, which is commonly an access point related to a wired community. The beneath determine constitute a clustered structure where any message can reach the BS in at most hops. Clustering may be extended to more depths hierarchically.

Clustered architecture is specifically beneficial for sensor networks because of its inherent suitability for information fusion. The facts accumulated through all members of the cluster can be fused at the cluster-head, and most effective the ensuing information needs to be communicated to the BS.A sensor community may be made scalable through the use of assembling the sensor nodes into companies i.e., clusters. Every cluster has a pacesetter, often referred to as the cluster head (CH). A CH may be elected by the sensors by way of the sensors in a cluster pre-assigned thru the network fashion designer. The cluster membership can be constant or variable. A style of clustering algorithms had been in particular designed for scalability and efficient conversation. The idea of cluster based routing is likewise applied to carry out energy green routing in WSNs. In a hierarchical structure, higher electricity nodes may be used to process and send the information at the same time as low strength nodes may be used to carry out the sensing. Clustering is a power-green communication protocol which may be utilized by the sensors to document their sensed data to the sink. We describe a layered protocol wherein a community consists of several clusters of sensors. Each cluster is managed by a unique node, called cluster head that is accountable for handling the statistics transmission sports activities of all sensors in its clump.

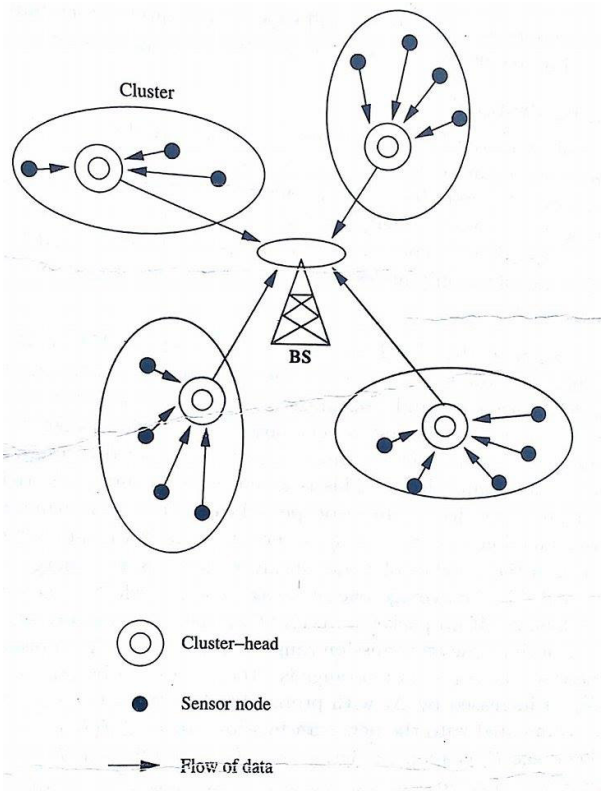


Figure 2: Cluster formation in sensor networks

Hierarchical Clustering: A hierarchical technique divides the network into layers [9-12]. Nodes are grouped collectively to shape the clusters and each cluster has a cluster head, liable for routing in the cluster as well as between unique clusters. Clustering gives inherent optimization talents on the cluster heads. In this phase, we offer a short introduction to some of hierarchical-primarily based routing protocols for WSNs. The primary target of hierarchical routing or cluster based totally routing is to successfully preserve the energy utilization of sensor nodes by way of implicating them in multi-hop communiqué within a selected cluster. Cluster formation is usually based on the strength reserve of sensors and sensors proximity to the Cluster Head (CHs). With clustering in WSNs, energy consumption, lifetime of the network and scalability may be advanced. Because best cluster head node consistent with cluster is needed to carry out routing venture and the opposite sensor nodes just ahead their facts to cluster head [13]. Clustering has vital applications in high-density sensor networks, because it's far lots less complicated to manage a hard and fast of cluster representatives (cluster head) from each cluster than to manipulate whole sensor nodes. In WSNs the sensor nodes are useful resource constrained this means that they have restrained electricity, transmit electricity, reminiscence, and computational capabilities. Energy exhausted by the sensory nodules for communicating records from sensor nodules to the sink nodule is the essential motive of electricity depletion in sensor nodes. LEACH, PEGASIS, TEEN, EAP, REEP, APTEEN etc are the hierarchical routing protocols.[14-16]

