

A New Method for Energy Saving on wireless sensor network based on Clustering Method

Ahmad Ayid Ahmad

Ali Ayid Ahmad

Ali Mahmood Humada

Kirkuk University
Kirkuk, Iraq

Kirkuk University
Kirkuk, Iraq

Ministry of Electricity
Salahaldin, Iraq

Abstract

In this paper we proposed a new clustering method for the saving of energy in overall the network. In proposed scenario we divided the area to 3 regions. At first region the sensors send directly their information to the BS with out any cluster head. In second region all sensors send their information to the cluster heads and these cluster heads send to the BS. At third region we selected the rechargeable nodes and these rechargeable nodes collect the informations and send to the BS. As shown in the simulation results we improved the life time of the sensors and we improved the packed size to sending to BS.

Keywords

Wireless Sensor Networks, Clustering, Energy Consumption.

1. INTRODUCTION

Wireless Sensor Networks (WSNs) are starting late made to reinforce a great deal of usages, which consolidate development control, home robotization, quick battle region, condition checking moreover, some more. WSN wires diverse sensors that are scattered around a particular center for achieving. In WSN, guiding is a fundamental task that will be dealt with meticulously. The basic premise, which is occupied with this paper, is about the coordinating tradition that adjustments in light of the application. The coordinating issue prompts lessened framework lifetime with extended imperativeness usage. Thusly, unique coordinating traditions have been delivered to restrain the imperativeness use and to grow the framework lifetime. The controlling traditions can be ordered in perspective of the nodes' participation, gathering traditions, technique for working and framework structure. The diverse challenges in coordinating join essentialness usage, center point plan, versatility, accessibility, scope, security [1].

A conventional remote sensor can accumulate information on the framework, in the district of interest, each decoding there are various circled sensors in the breaking point. These sensors assemble the information is sent to the base station. In a remote sensor sort out, the power supply units one of the main problems experienced in view of physical obstacles is compelled it is essentialness. With everything taken into account, if the

sensors are presented away or it is possible to change or invigorate it isn't. This prompts the need of using imperativeness beneficially it pulls. Remembering the true objective to use the sensor sources reasonably and successfully, the sensors and sensor stages must be managed. Acting normally dealing with, there is a necessity for an accuse tolerant, preferably working sensor structure. You request adversity, rebuilding and the number from helplessness of the amount of perfect sensors troublesome. Additionally, resource constraints, shaky development, data wealth, sort out components, this change is a result of prerequisites, for instance, essentialness alter, distinctive movement composes, divide it gets altogether harder. Along these lines, various examinations have been made with respect to this issue. In this work, remote sensor frameworks are used as a piece of a gathering of sensors that work in view of a base station keeping the ultimate objective to extend the life of the framework, a set number of sensors an estimation is proposed to be dynamic. Shannon information speculation consequently its effect on sensor life and extension are dissected and the effects of entropine it is best to save essentialness the most extraordinary entropy and the base number of running sensors entertainments were made.

With a particular ultimate objective to give information from each region, the domain is segregated from the doors and a sensor errand is performed on the structure at each work step it was centered around. The amount of dynamic sensors in each system is the total number of dynamic second sensors a probability is processed by parceling the total entropy using these probabilities it was found. The goal is to have a sensor impelled in each grid. It an edge probability is used as a piece of optmisis that is sent by the base to various sensors and remembering the true objective to extend the framework life, the amount of working sensors has been endeavored to be restricted, same the homogenous extension zone meanwhile with the most outrageous entropy described above It is given. The entropy is used for the general utilization of the sensor essentialness, ordinary imperativeness utilize is given. Gotten scope zone and framework lifetime depending upon the criteria: The amount of working sensors has been reduced however

much as could sensibly be normal and entropy is close to the best possible entropy regard [2]. The Sensor node architecture is shown in figure 1.

