iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** XI **Month of publication:** November 2017

DOI:

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue XI November 2017- Available at www.ijraset.com

Management And Conservation of Energy In Wireless Sensor Networks

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Abstract*: A wireless Sensors is one of the many new creations that present a new stage in the evolution of the technologies of the information. This small device allows measuring physical phenomena quantity in Environment such as light, heat, pressure, temperature and transforming it autonomously into a digital value, In order to send to one or several points of collections, which is going to be processed. However, a wireless sensor network (WSN) is a network formed by a large number of sensor nodes, which are able to acquire, aggregate compress and to transmit data towards a base station. However, several constraints complicate the deployment and management of wireless sensor networks. The economy of energy is among the major issues of these networks, and it is difficult even impossible to replace the sensors or their battery because of the location of deployment that is often inaccessible. Among scientific research developed to maximize the lifetime of wireless sensors network is the integration a new techniques of routing protocols existing. In this paper, we propose an improvement of routing protocol based on clustering in terms of management of energy in network. For increasing the lifetime and the good distribution of the energy throughout the network.

***Keywords—Wireless Sensor, Clustering, Energie consumption, N-Transfer, Producer-Consumer*.**

I. INTRODUCTION

Wireless sensor is one of many emerging creations of the new technology consisting of spatially distributed autonomous micro devices. This device allows detecting and measuring a physical quantity from the environment such as light, heat, pressure, and transforming it into a digital value that can be processing and routing toward base station. The deployment of several wireless sensors communicating by wireless radio, form a Wireless Sensor Network. Several constraints prevent proper deployment these networks. One of the most significant challenges for Wireless Sensor Networks is energy consumption. However the economy of energy is among the major issues of these networks, and it is difficult even impossible to replace the sensors or their battery because of the location of deployment that is often inaccessible [1,2,3]. Much of the research on the Wireless Sensor Network, work on the conservation of energy wireless sensors, however it may also seek to ensure that the energy of the network distributed fairly on the different areas [12,13]. In this work, we propose an improvement of routing protocols based on clustering by reducing the overload of Cluster-Head, in order to well distribute the energy overall network and avoid the black holes (death node). This optimization consists to create a new node (N-Transfer) within the cluster that is only responsible of transferring data into the base station (BS) and Structuring the network as a producer-consumer pattern. In this work, we make the Leach protocol as a reference to make comparisons with our proposed protocol.

II. HIERARCHICAL ROUTING

The hierarchical routing allows to partition network into sub-set (cluster) and it based on the concept of member nodes and Cluster-Head (CH) nodes. The member nodes route their messages to the Custer-Head, which then routes this messages in the entire network to the base station (Sink) [4,13]. The main objective of the hierarchical routing is to maintain effectively the energy consumption of sensor nodes in involving those into the communication multi-hop within a cluster and performing the aggregation and fusion of data in order to reduce the number of messages transmitted to the destination [4,5,13].

III. LEACH PROTOCOL

LEACH is one of the hierarchical routing protocols more popular in wireless sensor networks. LEACH protocol was introduced by Heinzelman in 2002. The principle is to form clusters of sensor nodes and then use cluster-Heads premises as gateway to reach the base station. This routing protocol allows conserving energy, because the transmissions are performed only by the cluster-Head rather than by all the sensor nodes [4,5]. The protocol takes rounds; each round consists of two phases:[6,7]:

A. Set-up

Principal object of this phase is the construction of the clusters and the Cluster-Heads. Indeed the protocol based on the desired percentage of Cluster-Head and the number of iteration in which a node elect to the role of Cluster-Head. Thus, each node ***n*** takes a random value between 0 and 1. The node is declared Cluster-Head if its value is inferior than a threshold T(n), The threshold value is calculated based on the following formula (1):[6,8]

$$T(n) = \begin{cases} \dfrac{P}{1 - P \times \left(r \bmod \dfrac{1}{P} \right)} & \text{If } (n \in G) \\ 0 & \text{Otherwise} \end{cases} \qquad (1)$$

Where

G: the set of nodes that does not elect Cluster-Head in the last 1/P rounds.