4. RESULTS AND DISCUSSIONS

The below Figure 3 and Figure 4 representing the simulation results having without clustering and with clustering concept. Here, in Figure we deployed much variety of nodes at different places and acting the communiqué between source and destination. A circle having from source to destination is a transmission range of a particular node. Without clustering we are having negative aspects like high time delay, no scalability, and collision takes place etc.

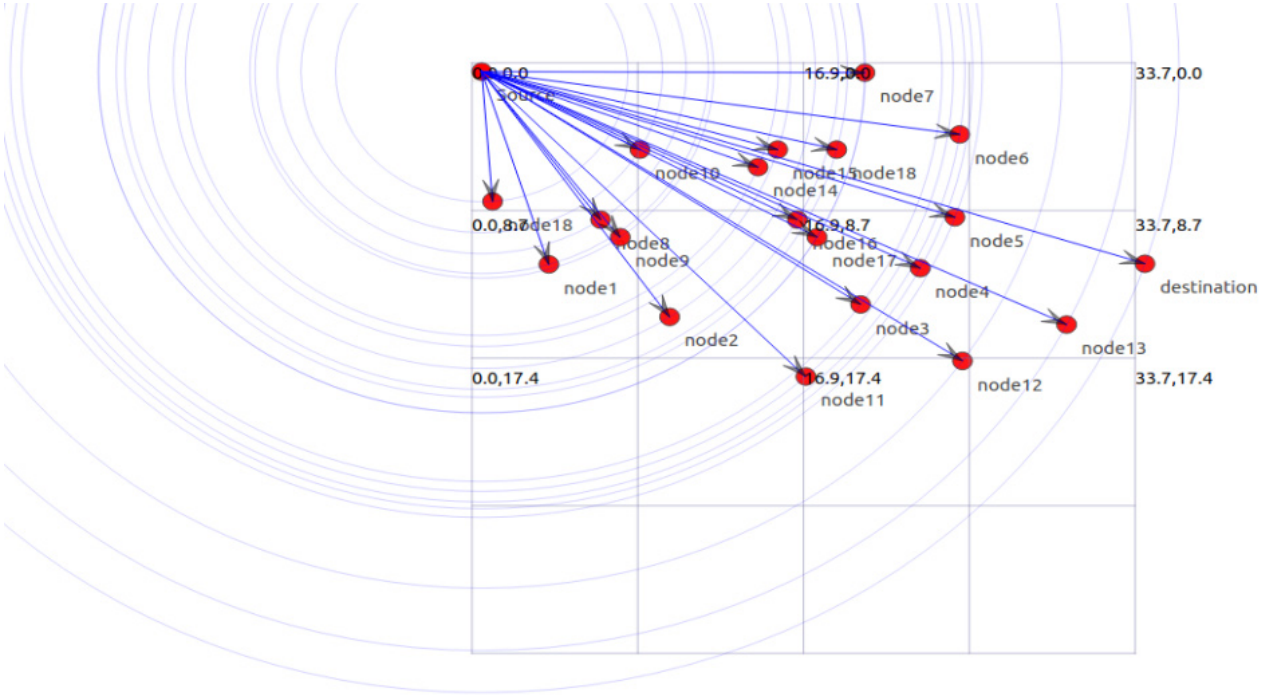


Figure 3: Simulation result without Clustering

To triumph over those, we are introducing clustering idea [17] which is proven in Figure 3, it includes cluster heads and supply sends the statistics packets to the close by cluster head and further cluster head and in the end to the destination. It consists of low time delay, extend the lifetime and reliability of the network.