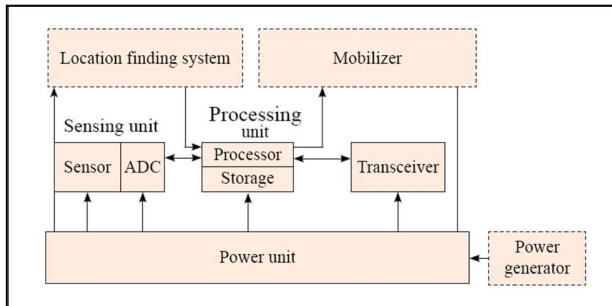


Figure 1. Sensor node architecture [3]

Remote sensor composes as a champion among the most basic advances of the 21 century it is described. Changes in remote advancement are essentially more affordable extreme littler scale sensors make it possible to make. A Wireless Sensor organize physical or biological conditions at different zones (temperature, sound, weight, development, sullyng, et cetera.) use sensors to screen with facilitated exertion, including scattered contraptions it is a framework. The enhancements in remote sensor frameworks started transcendently with military applications. In any case, nowadays, remote sensor sorts out in various zones, for example, regular discernments and live watching, social protection, home computerization and movement control it is used. Sensor frameworks information for astute conditions (structures, houses, industry) it's the catchphrase in the gathering. Each sensor data scattered over a specific region in these frameworks it can assemble and guide data to base station. Data base it is sent to the station through a multi-jump, non-establishment configuration, base correspondence by methods for the Internet or satellite with the sensors of the station and furthermore the Task Manager he can. The arrangement of sensor frameworks is influenced by various components; adjustment to inward disappointment, flexibility, the cost of creation, working condition, and sensor compose topology, gear goals, sensors like correspondences and power use. Sensor sorts out normally, radio recipients, transmitters or it involves distinctive remote particular gadgets and an essentialness source. Sensor estimations it can contrast from particle to shoe box, and the expenses are for this and the sensor. Four the capriciousness depends upon the need. Sensors long and esteem necessities, distinctive resources, for instance, essentialness, memory, tally speed, and transmission limit, are also unique. As an issue of first significance ask about on sensor frameworks (to check the ocean; channel enormous scale sound) little field sensors

for field target area moved. Of course, insignificant exertion sensors and correspondence orchestrates its embodiment has realized the progression of other potential applications. Potential sensor applications, running from military applications to biomedical applications the sensors can be set in places where life isn't possible. it can continue going for quite a while without restoring or supplanting the power supply. General remote sensor frameworks applications are for checking and controlling [4].

Abnormally, information blend is performed at application level. Information securing is including unmistakable flags and transmitting information as a solitary total. Regardless, information gathering is something like separating and plotting the principle information starting from all sensor nodes. Another to an incredible degree most likely comprehended class of frameworks for lifetime prolongation is gathering. The lead thought in bunching is gathering the sensor focus focuses relying on various criteria, as it were, all around that truly matters apportioning the topology into lattices. Clustering can give gigantic centrality hold finances particularly in high thickness systems [2].

My understanding point from another paper, remote sensor frameworks are an amassing of spatially coursed independent sensor nodes that casing into frameworks with the objective of distinguishing a particular or various physical wonders, for instance, weight, temperature, sound et cetera inside their range. Diverse employments of such a wsn organize are condition watching, untamed life count, pollution control, prosperity checking, military perception.

Amid the time spent data accumulation, pack heads in like manner performs data weight by taking out any data abundance caused due to distinguishing of constrained data by aggregate people [5]. The One-hop communication pattern for clustered wireless sensor networks is shown in figure 2.

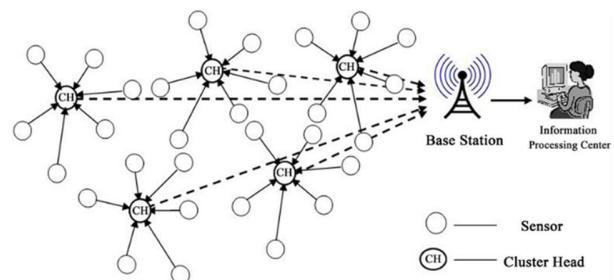


Figure 2. One-hop communication pattern for clustered wireless sensor networks [5].