P: desired percentage of Cluster-Heads

r: the Current round.

IV. STEADY-STATE

At this stage, the member nodes transmit the data to the Cluster-Head, when all data received; the Cluster-Head aggregates them and sends them directly to the Base Station.

In order to minimize collisions of data transmission since the member nodes toward the CH, the latter uses the TDMA technique (Fig.1). [7,12]

However, several criticisms made to the LEACH protocol:

The Cluster-Heads that are more distant from the base station are going to be dead quickly compared to those which are close to the Base Station [3,9], this means that the far area remain not covered by sensors.

Leach does not guarantee a homogeneous distribution of CHs on the network and creation of homogeneous cluster.

The use of a single hop communication instead of a multi hops communication decreases the energy of the nodes.

In turn of the CH on the set of nodes of the cluster allows a hand to balance the consumption of the energy of the cluster. But, it generates an over consumption of energy, because each rotation of CH needs a phase of dissemination to publicize the new CH. [9]

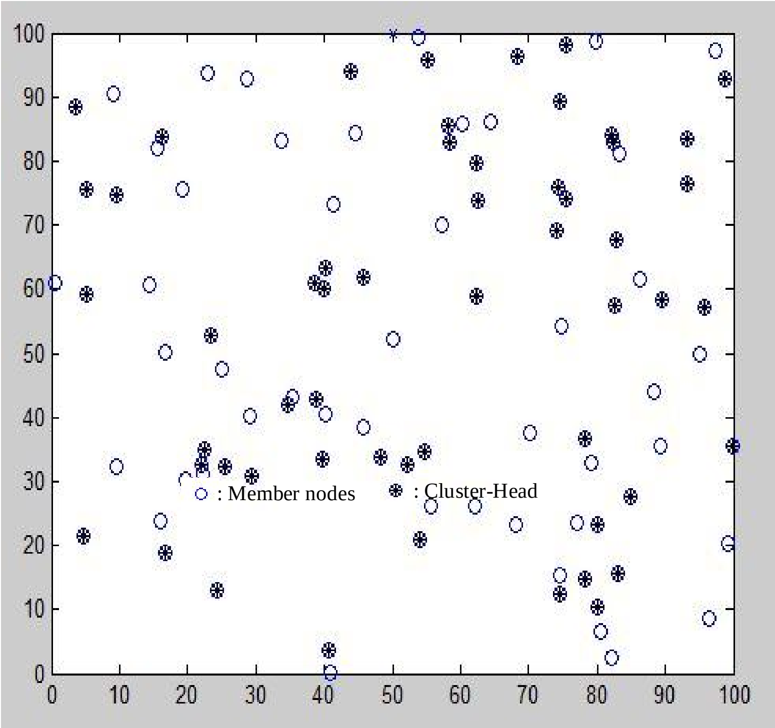


Fig. 1. Random Distribution of 100 sensor nodes.

V. PROPOSED WORK

A. Problematic (why overload the Clusters-Head?)

1) *Probleme 1*: Generally, the Cluster-Head is the most active node of the cluster, because it manages all nodes member in the cluster. In effect, after the election of the Cluster-Head, it is in charge of the creation and the organization of the cluster, and then the data collection, the treatment and the compression of these data in order to transmit them to the Base Station [12,13]. In carrying out all these stains, the Cluster-Head loses a lot of energy, so that result a quick death of the cluster head. Therefore, this leads to have holes (dead nodes) in the whole of the network [12].
2) *Probleme 2*: The sensors elute Cluster-Head who are located far from the BS consume more energy, because the transmission distance to the BS is important. As well, the areas that consist of these sensors die entirely. Therefore, when we work in the large area and especially when we have an important number of nodes, the main sensors in the network (far from BS) loses a lot of energy [10,12]. In this case, we can say that we do not have an equitable energy distribution over all the nodes of the network.