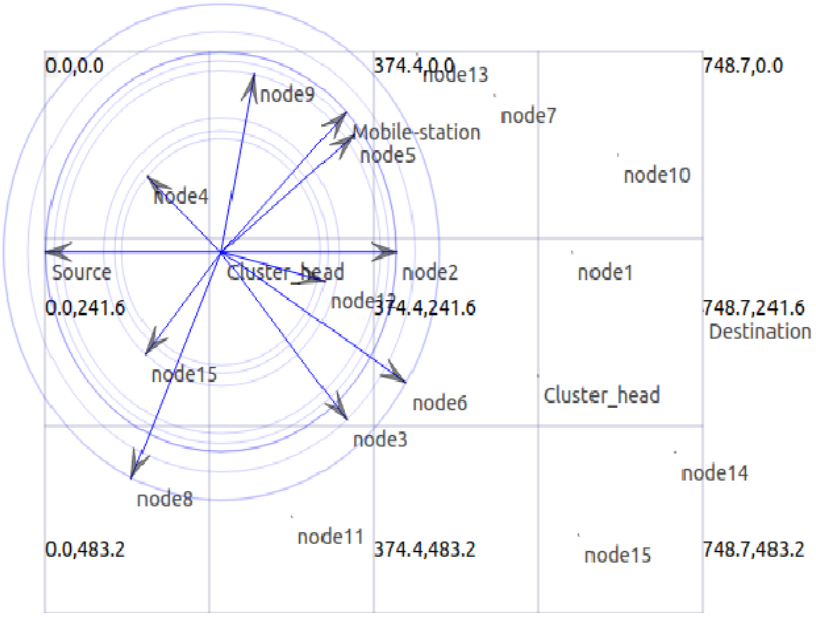


Figure 4: Simulation Result with Clustering

Delay: Delay is the time taken for a packet to be transmitted throughout a community from source to destination. Figure 5 indicates the simulation graph result of Delay using EEHC (Energy Efficient Hierarchical Clustering) Algorithm.