2. ENERGY MODEL

In our work, it is assumed that the sensor nodes have processed the data. In this case, there are two situations we have wasted; a sensor node Spend a moment sending a sensor knob energy and a sensor node from other sensor nodes energy consumed while receiving data [6].

$$P_{tx\ ij} = \rho + \epsilon da\ ij \quad (1)$$

$$P_{rx} = \rho \quad (2)$$

$P_{tx\ ij}$: 1 bit data transmission from node i to node j
 P_{rx} : Energy consumed to get 1 bit of data
 ρ : Energy consumed in the hardware of the sensor node
 ϵ : The efficiency factor of the transceiver
 α : path loss factor
 $da\ ij$: distance between node i and node j

3. DATA FLOW MODEL

Our model is starting at now a limited movement orchestrate It has; that is, the sensor center point the other sensor is transmitted between the nodes, base station. This model transfer of missing parts of two sorts of models in decision strain. Sensor nodes in a model where the data is sent particularly to the base station as will be grasped from the essentialness indicate unreasonably of the division is too and the most remote sensors quickly eats up the energies, the sensor the created data is traded to the determined neighbors reliably, station, the base station Due to the data pile of adjoining nodes an extreme measure of imperativeness the total framework lifetime we examined They are condensed. Henceforth, every one of the sensor nodes talking with sensor center and base station their imperativeness use is balanced by being favored. With the sensor nodes 4, 3, 2 on the screen, base station is shown as 1 and i,j node fij as data flows. Our mathematical model is based on linear programming constraints [6].

The first restriction is that no data flow is negative it can not be. In the formula (3), via the sensor the amount of data passed is expressed by the equation. Second the energy transmitted by each sensor is unrestrained total energy collected from other sensors is equal to the difference in total energy. We are third party the total energy consumed by each sensor; i.e. data from spent energy and other sensors the sum of the energy consumed while accumulating, it will not be bigger than its own energy [6].

$$fij \geq 0 \quad (3)$$

$$\sum f_{ij} - \sum f_{ji} = sit \quad (4)$$

$$\left\{ \left[P_{rx} \left(\sum_j f_{ji} \right) + P_{txij} \left(\sum_j f_{ij} \right) \right] \right\} \leq e_i \quad (5)$$

fij : the data stream for the j stream

si : the number of bits produced at the time of the unit

ei : the energy of my duo

t : the life of the network

4. ENERGY CONSUMPTION MODEL

In this paper, the established vitality display as portrayed in LEACH is utilized. As is known, essential components influencing vitality utilization are the quantity of bits transmitted and the separation between the imparting sets. On the off chance that the separation between the imparting nodes is more noteworthy than the edge esteem, at that point the effect of the separation on the vitality utilization develops exponentially as shown in Eq. (1-3) [4].

$$Esnd(l,d) = Esnd-elec(l) + Esnd-amp(l,d) \quad (6)$$

$$Esnd(l,d) = (1 * Eelec) + (1 * \epsilon fs * d^2), d < d_0 \quad (7)$$

$$(1 * Eelec) + (1 * \epsilon mp * d^4), d \geq d_0 \quad (8)$$

Two or three structure lifetime definitions are proposed in the composed work . Some of them consider the time in which a specific measure of the nodes bomb frightfully. Another course of action to consider is the time after which there is a zone never again secured by the structure. The one that looks great and which we related in this examination is the time when the standard focus point fails spectacularly. Right when a middle kicks the bowl, it would nor be right nor sensible to recognize that the straggling leftovers of the system will work extraordinarily. Finally, the center point is dead and no information can be gotten from the territory for which the right on is solid. Besides, this can accomplish a system separate which proposes there are two nodes which never again can converse with each other [4].

4.1 Routing

Next-node choice is performed relying on the geographical spots of the nodes. It is ordinary that all nodes consider their relative two dimensional deals with in the topology. Likewise, they are accepted to be told about the headings of their neighbors and the sinks settled in the topology. Diverse systems have been proposed in the elucidating limitation and masterminding contemplations. The principal motivating a passionate reaction is that setting up the sensor focus point with a Global Positioning System beneficiary. In any case, that isn't a promising approach by righteousness of sending and cost restrictions. There are other elective strategies proposed, for instance, lateration and angulation systems.