B. Proposed solution(N-Transfer)

To reduce the functionalities of the Cluster-Head, it has established a node that is only responsible of the transfer of the data. The cluster-head delegates the task of the transmission of packets to the base station to a node of the cluster.[13]
In this case, a cluster schematize as a producer-consumer pattern (Fig.2). The member nodes are the producers, the Cluster-Head is the buffer whose data processes, aggregate and compress, and the consumer is the transfer node. The latter who will pick up the data from the Cluster - Head to transfer them to the BS.
he node N-Transfer must have an energy capacity greater than or equal to that of the Cluster-Head (Fig.3).

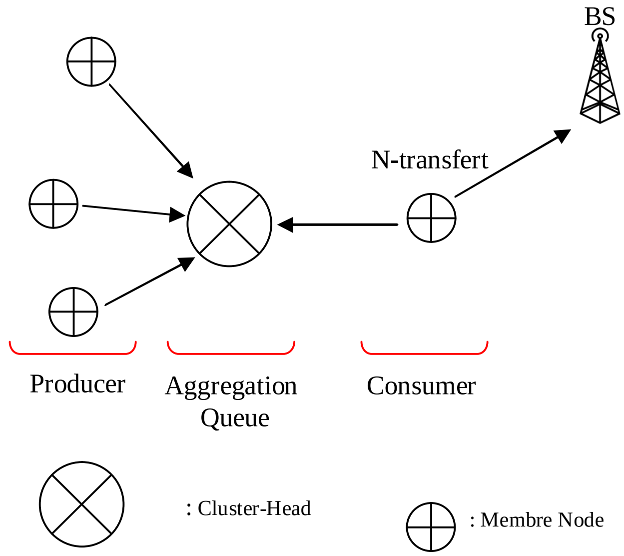
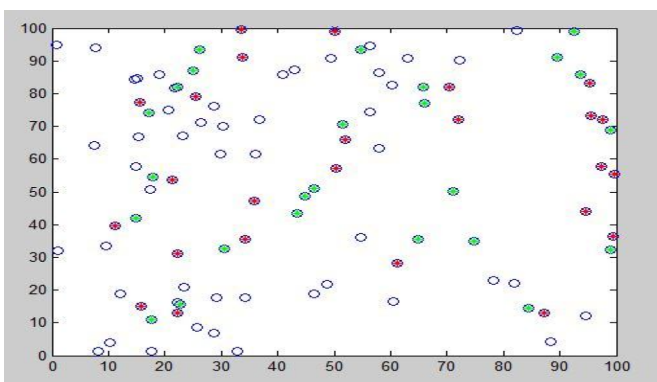


Fig. 2. Producer-consumer pattern apply to cluster

After studies and simulations, this proposition resolves our two problems.



ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue XI November 2017- Available at www.ijraset.com

Studies We will explore a few cases that reflect the effectiveness of the proposed protocol. We consider a small network that consists of four wireless sensors that communicate between them. These nodes form a cluster and we will initial by 20 units energies (Fig.4).