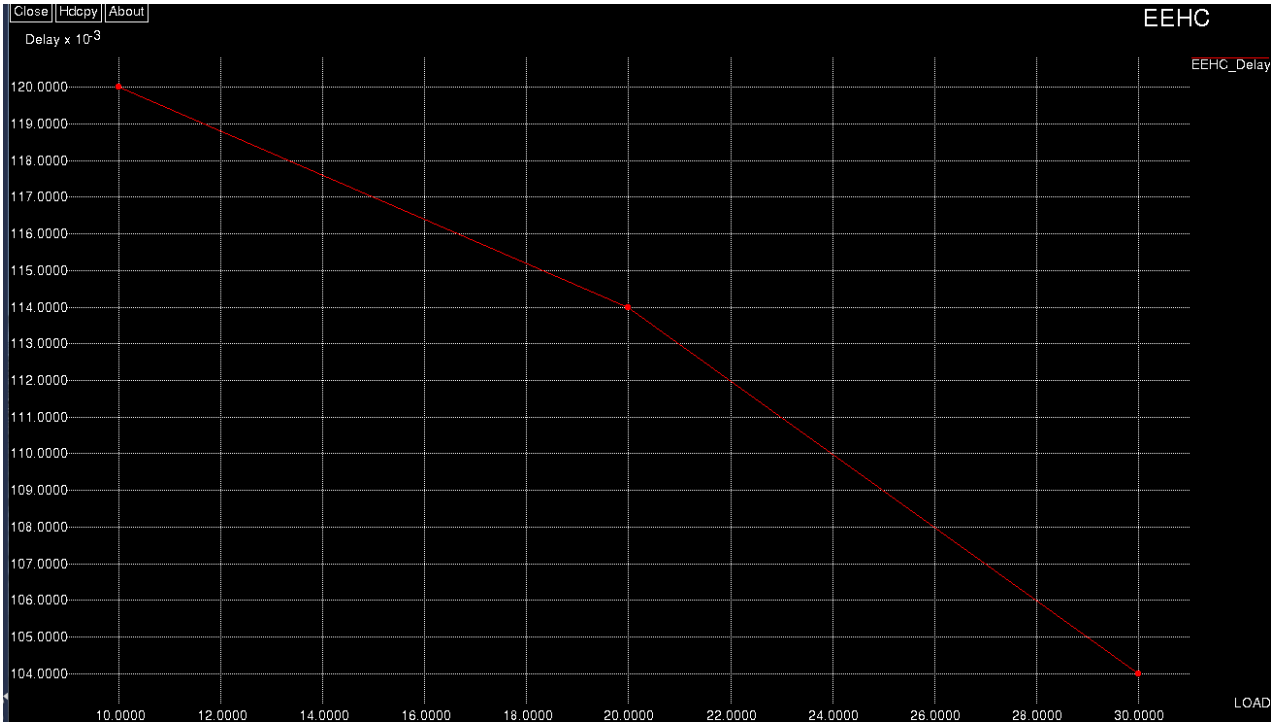


Figure 5: Delay Graph Result for EEHC

Figure 6 indicates the delay graph for EEHC v/s ECA (Energy Clustering Algorithm). It consists of Load (no. of packets) in *x*-axis and Delay on *y*-axis. By using ECA we are obtaining low delay time and efficient routing compared to EEHC.

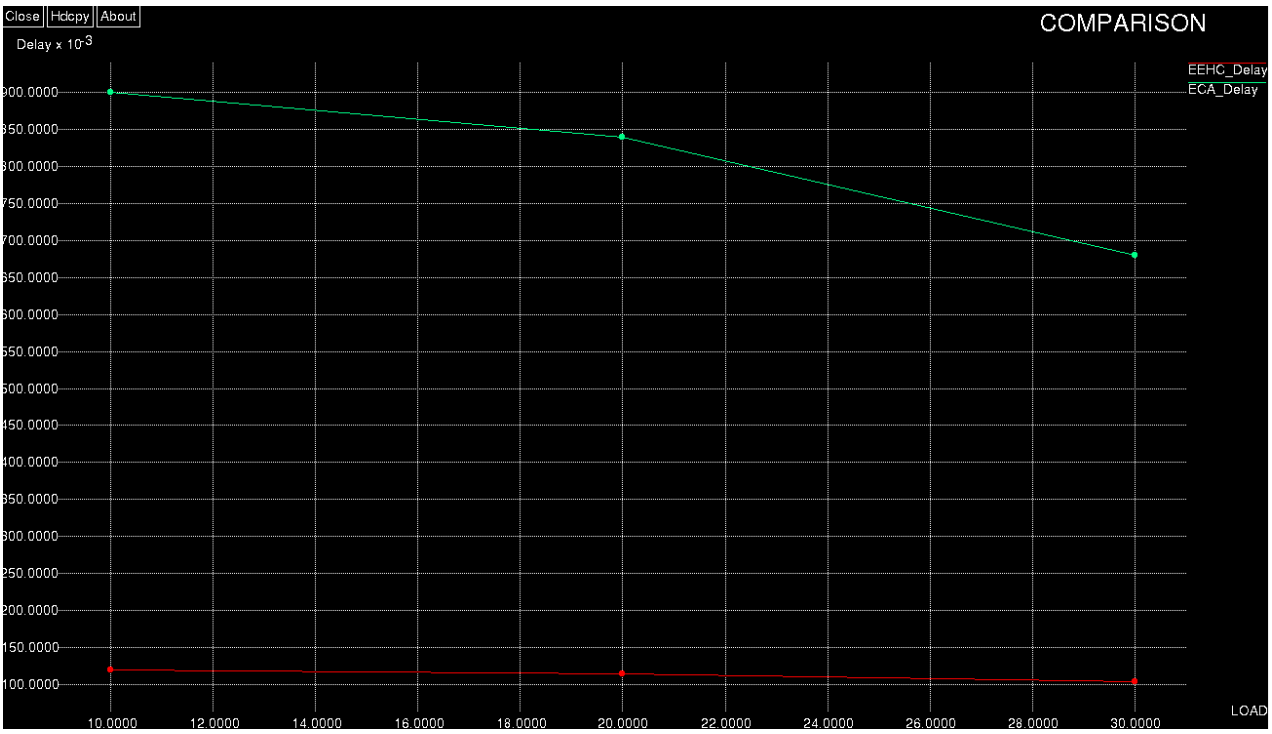


Figure 6: Delay Graph for EEHC v/s ECA

Throughput: Throughput is a rate of successful message delivery over a channel. Figure 7 indicates the simulation result of throughput using EEHC.