Since it is out of level of this examination, no particular organizing strategy is considered in the pape [4].

4.2 Node Density

In situations where thickness of nodes in the system is non-uniform, shaping the bunchsizes in view of separation can prompt problem area issues. So it is imperative to register the node thickness as groups are framed powerfully. The work by Bulusu in [21] proposed a technique to process the system thickness as where N is the quantity of nodes in unit territory A_n and r is the sweep of the transmission go. $Dn = Nr \pi ^{2/A}$

The node setup and proposed scenario is shown in figure 3.

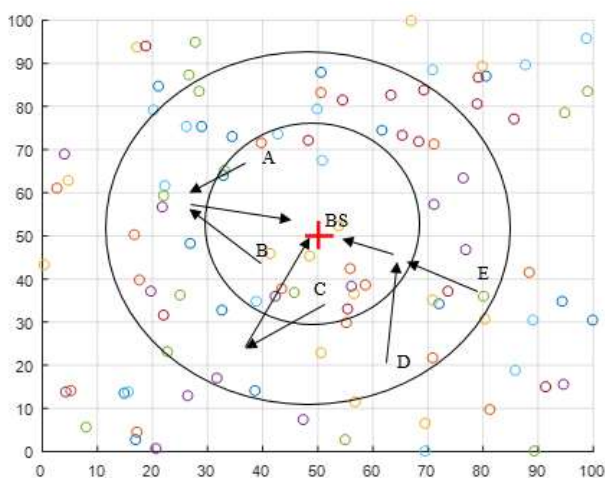


Figure 3. Subdivision of sensing area for non-uniform node distribution.

Alongside remove of a node with neighboring nodes, we have to fuse one-bounce availability of the node with different neighbors ought to be considered. In the event that the thickness of nodes in a region is high, clearly the availability will likewise be high. A limit number of network can be set for a node to have associations. As separation of node from base station expands, this limit esteem can be expanded as the scope territory for those bunches additionally increments [5].

In 2015, Taner et al. shown that, since the plain nodes in bunches manage their data to their pack heads, issues routinely experienced, for instance, different courses, flooding and coordinating circles are discarded or helped. This paper demonstrates a broad examination of the effects of the diverse assistant elements with respect to imperativeness usage in WSNs. General feeling about cluster based WSNs is that all together to moderate the issue region issue, groups arranged near the sink should be smaller estimated than the ones further from the sink. Other possible factors that may impact the lifetime of the framework are the amount of levels, the center point

thickness, the correspondence radio degree traverse, the number and region of the sinks. Each one of these parameters are reviewed for each and every possible blend in detail. Perceiving the basic piece of collection in organize lifetime prolongation, whatever is left of the paper is created as takes after [4].

Additionally, in result of controlling circles and various courses, monotonous essentialness uses will come to fruition. Thusly, to the extent turning away dull imperativeness use in the midst of data transmission, grouping approach surrenders greatly immense picks by techniques for unraveling the correspondence and updating the flexibility. The objective is to find the perfect skill for dealing with the centers into bundles and picking the most fitting center as the CH in each cluster in order to achieve essentialness efficiency by recognizing load alter among the centers. Various examinations have been proposed about pack based WSNs. The traverse of a gathering is picked by the incline estimation of its bundle head, and the data aggregated from the pack people should take after the orientation of sliding edge to accomplish the sink. Reenactment comes to fruition exhibit that EBCAG modifies the imperativeness use among the bundle heads, and in a general sense improves the framework lifetime [8], [9]

5. Maximum damage battery depletion attack in mobile sensor networks

Creating dependable safety efforts against plague of malware will make conceivable the development of remote detecting advancements. The initial move toward this objective is to investigate potential assault methodologies and the measure of harm they can cause. The malware at each infective node may try to contact more helpless nodes by opening up the transmission run and the media filtering rate and along these lines quicken its spread. This may however prompt (a) less demanding identification of the malware and in this way more viable counter-measure by the system, and (b) quicker exhaustion of the battery which may thusly recoil additionally spread of the contamination as well as misuse of that node. We expect the perspective of the malware and cast the issue of powerfully choosing the transmission range and media get to rate of the infective nodes as an ideal control issue. We use Pontryagin's greatest rule to locate an ideal arrangement, and demonstrate that the most extreme harm can be achieved utilizing basic three-stage blast techniques [10]. We decided the express responses for both the regular SI appear and the changed SI illustrate, which can get both the one of a kind and common components of the contamination spread process [11].