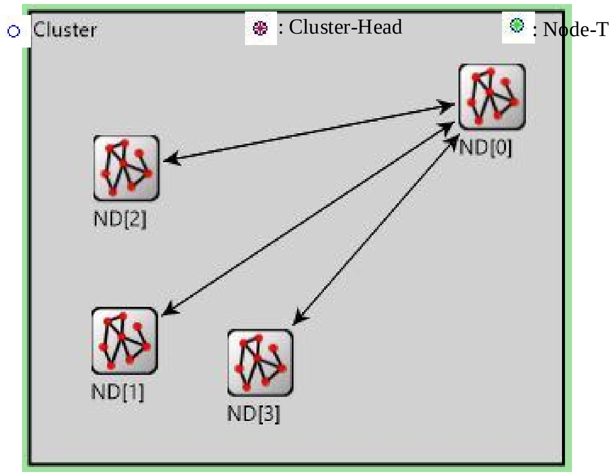


Fig. 2. Cluster of Wireless Sensor

C. Parametres and conditions

1) Concerning the collection and processing of data, the following nodes ND0, ND1, ND2, and ND3 lose two units of energy
2) The Cluster-Head loses energy units, during the processing, aggregation, and the compression of data.
3) The node loses six energy units, during the transmission to the base station
4) It considered that the loss of energy during the election of the cluster-head and the communication intra-cluster is negligible.

D. The treatment

We compare between the classic clustering and the proposed work. This comparing case will distributed in five steps of clustering and each step is comprised of 2 phases:

The election of the Cluster-Head until the aggregation and compression of the data.

Transmission of data to the Base Station.

In each round, it assumed that the node that has more energy will be chosen as a Cluster-Head.

TABLE I. CLUSTER

			ND0	ND1	ND2	ND3
INITIAL		Classical Clustering	20	20	20	20
		Proposed work	20	20	20	20
Round 1	Phase 1	Classical Clustering	16(CH)	18	18	18
		Proposed work	16(CH)	18	18	18
	Phase 2	Classical Clustering	10(CH)	18	18	18
		Proposed work	16	12(NT)	18	18
Round 2	Phase 1	Classical Clustering	8	14(CH)	16	16
		Proposed work	14(CH)	10	14	16
	Phase 2	Classical Clustering	8	8(CH)	16	16

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		Proposed work	14	10	14	10(NT)
Round 3	Phase 1	Classical Clustering	6	6	12(CH)	14
		Proposed work	10(CH)	8	12	8
	Phase 2	Classical Clustering	6	6	6(CH)	14
		Proposed work	10	8	6(NT)	8
Round 4	Phase 1	Classical Clustering	4	4	4	10(CH)
		Proposed work	6(CH)	6	4	6
	Phase 2	Classical Clustering	4	4	4	4(CH)
		Proposed work	0(NT)	6	4	6
Round 5	Phase 1	Classical Clustering	0(CH)	2	2	2
		Proposed work	0	2(CH)	2	4
	Phase 2	Classical Clustering				
		Proposed work				

E. Discussion

We note in this case treated that the proposed work is more efficient. Indeed, in the fifth round the sum of the energy units of the proposed work is greater than the sum of the units of the Clustering Classical. Which implies that our method has to conserve energy through decentralization of Cluster-Head tasks? Now, if we managed to conserve energy for a cluster of four nodes, then we can maximize the lifetime of an average wireless sensor network.

In the next step, we will establish simulations, with different node number and we will discuss the results obtained.

VI. SIMULATION & RESULTS

A. Parameters data

In this part, we will compare the performance of the proposed protocol (with N-Transfer) with the classical Leach protocol. The wireless sensors deployed on an area of 100m*100m with a base of station located at the point (50, 100).

TABLE II. PARAMETERS TABLE

Initial energy of nodes	0.25 joule
Transmitter and receiver energy	50nj/bit
Aggregation energy	5nj/bit
Data packet length	4000 bit
E_{fs}	10pj/bit/m2
E_{amp}	0.0003pj/bit/m4

THE TRANSMITSSION ENERGY[7,14]

$$E_{TX}(k,d)=\begin{cases} E_{elec}K + E_{fs}Kd^2 & \text{if } d<d_0 \\ E_{elec}K + E_{amp}Kd^4 & \text{if } d\geq d_0 \end{cases} \quad (2)$$

THE RECEIVER ENERGY [6,8]

(3)

$$E_{RX}(k)=E_{elec}K$$

With:

K= the message length in bits.

d= the distance between the node transmitter and receiver

E_{fs} , E_{amp} = amplifier energy.

