Enhanced Energy-Efficient Heterogeneous Routing Protocols in Wsns for IOT Application

Arun Kumar Rana, Sharad Sharma

Abstract- Bunch specific transducers of Wireless sensor networks (WSN) that give detecting administrations to the Internet of Things gadgets with constrained vitality and capacity assets. Because substitution or energizing of battery in tiny sensor nodes is practically incomprehensible, control utilization winds up one of the critical structure issues in WSN for the future, we proposed a crossbreed directing convention: Advanced Zone-Stable Election Protocol (AZ-SEP) with nature of heterogeneous WSNs for IoT situations. In this convention, a few nodes transmit information legitimately to the base station while some utilization the bunching method to send information to the base station. We actualized AZ-SEP and contrasted it and the customary Low Energy adaptive clustering hierarchy (LEACH). Recreation results demonstrated that Z-SEP improved the steadiness time frame and throughput than existing conventions like LEACH. The proposed AZ-SEP convention outflanks when contrasted with the current LEACH convention with a 64% ascent in better output in the form throughput and broadening the quantity of alive tiny nodes to 2702 rounds which can be utilized to improve the IoT lifetime. At the point when contrasted and other vitality productive conventions, it is discovered that the proposed calculation performs better as far as dependability period and system lifetime in various situations of region, vitality and node density. Thus our simulation result will show enhanced energy, throughput with data aggregation

Keywords- AZ-SEP, WSN, IoT, LEACH, Throughput, Energy efficient, heterogeneous protocol.

I. INTRODUCTION

The Internet of Things (IoT) is easily moving from an Internet of individuals towards an Internet of Things. As per Cisco, 50 billion things will be associated with the Internet in 2020, consequently dominating the information created by people. This is constrained by the birth rate: in 2020, it is relied upon to have 8 billion individuals around the world. The things to be associated with the Internet to a great extent fluctuate regarding qualities. In the up and coming Internet of Things (IoT), the ordinary articles that encompass us will wind up proactive entertainers of the Internet, creating and expending data. The components of the IoT involve not just those gadgets that are as of now profoundly established in the mechanical world, (for example, vehicles or ice chests), yet in addition objects unfamiliar to this condition (articles of clothing or transitory nourishment), or notwithstanding living creatures (ranches, woods or domesticated animals). Figure 1 shows the evolution of IoT scenario.

Revised Manuscript Received on October 30, 2019.
* Correspondence Author
Mr Arun Kumar Rana*, PhD scholar at MMEC MULLANA, Haryana India.
Dr. Sharad Sharma, Professor at MMEC MULLANA, Haryana India.

By installing computational capacities in a wide range of items and living creatures, it will be conceivable to give a subjective and quantitative jump in a few parts: human services, coordination and amusement, etc. Associating whatever checked or guarded from the web is known as the Internet of Things. Remote is the good favoured medium to accomplish this wide scope of the network. Wireless sensor networks can be depicted as the gathering of huge tiny sensor nodes sent over a huge zone to detect and collect different information from the earth and frameworks for various uses, for example, climate checking, creature following, fiasco the board, bio-medicinal uses and furthermore in the domain of IoT [1, 2]. Henceforth WSN can be viewed as one of the necessary pieces of IoT uses [3]. The MEMS that is Micro-Electro-Mechanical System sensor innovation has been very accommodating in creating shrewd sensors for IoT application those utilizations modest brilliant tiny sensor nodes with restricted power and calculation assets [4]. Wireless sensor networks go for a virtual layer and have turned into an inherent piece of IoT in a protected way. Be that as it may, to do as such, it needs to be at different difficulties, for example, security, joining issues, vitality improvement, organize lifetime, etc. The IoT [5] in a wide sense be similar to a mind that can both store certifiable information and can likewise be utilized to screen these present reality parameters, settle on important translation and even settle on choices dependent on the detected information.. WSN [6] look like the ears and eyes of the IoT. The extension associates this present reality to the computerized world. In addition, it is likewise in charge of passing on the detected true qualities to the Internet. The extraction of valuable data from an immense measure of information requires high handling and calculation to be implemented at the tiny sensor nodes that are tiny battery-driven gadgets with constrained power. Henceforth WSN has a few confinements as far as power, computational ability, etc, which should be streamlined [7]. Then again, IoT interfaces countless gadgets that gather metadata for handling. This again will prompt an abundance utilization of accessible power and will at the same time influence the system's lifetime. So as to expand the system lifetime in WSN, the ways for directing the information bundles must be chosen in such a way, that the vitality devoured in an all-out way can be limited. Despite the fact that most WSN conventions were not intended for two-way interchanges, they ought to likewise have the option to get data and send it to the sensors (as a type of order for example), and respond in the interest of the officer/client, e.g., computerizing home machines. The staying of this paper is as per the following. Section II audits the related work about low-vitality versatile grouping chain of importance (LEACH) and different successors of LEACH convention.