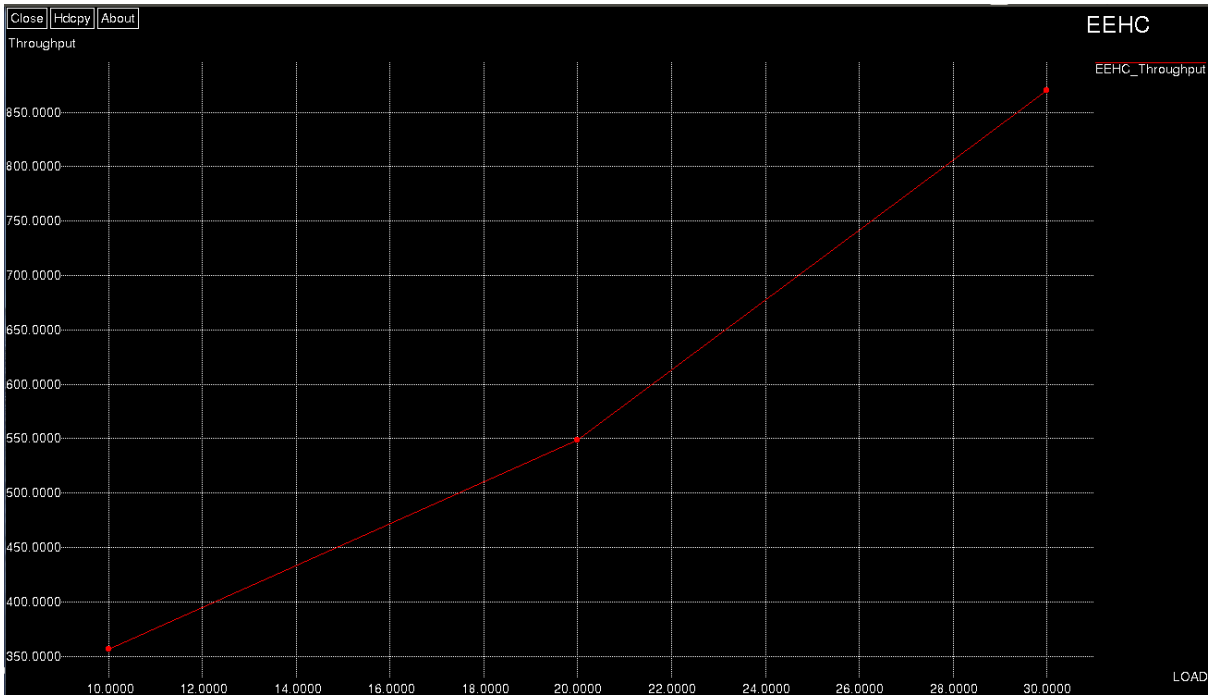


Figure 7: Throughput Graph for EEHC

Figure 8 indicates the simulation result of throughput for EEHC V/s ECA. By using ECA we are obtaining the efficient message delivery from BS to destination compared with EEHC.