6. Modeling overall energy consumption in Wireless Sensor Networks

NajmehKamyabpour et al., presents another approach for constraining the total imperativeness usage of remote sensor sort out applications in light of the Hierarchy Energy Driven Architecture. In particular, we perceived fragments of each bit of HEDA. We removed a model for each one of the constituents and sections similar to their dominating factors (or parameters). We proposed an arrangement for the total imperativeness cost fill in to the extent their constituents. Reenactment happens for lifetime and waiting essentialness of a case interface with different sensor extend, transmission traverse and sporadic and particular frameworks showed that our model and definition can be used to enhance the general imperativeness usage, choose the dedication of each constituent and their relative significance. The recommendation is that updating the imperativeness of the general model with respect to each and every constituent parameter will enable one to construct a modify of essentialness dispersal among constituents, enhance the imperativeness use among them and deal with the framework lifetime for the proposed application. It should be seen that various basic issues are still to be researched. This paper just suggests a plan exhibit for each constituent; a bare essential essentialness appear for each one of the constituent of HEDA is to be thought about. The paper recognized different overpowering parameters of each essentialness parts, in any case, not all features of WSNs have been pondered and they should be explored and analyzed out and out. Unmistakably, the relationship among the essentialness constituents and their trade inside an application are basic; we mean to research the cases and the condition of the imperativeness use for a flat application and convey an extensive guide of essentialness

Similarly the examination will give an arrangement to the end customers for genuine vaccination and standard usage of antivirus programming to the sensor nodes in the sensor field for influencing the assurance to instrument strong and to restrain the attacks [15]. This is in light of the fact that gathering head decision empowers other sensor nodes to simply distinguish and exchange data to the base station rather than controlling data from various nodes. Grouping works proficiently with the revolution of bunch head race and in a littler system [16].

7. Minimizes the Energy Consumption in Wireless Sensor Networks

Ravi Chandra Reddy et al. We proposed a comprehensive method as far as possible the total essentialness ate up by both flexibility of exchanges and remote transmissions. Most past work ignored the imperativeness ate up by moving flexible exchanges.

use as for a specific application. Preliminary examination acknowledged a weighted straight mix of essentialness use of the constituents, later on, we plan to convey a more exact imperativeness cost work which absolutely put due highlight on parameters, parts and the payoff factors among fragments. We assume that a non-straight cost work rather than a clear direct blend would empower the model to modify better to a specific WSN applicatio • by fitting parameter game plan, the disease spread can be satisfactorily controlled by the changed SI show [12].

8. Modeling of Node Energy Consumption for Wireless Sensor Networks

Hai-Ying Zhou et al. Stream WSN investigates focuses more on correspondence traditions than on imperativeness use illustrating. Traditional essentialness examination procedure is to finish up the imperativeness use statuses of nodes and frameworks in light of the theoretical essentialness use data or speculative models of system parts. An extensive segment of the present imperativeness models simply separate the essentialness status of correspondence module, being nonattendance of think the general essentialness usage from the point of view of nodes. By showing the imperativeness usage of different center point portions in different movement modes and state changes, this paper proposes another center essentialness exhibit in perspective of the event trigger framework. This model can be used to separate the imperativeness status of WSN nodes and systems, to survey the correspondence traditions and to pass on nodes and manufacture WSN application • both the TNP and the PNP designs can achieve mastermind security with respect to the distinction in infectivity and they are affirmed to be useful [13], [14].

When we demonstrate the two wellsprings of imperativeness usage, the perfect position of a center that gets data from one or distinctive neighbors and transmits it to a lone parent isn't the midpoint of its neighbors; rather, it centers to this circumstance as the measure of data transmitted goes to endlessness. Ideally, we start with the perfect beginning coordinating tree in a static space where no nodes can move. In any case, our approach can work with less perfect starting setups including one created using simply adjacent information, for instance, eager geographic directing. Our approach upgrades the fundamental outline using two iterative designs. The essential installs new nodes into the tree. The second figures the perfect spots of move nodes in the tree given a settled topology. This computation is legitimate for a grouping of data concentrated remote sensor frameworks. It empowers a couple of nodes to move while others don't in light of the fact that any close-by change for a given adaptable hand-off is an overall change. This empowers us to possibly extend our approach to manage handle

additional objectives on particular nodes, for instance, low essentialness levels or transportability restrictions in view of use requirements [17]. It is moreover watched that if the rate of treatment manufactures the spreading of malignant worms reductions and redesigns the life of remote sensor mastermind. By generation it is found that execution of proposed show is better interestingly with the SIRS appear, spoiled nodes are promptly removed from the system [18].

The steering issues of WSN have been tended to in a huge number of works. On assessing the work, different highlights for example, Energy, security, postponement and blunder that posture challenges are recognized. This area gives an exchange on the works, relating to those highlights, in a different way.

9. Data aggregation in wireless multimedia sensor networks

Rapid developments in the hardware field allow for a single sensor node to collect multiple pieces of information for visual and auditory wireless Multimedia Sensor Networks with Stamping and Secure Data Clustering modules. For example, the Cyclops image acquisition and processing module can be easily added to the Crossbow nodes. These rapid developments have led to the emergence of the Wireless Multimedia Sensor Network (WMSN) concept in the WSN literature. WMSN is a WSN type consisting of more advanced sensor nodes than KAA, where each node can collect more than one kind of data and processing of these data can make more complicated decision making processes possible. It is often difficult or even impossible to replace the batteries of the multimedia sensor nodes, especially as military deployments are deployed with the aid of an aircraft, which is difficult to access, and remote and dangerous areas are difficult to access. For this reason, WMSN 's have to extend the service life of the network by performing its primary tasks of data collection, transmission and disposal in an energy efficient manner. Generally speaking, which consist of a large number of sensor nodes, the sensors reduce their energy consumption by separating themselves into groups. The purpose of this grouping process is to select a sensor as a group leader in each group and to collect and transfer data through the selected group leader. Data clustering is a very important requirement in order to summarize the energy efficiently collected from which are composed of sensors with limited power resources. To send the data of each sensor separately to the base station, the sensor data in a group is collected and summarized by the group leader, that is, the cluster data is reduced by extracting the data from the cluster, reducing the energy consumption of the sensor and increasing the life span of the WMSN.

10. SIMULATION RESULT

We proposed a new scenario of clustering method to improve the energy consumption in wireless sensor network. We showed that clustering is a suitable method for reducing network energy consumption and, based on this, a head clustering selection algorithm is presented. In our proposed method, the entire sensor network was not investigated to detect an attacker node, and only the path chosen was taken into consideration by the cluster head selecting method. As a result, instead of looking at all of them, we only considered the selected nodes. Different states are considered as follows:

The other node showing itself as the head of the cluster. A message that is repeated continuously.

Figure 4 shows the structure of the nodes and the configuration of the node setup.

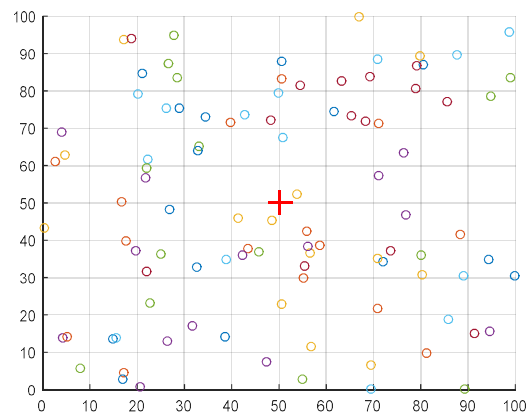


Figure 4. Node setup

Figure 5 shows the number of packets received at BS against the round.