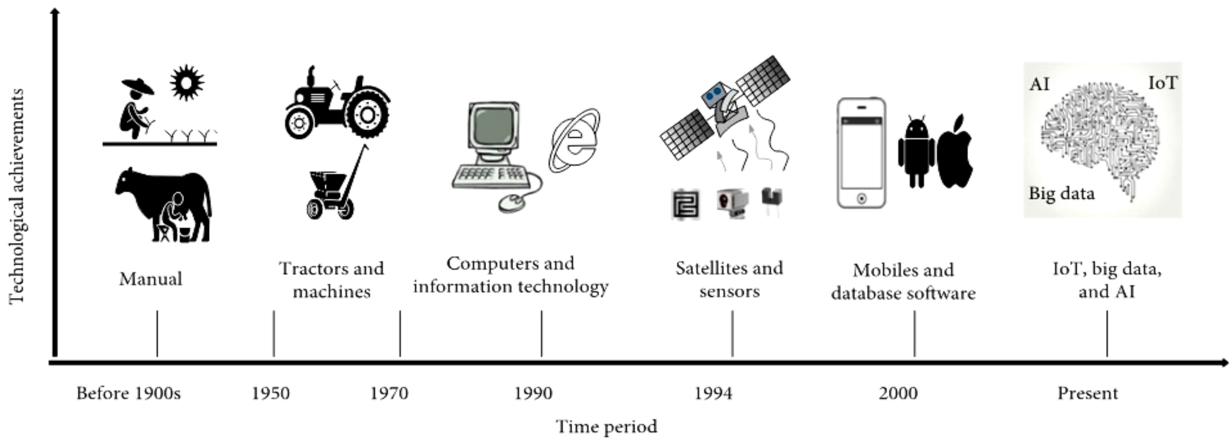

Figure.1. Evolution Of Different Technologies In IoT. [24]

And III introduce our framework model. Segment IV portrays our proposed plan in detail. Segment V speaks to the re-enactment results with simulation in Matlab.

II. RELATED WORK

IoT is another Internet worldview dependent on the way that there will be a lot a bigger number of things than people associated with the Internet. This implies machines/things will have the option to impart self-sufficiently without the need to interface with people, in this way rendering them into turning into the real substance producing information on the Internet. One of the significant issues of sensors that will be conveyed, as far as the expense of adjusting and upkeep [8]. Further supplanting tiny sensor backup which is now situated inside the system scope can be a dreary activity [9]. This prompts another significant test which is to control the board. Solid start to finish information transmission with appropriate blockage control and low parcel misfortune proportion is a portion of the other real worries in WSN [10]. The essential objective of any tiny sensor system is to course the information amassed by sensors and forwards it towards the sink. The least difficult technique to impart information is immediately forwarded where the nodes need to guide their information to the sink tiny node. Be that as it may, if the separation between the sink and system is huge, the tiny node will cease to exist rapidly because of pointless vitality utilization [11]. The bunching calculation diminishes the undesirable power utilization in conveying information to BS by gathering the system into groups. Each bunch is relegated a cluster head that sends information to the sink. A significant stage in the bunching calculation is the cluster head political race to ensure perfect vitality appropriation by nodes [12]. Filter convention has seriously been changed by scientists to improve organize execution. Specialized analysts are contributing enthusiastically in improving obtainable calculations for better execution of the Internet of Things framework [13]. A vitality proficient trust inference strategy was talked about in [14] for WSN-based IoT systems. A time-sensitive cluster head determination an is proposed in [15] known TB-LEACH that locate well-disseminated bunches and improves the duration by 20 to 30%. Another cluster head determination strategy for collection of information is talked about in [16] that wipes out repetition and upgrades the system lifetime. The edge worth is altered by in view of a warmth factor that characterizes the overall warmth of a specific sensor tiny node to that of the system. the cluster head is chosen to utilize for particle swarm modeling (PSM) in [17]. Particle swarm modeling -ECHS is talked about in [18], where PSO based CH determination is made utilizing parameters like tiny node to-tiny node separation, separation to BS and lingering vitality. Another advancement strategy known as Grouped Gray Wolf Search Optimization is utilized in [19] for safety-mindful CH choice to improve the system's lifetime. An enhancement of LEACH was planned in [20] where leftover vitality assumes a significant job in the CH political decision. A straightforward Multi-jump way to deal with LEACH was additionally examined, and it is discovered that the two conventions perform superior to LEACH by expanding lifetime after a specific timeframe. For the efficiency enhancement, no probabilistic multi-criteria based cluster head choice was exhibited in [21] in which the system is isolated into discrete zones. The CH or zone head is chosen utilizing the ANP (Analytical Network Process) choice instrument. A lot of parameters have been gathered from where the best parameters have been chosen for zone head choice. The IoT, being a pervasive system, associates shrewd gadgets and items to the cloud. WSN gives a stage to the gathering and correspondence of information to screen and direct the world for the advancement of society [22]. Bearing in mind the LEACH gathering [9] as a key calculation, numerous changes have been done dependent on various applications. A point by point overview of LEACH and its successors are appeared in [10] considering four significant parameters, for example, grouping technique, information accumulation, portability type, and adaptability. The LEACH convention arbitrarily chooses cluster head and no data about the remaining vitality of the system is known to the sink. Conveying remote innovations depletes more power when contrasted with the gadgets intended to get or sit inactively. The rising number of savvy gadgets associating with the web has made vitality protection a surplus parameter in IoT planning. Creating vitality productive systems for the sending of sensor systems has consistently been a difficult assignment for analysts.