The threshold distance d_0 given by (4):[11,14]

$$d_0=\sqrt{\frac{E_{fs}}{E_{amp}}} \qquad (4)$$

B. Simulation Results

The simulations run in MATLAB, we consider that all nodes have an equal initial energies and each death node excluded from the next round.

1) First simulation: In this simulation, we compare Energy conservation efficiency between proposed works and leach protocol with different number of sensor in the network.

TABLE III. COMPARATIVE TABLE (LIFETIME)

	Number of Round	
Number of Node	Leach Protocol	Proposed Protocol
10	970	1176
20	851	1013
40	937	1086
60	980	1069
80	1032	1133
100	962	1107

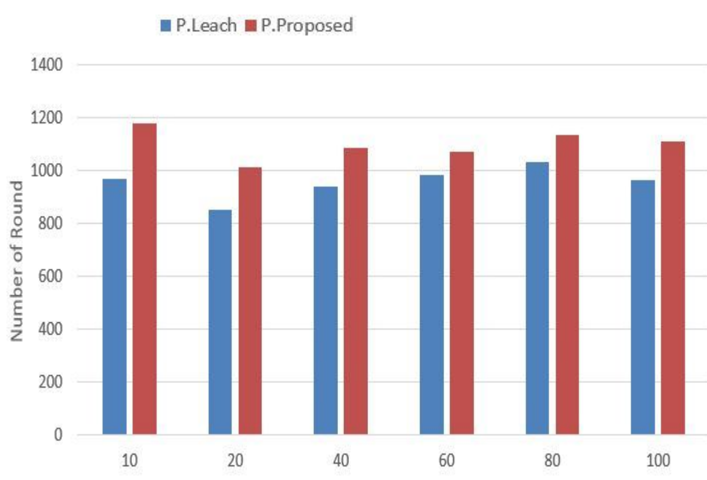

Fig. 5: Simulation with the protocol LEACH.

From the results of Table 3, interpreted in a diagram in (Fig.5), we observe that the proposed Protocol has made notable improvements over Protocol Leach. Indeed, the number of round obtained by the proposed protocol is greater than the number of round obtained by the Protocol Leach. An increase of 16%. Thus, the proposed protocol has maximized the lifetime of the wireless sensor network.

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In (Fig.6), we focus in on the case of the network that consists of 100 nodes. We compare the number of round with the dead node.

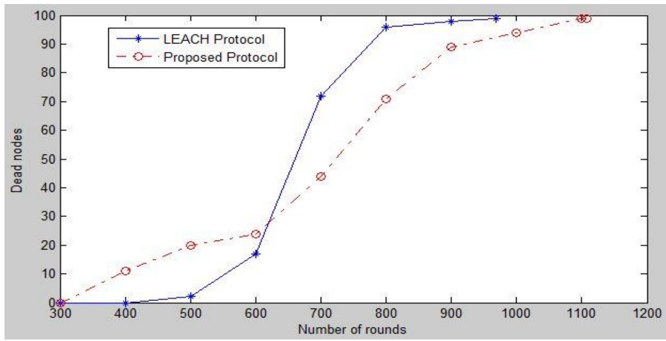


Fig. 6. Number of rounds in relation to the dead nodes.

Although the proposed protocol begins to lose its nodes from round 327, while the Leach protocol begins to lose its nodes from round 456. We note that the proposed protocol is more efficient than the Leach protocol, since it guarantees us more round with a preservation of the sensors.

2) *Second simulatio:* In this simulation, we compare the distribution (position) of dead nodes in the surface of the network. On the (Fig.7), which treated by the classical Leach protocol, shows clearly, that the lower part of the network represents a black area of which all sensors are dead? Thus, we may not have the information of this area that is not covered.