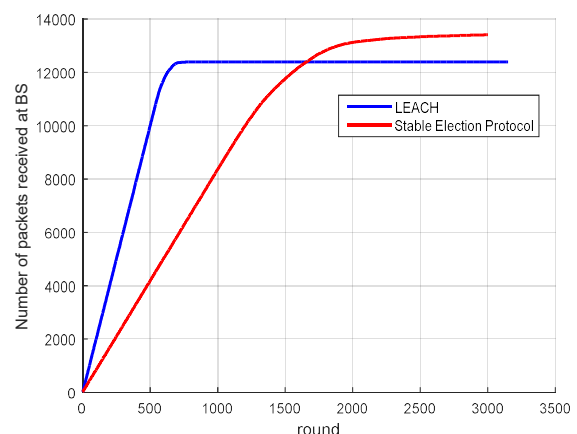


Figure 5. Number of packets received at BS

Figure 6 shows the number of allive nodes against of the rounds.

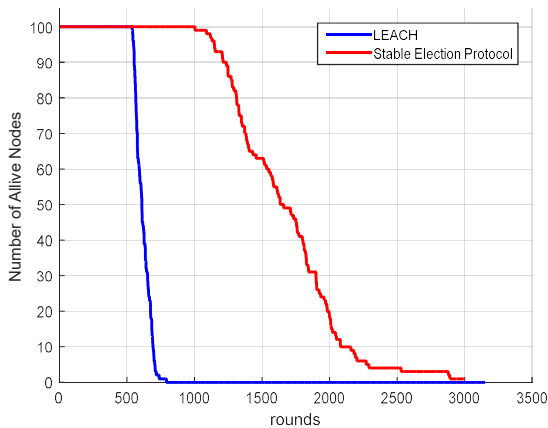


Figure 6. Number of allive nodes against of the rounds
The simulation parameters exploited in every experience are accessible in table 1.

Table 1 values of parameters

Parameter	Value
Position of BS	(50, 50)
X coordinate	[0 100] meter
Y coordinate	[0 100] meter
Number of nodes	100
E0	0.7 J
Eelec	5 nJ/bit
Efs	10 pJ/bit/m2
Emp	0.0013 pJ/bit/m4
Eda	5 pJ/bit
Message Size	4000

11. CONCLUSION

Therefore, remote sensor a scientific model of a system of nodes and utilizing direct programming method, this model information transmission by giving decreasing the vitality utilization, the system lifetime we gave the improvement. Other of our work high lifetime perceptions in their means, the topological impacts we set up the situations and these situations and contrast their outcomes with their derivations we did. Accordingly, the decision of the fitting topology it is a vital factor in enhancing the life we were the outcome. As needs be, a round territory design and as little as conceivable around there by keeping the vitality utilization is extreme more sensor nodes nearer to the base station with the goal that this vitality utilization is lastly grouping strategies and particularly to cluster calculations to create different bases by giving a station to the life of a system more beneficial and more steady

systems. The eventual fate of our work we give a preparatory to the work.