Retrieval Number: A1342109119/2019©BEIESP
DOI: 10.35940/ijeat.A1342.109119
Journal Website: www.ijeat.org

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

At the point when fused with IoT, control turns into an increasingly urgent issue inferable from the number of gadgets being associated with a huge scale. To keep up IoT guidelines, specialists have focussed on gadget vitality moderating systems, for example, grouping where the decision of cluster head ought to be done reasonably. Different strategies for productive cluster head determination were contemplated from the above writing that upgrades arrange execution. Be that as it may, significant parameters like leftover vitality, introductory vitality and an ideal number of bunches in the system, have not been considered as far as we could possibly know for alteration in the edge an incentive for CH determination. Aside from being a key and different convention, LEACH additionally has a few impediments. The choice of cluster head (CH) is done haphazardly, thus a tiny node with higher vitality and low vitality has a similar likelihood of turning into a CH. In the event that a tiny node with low vitality is chosen as CH, it will bite the dust rapidly influencing the heartiness of the system. Additionally, the position and number of CHs shift in each round.

III. IOT SYSTEM MODEL

In new IoT system model LEACH is perfect homogeneous an adaptive clustering routing protocol projected by amazing man Wendi B.Heinzelman, et al. Usage procedure of LEACH incorporates numerous rounds. Each round has an arrangement stage and the unfaltering information transmission stage. In the set-up stage, the group head nodes are haphazardly chosen from all the smart tiny sensor nodes and a few bunches are built powerfully. LEACH is a low vitality convention that may adjust grouping. In bunch based convention that uses the idea for randomized turn of nearby group heads and conveys the vitality load uniformly among all the sensor nodes in the detecting field of the system.

A. Characteristics of LEACH:

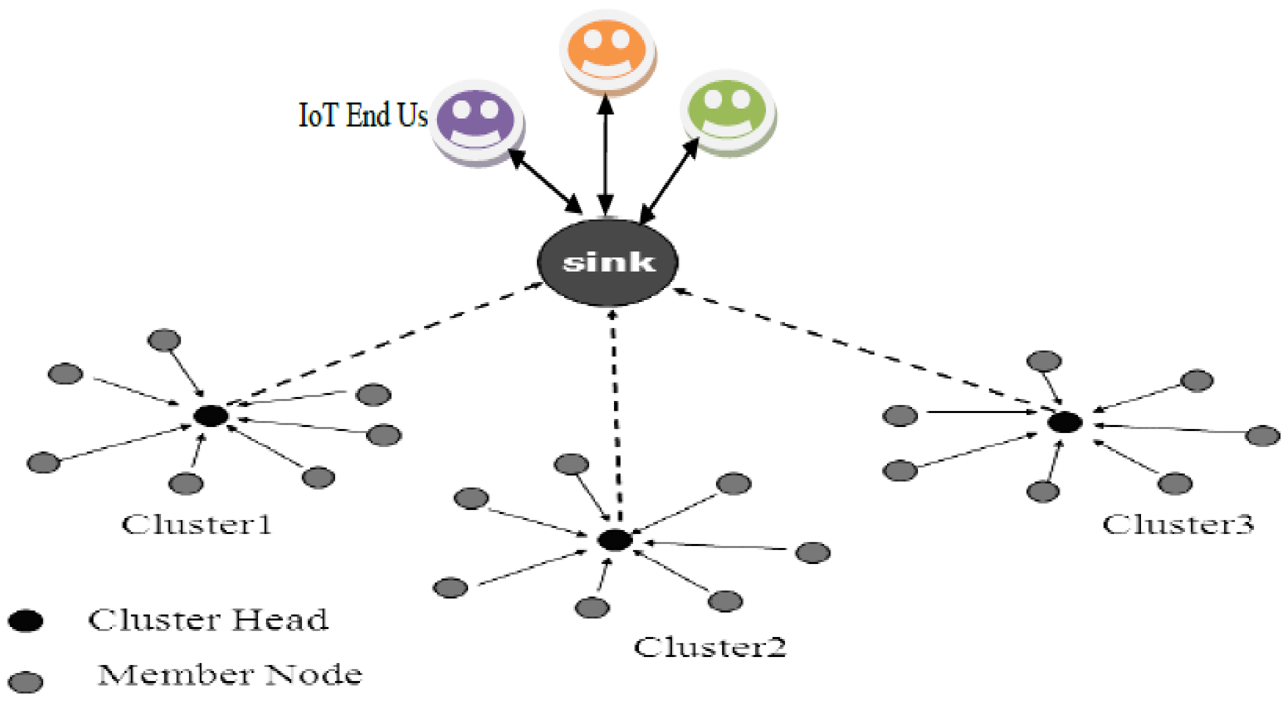

Figure.2. CH selection in IoT scenario for LEACH process with WSN process.