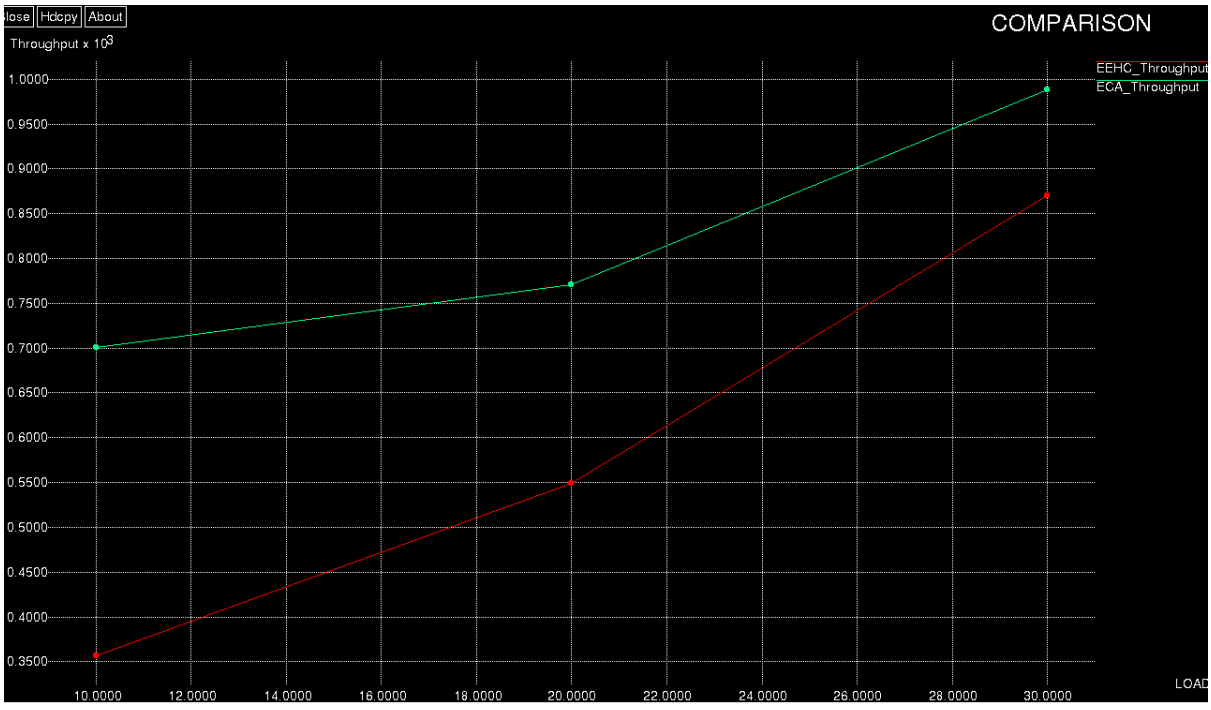


Figure 8: Throughput Graph for EEHC v/s ECA

Software and Simulators used: Here, we are using Ubuntu software program and ns simulator and Net Animator for results. Ubuntu (pronounced oo-BOON-too) is an open source Debian-based Linux distribution. Sponsored with the aid of Canonical Ltd., Ubuntu is taken into consideration an awesome distribution for beginners. The operating device was intended frequently for non-public computer systems (PCs) however it could additionally be used on servers.

Ns (from network simulator) are a call for a chain of discrete event community simulators, especially ns-2 ns-3. All of them are discrete-event computer community simulators, often utilized in inquiry and training.

5. CONCLUSION

In this paper, we proposed efficient clustering protocol in wireless sensor networks. The key concept in the back of this set of rules is to resourcefully split the sensory community into four partitions symmetrical about a centric node [18]. Furthermore, a set of cluster heads in the middle of every partition are described so that it will aggregate facts from cluster individuals and transmit those facts to cluster heads inside the subsequent hierarchical stage. This algorithm adopts the idea of hierarchical clustering which prevents cluster heads from sending their statistics for long distances and as a result the strength consumption of the sensor nodes is notably advanced. This set of rules focused on avoiding the overhead of dynamic clustering, lowering the transmission route among sensor nodes and cluster head nodes, and minimizing the direct communiqué among the sink node and cluster heads. Simulation consequences confirmed that the proposed algorithm completed higher overall performance in assessment between the EEHC and ECA algorithms which affords low Delay time and excessive Throughput.