REFERENCES

1. Sarkar, A. and T.S. Murugan, *Routing protocols for wireless sensor networks: What the literature says?* Alexandria Engineering Journal, 2016. **55**(4): p. 3173-3183.
2. Elbaşı, E. and Ö. Suat. *Secure data aggregation in wireless multimedia sensor networks via watermarking.* in *Application of Information and Communication Technologies (AICT), 2012 6th International Conference on.* 2012. IEEE.
3. Liu, X., *A Survey on Clustering Routing Protocols in Wireless Sensor Networks.* Sensors, 2012. **12**(8): p. 11113.
4. Cevik, T. and F. Ozyurt, *Impacts of structural factors on energy consumption in cluster-based wireless sensor networks: a comprehensive analysis.* arXiv preprint arXiv:1512.03580, 2015.
5. Anandh, S.J. and E. Baburaj, *An Improved Energy Balanced Dissimilar Clustered Routing Architecture for Wireless Sensor Networks.* Circuit and Systems, Scientific Research, 2016.
6. ELBAŞI, E. and S. ÖZDEMİR, *Kablosuz Çoklu Ortam Algılayıcı Ağlarında Damgalama İle Güvenli Veri Kümeleme.* Gazi Üniversitesi Mühendislik-Mimarlık Fakültesi Dergisi, 2013. **28**(3).
7. Zhu, X., L. Shen, and T.-S.P. Yum, *Hausdorff clustering and minimum energy routing for wireless sensor networks.* IEEE transactions on vehicular technology, 2009. **58**(2): p. 990-997.
8. Liu, T., Q. Li, and P. Liang, *An energy-balancing clustering approach for gradient-based routing in wireless sensor networks.* Computer Communications, 2012. **35**(17): p. 2150-2161.
9. Rana, A., *Analyze Portrayl of SEP for WSN Using Matlab.* 2017.
10. Khouzani, M. and S. Sarkar, *Maximum damage battery depletion attack in mobile sensor networks.* IEEE Transactions on Automatic Control, 2011. **56**(10): p. 2358-2368.
11. Tang, S. and W. Li, *An epidemic model with adaptive virus spread control for Wireless Sensor Networks.* International Journal of Security and Networks, 2011. **6**(4): p. 201-210.
12. Kamyabpour, N. and D.B. Hoang, *Modeling overall energy consumption in Wireless Sensor Networks.* arXiv preprint arXiv:1112.5800, 2011.
13. Zhou, H.-Y., et al., *Modeling of node energy consumption for wireless sensor networks.* Wireless Sensor Network, 2011. **3**(01): p. 18.

14. Mann, P.S. and S. Singh, *Improved metaheuristic based energy-efficient clustering protocol for wireless sensor networks*. Engineering Applications of Artificial Intelligence, 2017. **57**: p. 142-152.
15. Mishra, B.K. and N. Keshri, *Mathematical model on the transmission of worms in wireless sensor network*. Applied Mathematical Modelling, 2013. **37**(6): p. 4103-4111.
16. Ponnusamy, V., *Energy analysis in Wireless Sensor Network: a comparison*. International Journal of Computer Networks and Communications Security, 2014. **2**(9): p. 328-338.
17. Ravichandran, S. and M. Umamaheswari, *Design and Development in Research of Adaptive Multipath Routing for Burden Harmonizing in MANET*. Asian Journal of Computer Science and Technology, 2015. **4**(2): p. 39-43.
18. Shashank, A., et al., *Stability Analysis of SITR Model and Non Linear Dynamics in Wireless Sensor Network*. Indian Journal of Science and Technology, 2016. **9**(28).



Ali Mahmood Humada was born in 1982, April in Karkuk city, Iraq. He received his B.Sc. degree in 2004 from the University of Tikrit, Salahadden, Iraq, and his M.Sc degree in 2012 from University Tenaga Nasional, Selangore,

Malaysia, and PhD from University Malaysia Pahang, Kuantan, Pahang, in August 2016. His research interests include soft computig optimisation method, electrical engineering, renewable energy systems, power electronics, solar energy, and Artificial Intelligent systems. He has published more than thirty papers in International Journals and conferences.

Ali M. Humada Electricity Production Directerate of Northern Region, Ministry of Electricity, 34007 Baiji, Iraq



Ahmad Ayid Ahmad received the B.Sc. degree in Software Engineering in 2006 from the Faculty of Software Engineering at the Northern Technical University. He received the MSc degree in Information Technology in 2017 from the Post Graduate Institute/Cankaya University,

Turkey. His current research interests lie in the fields of Information Technology, Computer Science, Network, and Wireless Sensor Networks.



Ali Ayid Ahmad: Received B.Sc. in Computer Engineering from Engineer College Mosul / Mosul -Iraq in 2007 and M.Sc degrees in Computer Engineering from Voronezh State Technical University / United Russia,

in 2014. During 2008-2011, he worked as an engineer in Ministry of Higher Education And Scientific Research in Iraq / Tikrit University, then in 2015 joined to the Electrical Engineering /Engineering College / Kirkuk University. He now lecturer in Engineering College / Kirkuk University / Kirkuk-Iraq/Electrical Engineering Department.