- Set up of clusters through local collaboration and control.
- To decrease the Data total in system traffic
- Local pressure to downsize world correspondence.
- The randomized pivot of the group heads and furthermore the comparing bunches.
- Random Death of nodes

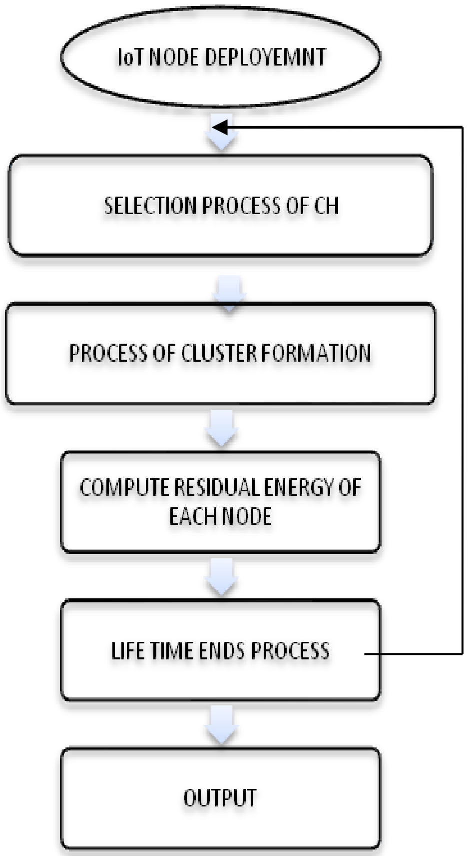

Figure.3. Flowchart for CH selection in LEACH protocol.

B. Suppositions of LEACH:

- All nodes are comparable with regards to introductory vitality.
- All nodes utilize Omni-directional receiving antenna
- BS is fixed and is far off from WSN

With each round, the CH changes dependent on the choosing likelihood which demonstrates that every one of the tiny IoT nodes in the bunch has a similar opportunity to be chosen as CH regardless of its lingering vitality [23]. Equi-plausible CH political decision procedure offers to ascend to the plausibility of choosing a CH with negligible leftover vitality which will vanish rapidly when contrasted with the one with near higher vitality level.

Accordingly, the remaining vitality of every tiny node is incorporated into the condition of the political race likelihood of CH to such an extent that the tiny IoT nodes with higher vitality levels have a more noteworthy opportunity to be chosen as CH. This consequently guarantees equivalent dissemination of intensity in the system therefore upgrading system lifetime. So as to battle this issue, a propelled calculation is proposed called AZ-SEP that is clarified next section.

$$T(n)=\begin{cases}\frac{p}{1-P\left(r \bmod \frac{1}{p}\right)} & ;\, for\ all\ n\ U\ G \\ 0; & otherwise\end{cases} \qquad (1)$$

In this framework, LEACH is a basic single-bounce bunching convention that secures a gigantic measure of vitality when contrasted with no grouping calculations [26]. When the tiny IoT nodes are sorted out, the sensors gathering made to frame groups with one CH in each bunch for information conglomeration with the utilization of condition 1. The convention is actualized in rounds. In this procedure, Clusters are shaped progressively and the group heads are chosen haphazardly [24]. In this to be chosen as CH every tiny node in the bunch has an equivalent likelihood that expects to adjust the vitality scattering. The leftover vitality is tried continually by the base until the lifetime closes, for example, all beyond words their battery control. The means required for each round in LEACH is portrayed in the flowchart given in Figure 3.

IV. PROPOSED MODEL FOR NEW IOT SYSTEM

In our new IoT scenario first zone formation established as shown in figure 3 then CH selection process start in zone 1 and zone 2 and after formation of CH then data forwased to the base station. Proposed protocol is enhancement of LEACH and everyone know LEACH is homogeneous protocol and our proposed approach is heterogeneous that is used first time in IoT scenario.

Directing conventions, nodes are conveyed haphazardly in the system field and the vitality of nodes in a system isn't used productively. We altered this subject: the system field is isolated into three zones: IoT zone 0, IoT Head zone 1 and IoT Head zone 2, based on vitality levels and Y co-ordinate of a system field.

We accept that a small amount of the all-out nodes is furnished with more vitality. Give m a chance to be a small amount of the all-out nodes n, which are furnished with α time more vitality than different nodes. We allude these nodes as development nodes, (1-m)×n are ordinary nodes.