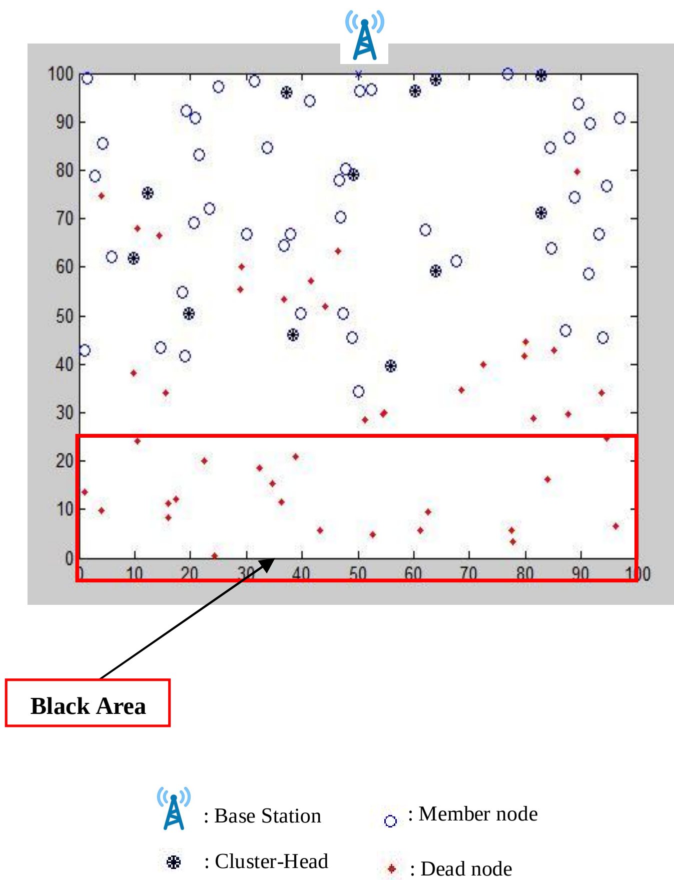


Fig. 7. Simulation with the protocol LEACH.

On the (Fig.8), treated by the proposed protocol in which we show the death of the nodes well distributed across the network. Consequently, we can have a data collection on the whole area of the network.

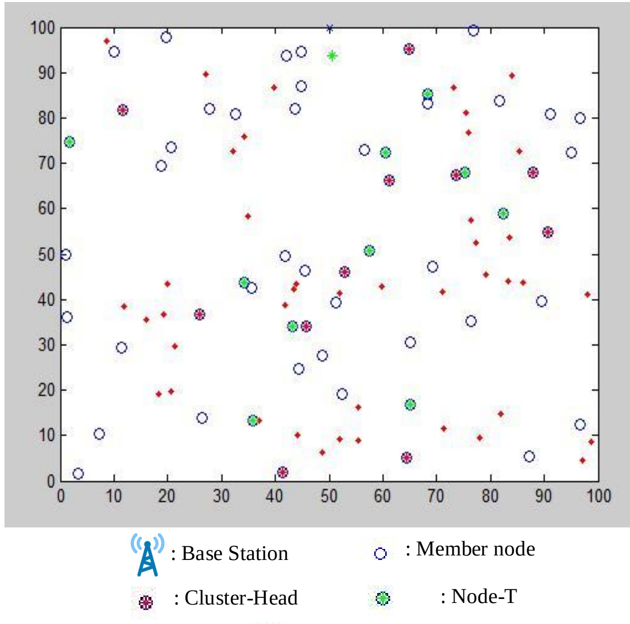


Fig. 8. Simulation with the proposed protocol.

VII. CONCUSION & PERSPECTIVES

The wireless sensor networks presents an interesting evolution in the new technologies of information and communication. As well, the Wireless Sensor Networks have been the object of several studies and research to solve the problems that prevent and stabilize the good design of these networks. Often, the scientific researches in the field of energy conservation focus on maximizing the lifetime of wireless sensors. However, we must not forget the good distribution of energy on the whole of the network.The integration of the transfer node (N-Transfer) and producer-consumer pattern in this proposed work have exposed efficiency for having an Energy conservation and a good fair distribution on the whole of the network. For perspective, we suggest developing our protocol to improve the results concerning the first dead node.

REFERENCES

[1] Loren P. Clarea ,Gregory J. Pottieb and Jonathan R. Agrea. " Self-Organizing Distributed Sensor Networks " Proc. SPIE 3713, Unattended Ground Sensor Technologies and Applications, (July 30, 1999), 229.

[2] Chunyao FU, Zhifang JIANG, Wei WEI, Ang WEI "An Energy Balanced Algorithm of LEACH Protocol in WSN" , IJCSI International Journal of Computer Science Issues, Vol. 10, Issue 1, No 1, January 2013.

[3] J.Gnanambigai, Dr.N.Rengarajan, K.Anbukkarasi. "Leach and Its Descendant Protocols: A Survey". International Journal of Communication and Computer Technologies Volume 01 – No.3, Issue: 02 September 2012.

[4] Khushboo Pawar, Y.Kelkar. "A Survey of Hierarchical Routing Protocols in Wireless Sensor Network". International Journal of Engineering and Innovative Technology (IJEIT) Volume 1, Issue 5, May 2012.

[5] Xu-Xun Liu ."A Survey on Clustering Routing Protocols in Wireless Sensor Networks". 9 August 2012, Sensors 2012, 12, 11113-11153.

[6] W.R. Heinzelman, A. Chandrakasan, and H.Balakrishnan, "Energy-efficient CommunicationProtocols for Wireless Microsensor Networks", in Proc.33rd Hawaii International Conference on SystemSciences, vol. 2, January 2000.

[7] W.B. Heinzelman, A. Chandrakasan, and H.Balakrishanan, "An Application-Specific ProtocolArchitecture for Wireless Microsensor Networks", IEEETrans. Wireless Communication, vol. 1, no. 4, October 2002, pp. 660-70,.

[8] M.J.Handy, M. Haase, D. Timmermann. "Low Energy Adaptive Clustering Hierarchy with Deterministic Cluster-Head Selection. "Mobile and wireless communication network, 2002. 4th international worksho, p.p 368-372.

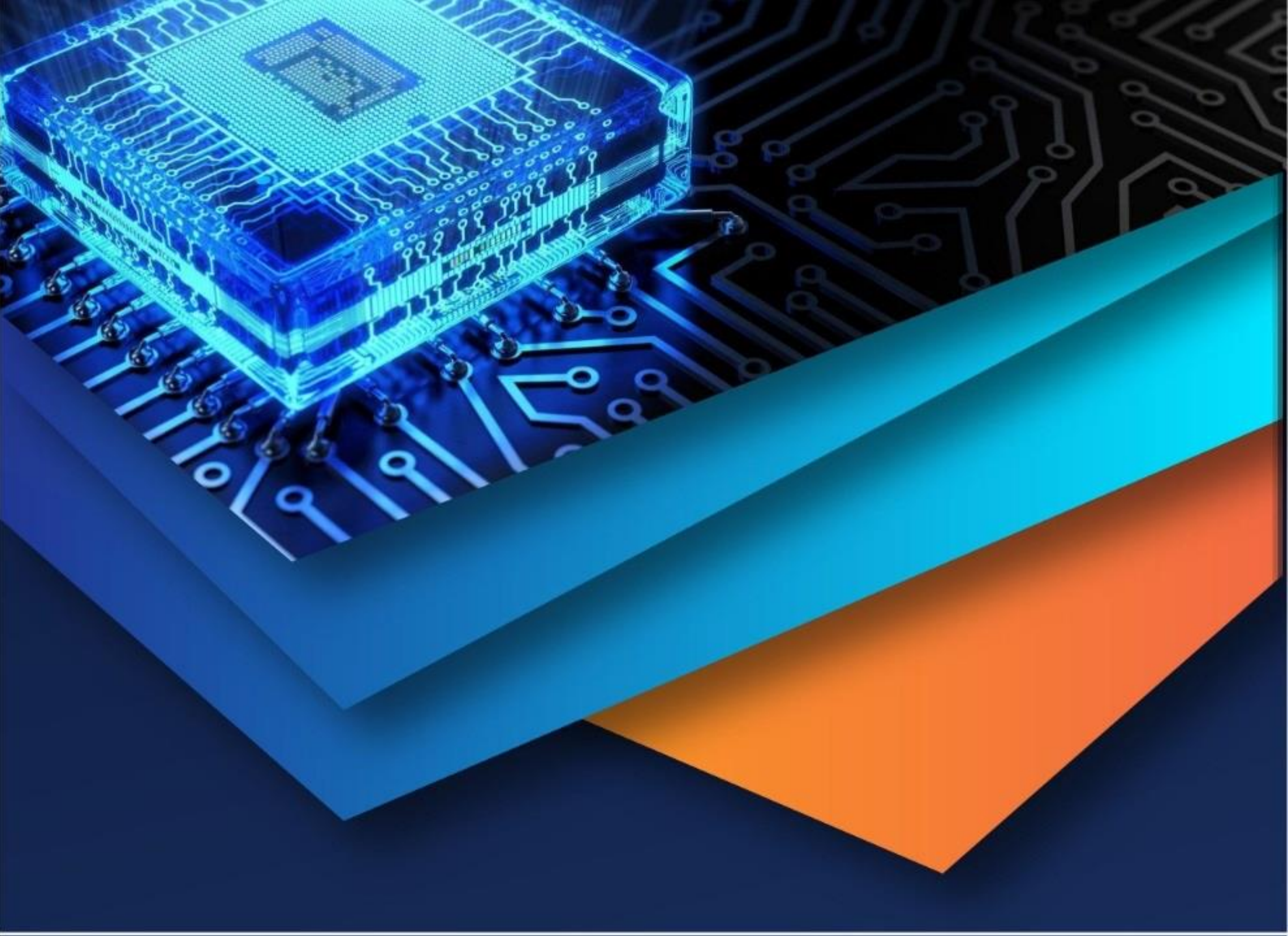
[9] Meena Malik, Dr. Yudhvir Singh, Anshu Arora. "Analysis of LEACH Protocol in Wireless Sensor Networks". International Journal of Advanced Research in Computer Science and Software Engineering. Volume 3, Issue 2, February 2013.

[10] Ravneet Kaur ,Deepika Sharma and Navdeep Kaur. "Comparative Analysis Of Leach And Its Descendant Protocols In Wireless Sensor Network". International Journal of P2P Network Trends and Technology- Volume3, Issue1- 2013.

[11] Smaragdakis G. Matta I. Bestavros A. "A Stable Election Protocol for Clustered Heterogeneous Wireless SensorNetworks", Proceedings of the 2nd International Workshop on SANPA 2004, Massachusetts, U.S, 2004, pp:1-11.

[12] Heena Dhawan, Sandeep Waraich "A Comparative Study on LEACH Routing Protocol and its Variants in Wireless Sensor Networks: A Survey ", International Journal of Computer Applications (0975 – 8887) Volume 95– No.8, June 2014, pp:21-27

[13] NEETIKA & SIMARPREET KAUR, "Rreview on Hierarchical Routing in Wireless Sensor Networks", in International Journal of Smart Sensors and Ad- Hoc Networks (IJSSAN), Vol. 2, Issue 3, 4, 2012, pp. 85-90.
[14] Surender Kumar, M.Prateek, N.J.Ahuja, Bharat Bhushan "DE-LEACH: Distance and Energy Aware LEACH", International Journal of Computer Applications (0975 – 8887) Volume 88 – No.9, February 2014, pp: 36-42



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