REFERENCES

[1] Srbija, Beograd, November 23.-25., 2010, Single-hop vs. Multi-hop – Energy efficiency analysis in wireless sensor networks.

[2] Oliver Stecklina and Peter Langendoerfer, Christian Goltz "A Fair Energy Trade Multi-Hop Routing in Wireless Sensor Networks" IEEE 2013

[3] Gagandeep kaur, "A Survey on an Energy Efficient Routing Algorithms to Improve Performance & to Reduce Energy Consumption in Wireless Sensor Networks", IJCSC Volume 5, March 2014.

[4] Chen, Tseng-Yi, et al,"Energy Efficient Geographic Routing Algorithms in Wireless Sensor Networks" Journal of Interconnection Networks 14.01(2013).

[5] Gagandeep kaur, "A Survey on an energy Efficient Routing Algorithms to Improve Performance & to Reduce Energy Consumption in Wireless Sensor Networks" Volume 5 • Number 1 March 2014.

[6] A. E. A. A. Abdulla, H. Nishiyama, and N. Kato, "Extending the lifetime of wireless sensor networks: a hybrid routing algorithm," Computer Communications Journal, Vol. 35, No. 9, pp. 1056–1063, 2012. · ·

[7] B. Nazir and H. Hasbullah, "Energy efficient and QoS aware routing protocol for Clustered Wireless Sensor Network," Computers and Electrical Engineering, Vol. 39, No. 8, pp. 2425–2441, 2013.

[8] Puneet Gurbani, Hansa Acharya, Hierarchical Cluster Based Energy Efficient Routing Protocol for Wireless Sensor Networks Vol. 7 (2), 2016, 682-687.

[9] Seongsoo Jang; Ho-Yeon Kim; Nam-Uk Kim; Tai-Myoung Chung, "Energy-Efficient Clustering scheme with Concentric Hierarchy," RF and Microwave Conference (RFM), 2011 IEEE International, vol., no., pp.79,82, 12-14 Dec. 2011.

[10] Begum, Nithya and Prasanth "Energy Efficient Hierarchical Cluster Based Routing Algorithm in WSN: A Survey", International Journal for Innovative Research in Science and Technology, Vol. 1, Issue 7,261 – 266, December 2014.

[11] Abolfazli and Mahdavi "A Homogeneous Wireless Sensor Network Routing Algorithm: An Energy Aware Cluster Based Approach", IEEE, 2014

[12] D. Wei, Y. Jin, S. Vural, K. Moessner, and R. Tafazolli., An Energy-efficient Clustering Solution for Wireless Sensor Networks IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS, SEPTEMBER, 2011

[13] Mundada, Kiran, Khorana, Varsha and George, "A Study on Energy Efficient Routing Protocols in Wireless Sensor Networks", International Journal of Distributed and Parallel Systems, Vol. Three, No.3, 311 – 330, May 2012,

[14] G. Ran, H. Zhang and S. Gong. 2010. Improving on LEACH protocol of Wireless Sensor Networks Using Fuzzy Logic. Journal of Information and Computational Science. pp. 767-775.

[15] R. S. Bhadoria and D. G. Chandra, "Routing protocol in Wireless Sensor Networks," in Proceedings of the 2nd IEEE Conference on Parallel Distributed and Grid Computing, Vol. 35, No. 1, pp. 128–140, February 2012.

[16] C. Cirstea, "Energy Efficient Routing Protocols for Wireless Sensor Networks: A Survey," 17th IEEE International Symposium For Design and Technology in Electronic Packaging (SITTME), Aurelia, Romania, Nov. 2011

[17] Nikolidakis, Kandris, Vergados and Douligeris "Energy Efficient Routing in Wireless Sensor Networks through Balanced Clustering", Journal of Algorithms, 29 – 42, January 2013 [1999 - 4893]

[18] Abdullah I. Alhasanat, Ahmad Ali Alhasanat, Khitam M. Alatoun, Aws AlQaisi4 Data Gathering in Wireless Sensor Networks Using Intermediate Nodes Vol.7, No.1, January 2015.