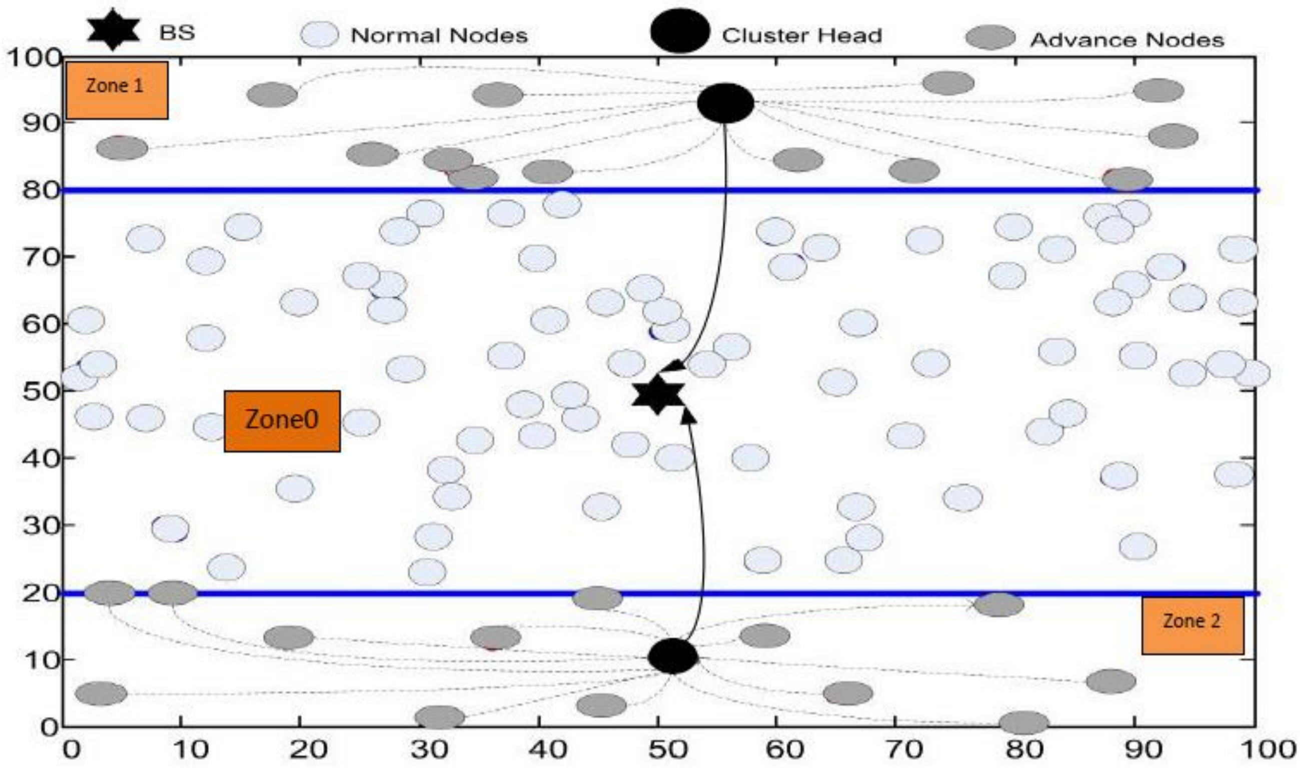

Figure.4. Network architecture with CH formation and data send to base station BS

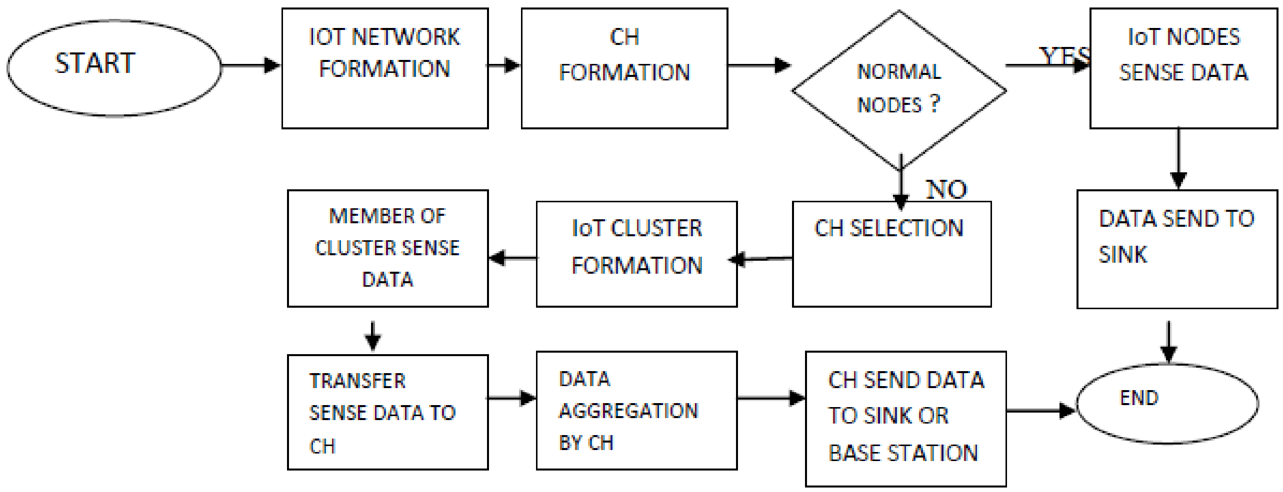

Figure.5. Flowchart of AZ-SEP enhanced protocol with new IoT system

- between 20<Y<=80 As shown in fig. 4 for normal nodes Zone 0: Normal nodes are sent haphazardly in Zone 0
- between 80<Y<=100 For advance node CH zone 1: Half of the development nodes are sent haphazardly in this zone,
- lying between 0<Y<=20 For advance node CH zone 2: Half of the development nodes are sent haphazardly in Head Zone 2,.The reason behind this type of deployment is that advance nodes have high energy than normal nodes.

And the probability for advanced node Pa is

$$Pa=\frac{Po}{1+(\alpha \times m)} \times (1+\alpha) \qquad (2)$$

And now calculation of threshold for advanced nodes Pa is

$$T(advanced) = \begin{cases} \frac{Pa}{1-pa\left(r \times mod \frac{1}{Pa}\right)} & \text{if } adv \in G \\ 0 & otherwise \end{cases}$$

(3)

As corners are most distant places in the field, so if a node is at corner then it requires more energy to communicate with base station so we have deployed high energy nodes (advance nodes) in Head zone 1 and Head zone 2.

V. SIMULATION RESULT AND DISCUSSION

A sensor system is viewed as where 100 tiny IoT nodes are conveyed as appeared in Fig. 4. The sink is situated at the inside with boundless vitality.

The ordinary sensor tiny IoT nodes have constrained vitality. Reenactment is directed utilizing MATLAB for 3000 rounds of emphases to acquire various plots. Consequently all through the reproduction, the examination is accomplished for various existing vitality proficient conventions with the proposed AZ-SEP convention by dismissing the vitality related to the overheads for every parcel. Reproduction results obviously demonstrate that AZ-SEP outflanks LEACH convention under various measurements, for example, lingering vitality, throughput, organize lifetime and CH tally.

In this segment, we think about the aftereffects of our convention AZ-SEP with LEACH. We have presented heterogeneity in LEACH, with a similar setting as in our proposed convention, to get to the exhibition of all the convention within the sight of heterogeneity. Our objectives in directing a recreation to analyze the soundness time of LEACH and AZ-SEP and a system lifetime of LEACH and AZ-SEP. Fig.6 fig.7 and fig.8 show recreation result in MATLAB for the situation when m=0.1 and α=2. We have an aggregate of 10 development tiny IoT nodes in the field, 5 tiny IoT nodes in Head propelled zone 1 and 5 tiny IoT nodes in Head propelled zone 2. Anyway there vitality is expanded for example α=2. Fig.5 exhibits the quantity of alive tiny IoT nodes against rounds. Fig.5 unquestionably exhibits that our show AZ-SEP is improved from LEACH similar to adequacy. As LEACH is incredibly sensitive to heterogeneity so amazing a snappier rate. AZ-SEP performs better than LEACH, since tiny IoT nodes in Advanced zone 0 (normal tiny IoT nodes) bestows genuinely to base station while tiny IoT nodes in head propelled zone 1 and head propelled zone 2 passes on by methods for pack head to base station: As in gathering strategy, bunch head exhausts imperativeness as data accumulation and moreover by getting data from tiny IoT nodes in the gathering. So this essentialness is proportioned in conventional tiny IoT nodes as they don't have to add up to data and get data from various tiny IoT nodes , so imperativeness isn't spread as that of the gathering head, coming about the extension of security period. In Fig.5, we can see that the framework lifetime is furthermore developed record of the advancement little hub. Advance tiny IoT nodes have α time more essentialness than regular tiny IoT nodes so advance tiny IoT nodes kick the can later than standard tiny IoT nodes . So this extends the trickiness time span.

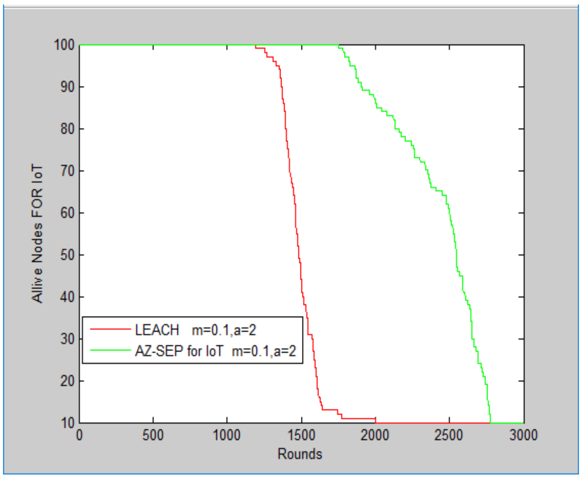

Figure.6. average residual energy for alive node in IoT LEACH and AZ-SEP

The recreation result in Fig.6 demonstrates the normal remaining vitality with system life for both the LEACH and AZ-SEP conventions. As appeared in figure The remaining vitality channel quicker in LEACH than that of AZ-SEP. The principle little hub for LEACH evaporates at 2000 round however for AZ-SEP it is at 2702 rounds. Since the vitality for changed LEACH exhausts at a moderate rate, the system lifetime additionally reaches out to increasingly number of rounds.

Drain convention accept CHs disperses a similar vitality for each round that prompts wasteful CH determination and influences the system life expectancy. AZ-SEP chooses CHs considering the leftover vitality of nodes and an ideal number of groups together in this manner improving the system lifetime to more adjust. The quantity of genuine information bundles sent to the sink is indicated inFig.4. Since the CHs are chosen dependent on the rest of the vitality of every tiny node, it adequately lessens the vitality dissemination in moving information. Thus, information transmission recurrence increments and more parcels are effectively transmitted to the BS when contrasted with that in LEACH convention.

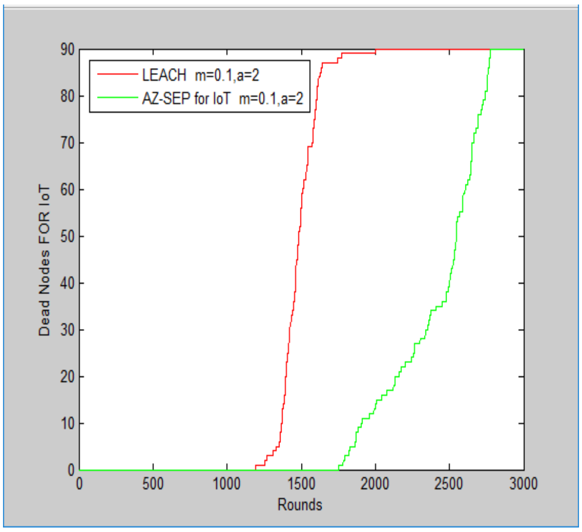

Figure.7. Dead node in LEACH and AZ-SEP (for network life time)

The normal vitality use of the system is appeared in Fig. 7 with Dead node in LEACH and AZ-SEP (for network life time).as the scenario shown in fig.7 The first tiny node for our protocol LEACH dies out at 1190 round while for AZ-SEP it is at 2012 rounds. Similarly, the last node for LEACH dies out at 1580 rounds while for AZ-SEP it is at 2701 rounds. The leftover vitality drains quicker in LEACH than that of AZ-SEP. Since the vitality for changed LEACH drains at a moderate rate, the system lifetime additionally reaches out to progressively number of rounds. Throughput speaks to the proportion between really transmitted information parcels to the effectively got information at BS or sink. The higher the proportion, the better is the exhibition. Fig. 8 demonstrates the diagram of the throughput which is calculated with packet to BS, of the two conventions in which throughput of LEACH is 2.45×10^4 and for AZ-SEP this is 2.49×10^5.

Plainly because of the adjustment in the edge estimation of CH determination, the throughput is expanded by 64% for AZ-SEP. Henceforth, it tends to be reasoned

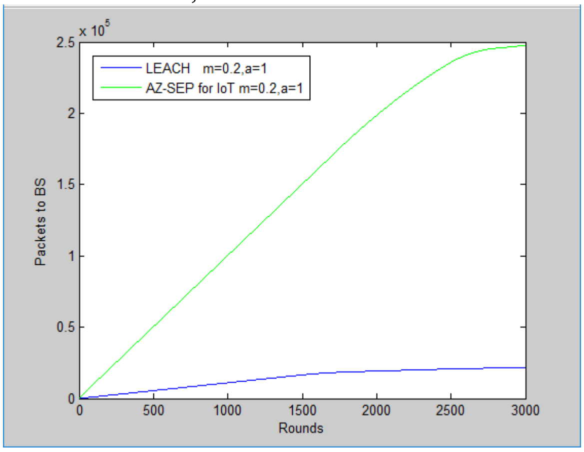

Figure 8 Throghput Of LEACH And AZ-SEP

that the altered convention performs superior to the LEACH convention and can be utilized broadly for homogeneous systems.

VI. CONCLUSION

Since its reality in the realm of WSN, LEACH protocol still picks up consideration among specialists which itself demonstrates the significance of the convention. Various relatives of LEACH have likewise been centered on different applications. In this paper, we altered the convention dependent on proficient CH choice with synchronous exchanging of various power levels Results have demonstrated that the steadiness period is expanded by roughly 64% with AZ-SEP, by simply changing the arrangement of the various kinds of tiny IoT nodes in various advanced zones as per their vitality prerequisite. The throughput of AZ-SEP is very much expanded analogized with LEACH. Thus our new transmission control protocol AZ-SEP develop new approaches for providing energy efficiency, longer lifetime for IoT scenario and this work can also extended with more numbers of rounds in future.

REFERENCES

1. Yick, J., Mukherjee, B., Ghosal, D.: 'Wireless sensor network survey', Comput. Netw., 52, (12), pp. 2292–2330, 2008.
2. Kim, D.S., Chung, Y.J.: 'Self-organization routing protocol supporting mobile nodes for wireless sensor network'. First Int. Multi-Symp. on Computer and Computational Sciences, IMSCCS '06, Hanzhou, Zhejiang, China, vol. 2, pp. 622–626,2006
3. Akyildiz, I.F., Su, W., Sankarasubramaniam, Y., et al.: 'Wireless sensor networks: a survey', Comput. Netw., 38, (4), pp. 393–422,2002.
4. Kumar, V., Jain, S., Tiwari, S., et al.: 'Energy efficient clustering algorithms in wireless sensor networks: a survey', Int. J. Comput. Sci. Issues, 2011, 8, (5), pp. 814–1694, 2011.
5. Zorzi, M., Gluhak, A., Lange, S., et al.: 'From today's intranet of things to a future internet of things: a wireless-and mobility-related view', IEEE Wirel. Commun., 2010, 17, (6), pp. 44–51, 2010.
6. Gubbi, J., Buyya, R., Marusic, S., et al.: 'Internet of things (IoT): a vision, architectural elements, and future directions', Future Gener. Comput. Syst., 29, (7), pp. 1645–1660, 2013.
7. Padmavathi, D.G., Shanmugapriya, M., et al.: 'A survey of attacks, security mechanisms and challenges in wireless sensor networks', arXiv preprintarXiv:09090576, 2009.
8. Y.-K. Chen, "Challenges and opportunities of the internet of things," in 17th Asia and South Pacific Design Automation Conference, pp. 383–388, 2012.
9. A. Ali, Y. Ming, T. Si, S. Iram, and S. Chakraborty, "Enhancement of RWSN Lifetime via Firework Clustering Algorithm Validated by ANN," Information, vol. 9, no. 3, p. 60, 2018.
10. C. Wang, K. Sohraby, B. Li, M. Daneshmand, and Y. Hu, "A survey of transport protocols for wireless sensor networks," IEEE Netw., vol. 20, no. 3, pp. 34–40, 2006.
11. M. C. M. Thein and T. Thein, "An energy efficient cluster-head selection for wireless sensor networks," in Intelligent systems, modelling and simulation (ISMS), 2010 international conference on, 2010, pp.287–291.
12. S. H. Kang and T. Nguyen, "Distance based thresholds for cluster head selection in wireless sensor networks," IEEE Commun. Lett., vol. 16, no. 9, pp. 1396–1399, 2012.
13. J. A. Stankovic, "Research directions for the internet of things," IEEE Internet Things J., vol. 1, no. 1, pp. 3–9, 2014.
14. J. Duan, D. Gao, D. Yang, C. H. Foh, and H.-H. Chen, "An energyaware trust derivation scheme with game theoretic approach in wireless sensor networks for IoT applications," IEEE Internet Things J., vol. 1, no. 1, pp. 58–69, 2014.
15. H. Junping, J. Yuhui, and D. Liang, "A time-based cluster-head selection algorithm for LEACH," in Computers and Communications, 2008. ISCC 2008. IEEE Symposium on, 2008, pp. 1172–1176.
16. K. Maraiya, K. Kant, and N. Gupta, "Efficient cluster head selection scheme for data aggregation in wireless sensor network," Int. J. Comput. Appl., vol. 23, no. 9, pp. 10–18, 2011.
17. [20] B. Singh and D. K. Lobiyal, "A novel energy-aware cluster head selection based on particle swarm optimization for wireless sensor networks," Human-Centric Comput. Inf. Sci., vol. 2, no. 1, p. 13, 2012.
18. P. C. S. Rao, P. K. Jana, and H. Banka, "A particle swarm optimization based energy efficient cluster head selection algorithm for wireless sensor networks," Wirel. networks, vol. 23, no. 7, pp. 2005–2020, 2017.
19. A. Shankar, N. Jaisankar, M. S. Khan, R. Patan, and B. Balamurugan, "Hybrid model for security-aware cluster head selection in wireless sensor networks," IET Wirel. Sens. Syst., 2018.
20. F. Xiangning and S. Yulin, "Improvement on LEACH protocol of wireless sensor network," in Sensor Technologies and Applications, International Conference pp. 260– 264,2007.
21. H. Farman et al., "Multi-criteria based advanced zone head selection in Internet of Things based wireless sensor networks," Futur. Gener. Comput. Syst., 2018.
22. S. Kallam, R. B. Madda, C.-Y. Chen, R. Patan, and D. Cheelu, "Low energy-aware communication process in IoT using the green computing approach," IET Networks, vol. 7, no. 4, pp. 258–264, 2017.
23. Trupti Mayee Behera, Sushanta Kumar Mohapatra, Umesh Chandra Samal, Mohammad. S. Khan, Mahmoud Daneshmand, and Amir H. Gandomi, "Residual Energy Based Cluster-head Selection in WSNs for IoT Application", IEEE Internet of Things Journal, Volume: 6 , Issue: 3 , June 2019.
24. B. Basnet and J. Bang, "The state-of-the-art of knowledge-intensive agriculture: A review on applied sensing systems and data analytics," Journal of Sensors, vol. 2018, 2018.
25. Trupti Mayee Behera , Umesh Chandra Samal , Sushanta Kumar Mohapatra,"Energy-efficient modified LEACH protocol for IoT application" IET Wireless Sensor Systems , Volume: 8 , Issue: 5 , 10 2018 .
26. Y. Li, N. Yu, W. Zhang, W. Zhao, X. You, and M. Daneshmand, "Enhancing the performance of LEACH protocol in wireless sensor networks," in Computer Communications Workshops (INFOCOM WKSHPS), IEEE Conference, pp. 223–228, 2011.

AUTHORS PROFILE

Mr Arun Kumar Rana has completed his B.tech degree from Kurukshetra University and M.Tech. Degree From MMEC MULLANA (HR). Mr Rana is currently pursuing his PhD from MMEC MULLANA University HARYANA. His area of interest includes Image Processing, WSN, IoT and Embedded System. Mr. Rana is currently working as Assistant Professor in PIET College Samalkha with more than 12 years of experience. He has published around 40 papers in National and International Journals and also in conferences. He has also published 4 books and many time member of Sci Scopus indexed international conference/symposium.

Dr. Sharad Sharma has a vast experience of more than 20 years of teaching and administrative work. He has received his B. Tech degree in Electronics Engineering from Nagpur University, Nagpur, India, M.Tech in Electronics and Communication Engineering from Thapar Institute of Engineering and Technology, Patiala, India and Ph.D. from National Institute of Technology, Kurukshetra, India. He has a teaching experience of more than 20 years. He has conducted many workshops on Soft Computing and its applications in engineering, Wireless Networks, Simulators etc. He has a keen interest in teaching and implementing the latest techniques related to wireless and mobile communications. He has opened up a student chapter of IEEE as Branch Counselor. His research interests are routing protocol design, performance evaluation and optimization for wireless mesh networks using nature inspired computing, Internet of Things and Space Communication etc. He is member of various professional bodies.

Retrieval Number: A1342109119/2019©BEIESP
DOI: 10.35940/ijeat.A1342.109119
Journal Website: www.ijeat.org

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication