IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Volume-6, Issue-3 E-ISSN: 2347-2693

# DMGEECA: Density Based Mean Grid Energy Efficient Clustering Algorithm for Mobile Wireless Sensor Networks

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**Available online at: www.ijcseonline.org**

Received: 17/Feb//2018, Revised: 23/Feb2018, Accepted: 18/Mar/2018, Published: 30/Mar/2018

***Abstract* -** Clustering is an important technique in Mobile Wireless Sensor Networks to reduce the communication overhead in several cases and reduce the energy consumption. In this paper, we propose a new clustering algorithm, DMGEECA(Density Based Mean Grid Energy Efficient Clustering Algorithm for Mobile Wireless Sensor Networks). The objective of our proposed algorithm is to elect a Cluster Head and increase the number of Cluster Heads based on the density of nodes in the area to reduce the energy consumption and thereby increasing the network lifetime. Simulations are carried out to evaluate the performance of our clustering algorithm by comparing its performance with the previous work. The results of simulation demonstrate that our proposed clustering algorithm outperforms the other algorithms in terms of Network Lifetime, Energy Consumption.

Keywords – MWSNs, Clustering, Grid, Density, Mobility, Energy Efficiency

## I. INTRODUCTION

Mobile Wireless Sensor Network (MWSN) is a network with nodes that are smaller in size and are in mobility. Since nodes are mobile in nature the energy drains out while communicating with each other. Clustering[1][2] is an Energy Efficient technique used to minimize the energy consumption during the delivery of packets from a Sensor node to the Base Station. In this paper, Density based Mean Grid Energy Efficient Algorithm Clustering Algorithm for Mobile Wireless Sensor Networks (DMGEECA) is proposed to minimize the energy consumption while electing a Cluster Head (CH). The algorithm elects a Cluster Head based on the weightage of the node. Cluster Heads are increased based on the density of nodes in the Grid. The weight is calculated for each node based on the Degree, Energy, Distance and Mobility. The node with minimum weight is elected as a Cluster Head.

The rest of the paper is organized as follows: Section II deals with the Related Work followed by the problem specification. Section III describes the Proposed Work, issues in the previous algorithm and the Steps in the proposed algorithm. Section IV describes the MWSN Parameters and Definitions. Section V shows the experimental Results and Discussions followed by Conclusion with future research directions in Section VI.

## II. RELATED WORK

Researchers have proposed several algorithms for Cluster Head selection in MWSN where Clustering technique is used to communicate within the network, but still there exist various challenges for Cluster Head Election process. J. Corn, et. al. proposed a Clustering Algorithm For Improved Network Lifetime of Mobile Wireless Sensor Networks aimed at improving wireless sensor network lifetime in the case of mobile sensor nodes. LEACH-CCH is a modification of the LEACH algorithm, which was developed for stationary networks. An analysis of energy consumption for the LEACH algorithm is presented to identify which data transmissions are most energy expensive for a node throughout its lifetime. LEACH-CCH reduces the energy expended during the costliest data transmission. By predicting the future positions of sensor nodes and restructuring clusters accordingly, an improvement is seen in overall network lifetime when compared with LEACH.

Fatiha Djemili Tolba, et. al. proposed a Distributed Clustering Algorithm For Mobile Wireless Sensors Networks[4]. The algorithm is improves the network stability and saves the energy consumption while keeping the network connectivity. Cluster-heads are selected during the formation of cluster process. The proposed clustering algorithm outperforms the other algorithms in terms of network lifetime, energy consumption.

Sangeetha M, et. al. proposed Genetic Optimization Of Hybrid Clustering Algorithm In Mobile Wireless Sensor

 

Networks to provide a prolonging network lifetime and optimizing energy consumption in Mobile Wireless Sensor Networks (MWSNs)[5]. The algorithm consists of two centralized dynamic genetic algorithm-constructed algorithms. The improved genetic centralized clustering algorithm helps to find the good cluster configuration and number of cluster heads to limit the node energy consumption and enhance network lifetime.

An Improved Cluster Head Selection Algorithm for Mobile Wireless Sensor Networks proposed by Kavita Gupta, et al.[6]. The cluster head is primarily selected on basis of the residual energy of the node during the communication. Node with highest remaining energy will be elected as new cluster head. The unique contribution of this research work is a process when the existing cluster head moves out of the cluster range and cluster remains unattended. The results obtained are reflecting a significant improvement in the life time of the network and it was further discovered that the ratio of unattended clusters has reduced potentially.

Dahane Amine, et. al. proposed a Distributed and Safe Weighted Clustering Algorithm for Mobile Wireless Sensor Networks[7] which is an extended version of our previous algorithm (ES-WCA) for mobile WSNs using a combination of five metrics. The proposed algorithm detects common routing problems and attacks in clustered Mobile Wireless Sensor Networks, based on behavior level. It generates a reduced number of balanced and homogeneous clusters in order to minimize the energy consumption of the entire network and prolong sensors lifetime.

The critical look at the literature presented above highlights the fact that there exists lot of clustering based mechanisms but very few are suitable for MWSN[8][9]. Moreover the best of our knowledge, none of these have suggested an algorithm addressing issues such as electing a Cluster Head with minimum energy consumption, minimum distance to the Base Station, minimum Mobility and maximum Degree based on the weight of the node. Hence an improved design of CH selection algorithm is being proposed in next section.

## III. PROPOSED WORK

Grid based Energy Efficient Clustering Algorithm (GEECA) [10], an energy efficient algorithm which minimizes the energy consumption and thereby maximize the lifetime for the MWSN. GEECA algorithm partitions the sensing field into uniform grids with mobile sensor nodes which change the mobility with time. The algorithm focused mainly on four metrics, namely the Degree, Energy consumption, Distance between the node and the Base Station and the Mobility of a node. The weight of each node is calculated and the node with minimum weight is considered as the Cluster Head.

### Issues in GEECA

GEECA finds a Cluster Head based on the weight calculated using four metrics namely Degree, Energy Consumption, Distance between node and the Base Station and the Mobility of the node. A Cluster Head is elected in each grid based on the calculated weight. The Node with minimum weight is elected as Cluster Head in each grid. As the nodes are in mobility some of the grids are densely populated which is an overhead for the Cluster Head. The energy of the Cluster Head drains and the node is subjected to deplete energy and lead to the death of the node.

### DMGCEEA Algorithm

The proposed algorithm Density based Mean Grid Energy Efficient Clustering Algorithm (DMGEECA) for Mobile Wireless Sensor Networks uniformly partitions the sensing field into grids. The algorithm selects a Cluster Head in each grid based on the weight calculated from four metrics, Degree of the node, Energy Consumption of the Node, Mobility of the node and the Distance between the Base Station and the node. The algorithm increases the number of clusters in high density grids in order to reduce the overhead of the Cluster Head. The algorithm also elects a new Cluster Head when the Cluster Head leaves the Grid area due to mobility.

DMGEECA highlights mainly on the various assumptions for Mobile Wireless Sensor Networks that are as follows.

i. All nodes are deployed randomly and are in mobility.
ii. Sensor nodes have same initial energy level.
iii. The location of BS is in the center of the sensing field.
iv. All the Cluster Members send data to the CH which is forwarded to the Base Station.
v. All nodes will use the same radio channel for communication with each other.
vi. All the nodes communicate via a shared bidirectional wireless channel.

Step 1 : Check for node existence in each Grid
Step 2 : If Node exists in Grid
    Node - > Find 1 hop neighbors;
    Node - > Find the Deg( );
    Node - > Checks the Distance to the Base Station Dis_BS( ) ;
    Node - > Find the total Energy Consumption Econ( ) from Etrans and Erec ;
    Node - > Find the Mobility Mob() of the Node;
    Node - > Calculate the Weight based on Deg(), Dis_BS(),Econ and Mob( );
    End if
Step 3 : Check the position of the Node Node_Pos( )
Step 4 : Based on the Node_Pos( ) categorize into the specific Grid.
Step 5 : Check the density of the nodes in each Grid
Step 6 : For each Grid

If the Density_Nodes > Max_Density
Find the mean distance Mean_Dis ( ) of the nodes in the Grid
Group the nodes with
Node _ Dis_BS < Mean_Dis( )
CH - > Node with Minimum Weight
CH - > Form a Cluster with CM
CH - > Receives data, aggregates sends to BS
Else
CH - > Node with Minimum Weight
CH - > Form a Cluster with CM
CH - > Receives data, aggregates and sends it to BS
End If
` End For
Step 7 : Check the Node_Pos( ) of each node
Step 8 : If CM leaves Grid
CH - > Rejects the Membership of the CM
CM - > Requests the CH in the newly entered Grid
CH - > Accepts the Request by sending ACC to become CM
CM - > Joins the CH to form Cluster
Else
CM - > Requests the CH in the current Grid
CH - > Accepts the Request by sending ACC to become CM
CM - > Joins the CH to form Cluster
End If
Step 9 : Find the Mobility of the CH and the CMs
Step 10 : Find the Average Mobility of the Cluster
Step 11 : Find the overall Energy Consumption of the Cluster
Step 12 : Find the Lifetime of the entire Network

## IV. MWSN PARAMETERS AND DEFINITIONS

The Mobile Wireless Sensor Network can be defined by a graph $G = (V, E)$ where $V$ represents the Sensor Nodes and $E = \{(u,v): V/D(u,v) <= R\}$ represents the wireless connection between two nodes $u$ and $v$. $R$ represents the Transmission Range and $D(u,v)$ represents the Euclidean Distance between node $u$ and $v$.
Table 1 defines the parameters and their definitions in MWSN.

Table 1. Parameters and their Definitions in MWSN

| Parameters | Definitions |
|---|---|
| *N* | Number of nodes |
| *M(i)* | Mobility level of *u* |
| *Ec(i)* | Energy consumed by the node *u* |
| *DisBS(i)* | Distance between the node *u* and the Base Station |
| *Deg(i)* | Degree of node *u* |
| *Weight(i)* | Weight of the node *u* |
| *Mob(i)* | Mobility of *u* |

## V. RESULTS AND DISCUSSIONS

The algorithm is implemented using MATLAB 7.0.1 tool. The number of nodes N varies from 10 to 100. The simulation is carried out in a space of 100m x 100m and the Transmission Range of 40 m. The size of the message is 4000 bits. The initial Energy EI is 1.5J,
$E_{elec}$ = 50nJ/bit, $\epsilon_{amp}$=100pJ/bit/m$^2$.

The BS coordinates are (50, 50).

The proposed algorithm DMGEECA is compared with the recent algorithm GEECA (Grid based Energy Efficient Clustering Algorithm for Mobile Wireless Sensor Networks). This algorithm selects a node with minimum weight as the Cluster Head. Number of clusters in high density grids are increased. Table 2 represents the comparison of average energy consumption of GEECA and DMGEECA at Grid 1. Figure.1 represents that the average energy consumption of DMGEECA at Grid 1 is lesser than GEECA at Grid 1. As the density is reduced in Grid 1 at the completion of 30 sec the energy consumption remains the same.

Table 2. Comparison Of Average Energy Consumption Of GEECA Vs DMGEECA At Grid 1

| Time (Sec) | Energy (Joules) | |
|---|---|---|
| | ***GEECA_Grid -1*** | ***DMGEECA_Grid 1*** |
| **10** | 0.000711333 | 0.000489 |
| **20** | 0.00064505 | 0.00064505 |
| **30** | 0.00049025 | 0.00049025 |

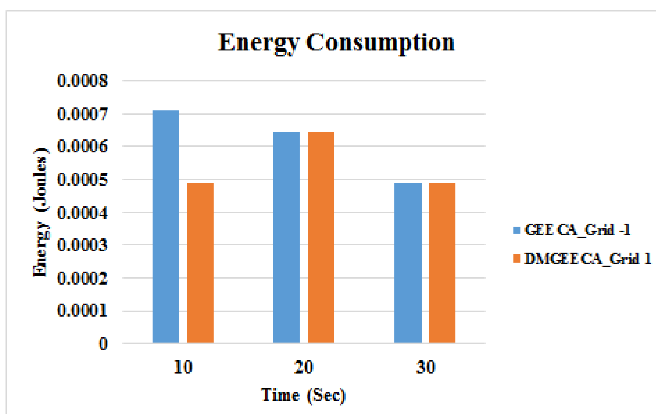


Figure1: Energy Consumption GEECA_Grid-1 Vs DMGEECA_Grid-1

 

Table 3 represents the comparison of average energy consumption of GEECA and DMGEECA at Grid 2. Figure.2 represents that the average energy consumption of DMGEECA at Grid 2 is lesser than GEECA at Grid 2. At 10 sec and 20 sec the energy consumption has been reduced as the number of clusters have been increased due to more density. After the completion of 30 sec the energy consumption remains the same as the density of nodes in the grid is less.

Table 3. Comparison Of Average Energy Consumption Of GEECA Vs DMGEECA At Grid 2

| Time (Sec) | Energy (Joules) | |
|---|---|---|
| | GEECA_Grid -2 | DMGEECA_Grid 2 |
| 10 | 0.00089207 | 0.000770804 |
| 20 | 0.00088414 | 0.00060213 |
| 30 | 0.0007945 | 0.0007945 |

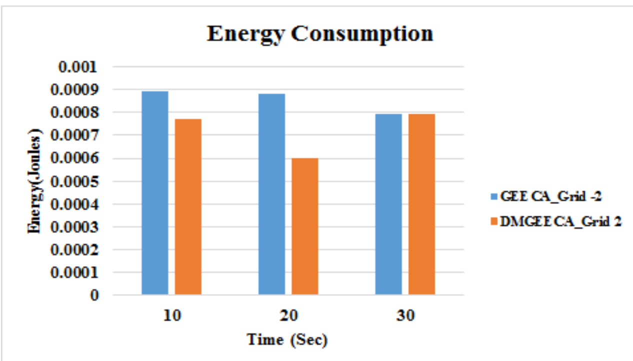


Figure. 2: Energy Consumption GEECA_Grid-2 Vs DMGEECA_Grid-2

Table 4 represents the comparison of average energy consumption of GEECA and DMGEECA at Grid 3. Figure.3 represents that the average energy consumption of DMGEECA at 10 sec, 20 sec and 30 sec has been reduced due to the increase in the number of clusters due to high density than in GEECA.

Table 4. Comparison Of Average Energy Consumption Of GEECA Vs DMGEECA At Grid 3

| Time (Sec) | Energy(Joules) | |
|---|---|---|
| | GEECA_Grid – 3 | DMGEECA_Grid 3 |
| 10 | 0.00073558 | 0.000722481 |
| 20 | 0.00083135 | 0.000572198 |
| 30 | 0.00076567 | 0.000544152 |

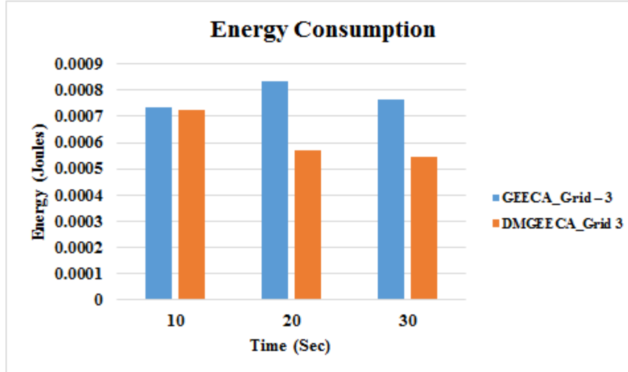


Figure 3: Energy Consumption GEECA_Grid-3 Vs DMGEECA_Grid-3

Table 5 represents the comparison of average energy consumption of GEECA and DMGEECA at Grid 4. Figure. 4 represents that the average energy consumption of DMGEECA is reduced than GEECA in Grid 4 at 10 sec and 20 sec due to the increase in number of clusters as the density is higher. After the completion of 30 sec the energy consumption of nodes retain the same as the density of nodes are lesser.

Table 5. Comparison Of Average Energy Consumption Of GEECA Vs DMGEECA At Grid 4

| Time (Sec) | Energy(Joules) | |
|---|---|---|
| | GEECA_Grid – 4 | DMGEECA_Grid 4 |
| 10 | 0.000980333 | 0.00049496 |
| 20 | 0.00112564 | 0.00074146 |
| 30 | 0.000881 | 0.000881 |

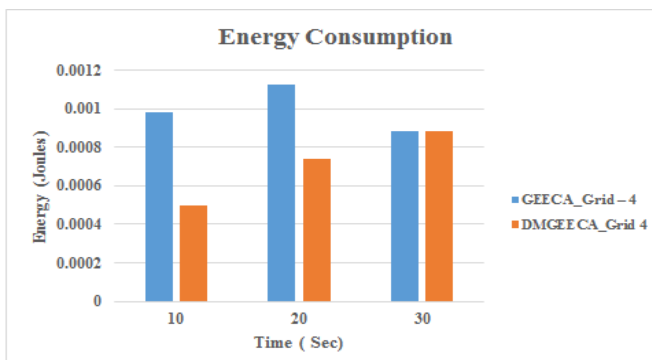


Figure. 4: Energy Consumption GEECA_Grid-4 Vs DMGEECA_Grid-4

Table 6 represents the comparison of average energy consumption of GEECA and DMGEECA. Figure. 5 represents that the average energy consumption of DMGEECA lesser than GEECA as the number of clusters are increased in Grids with high density.

 

Table 6. Comparison Of Average Energy Consumption Of GEECA Vs DMGEECA

| Time (Sec) | GEECA | DMGEECA |
|---|---|---|
| **10** | 0.000829829 | 0.000619311 |
| **20** | 0.000871545 | 0.000643572 |
| **30** | 0.000732855 | 0.000677476 |

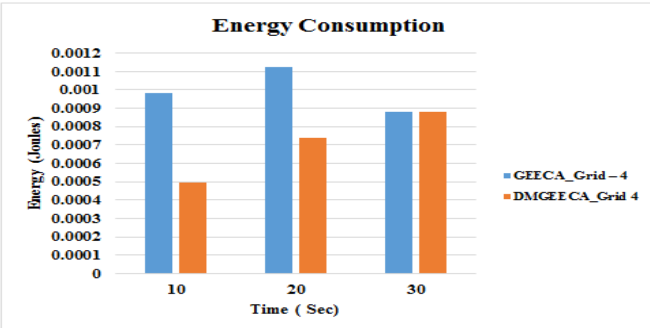


Figure. 5: Average Energy Consumption GEECA Vs DMGEECA

Table 7 represents the comparison of energy consumption with mobility based on time in GEECA and DMGEECA at Grid 1. Figure.6 depicts the energy consumption of GEECA and DMGEECA during mobility for a duration of 10 Seconds, 20 Seconds and 30 Seconds in Grid 1. The Figure shows that the energy consumption at 10 Seconds, 20 Seconds and 30 Seconds is similar in GEECA at Grid 1 and DMGEECA as the migration of nodes to Grid 1 is very low.

Table 7. Comparison Of Energy Consumption With Mobility Based On Time At Grid 1

| Mobility Vs Energy | | | | | | |
|---|---|---|---|---|---|---|
| GEECA Vs DMGEECA at Grid 1 | | | | | | |
| Mobility | Energy (Joules) | | | | | |
| | 10 Sec | | 20 Sec | | 30 Sec | |
| | GEECA - Grid 1 | DMGEECA - Grid 1 | GEECA - Grid 1 | DMGEECA-Grid 1 | GEECA - Grid 1 | DMGEECA - Grid 1 |
| 0.98995 | 0.000439 | 0.000439 | 0.000429 | 0.000429 | 0.000439 | 0.000439 |
| 1.08423 | 0.000439 | 0.000439 | 0.000429 | 0.000429 | 0.000439 | 0.000439 |
| 1.13137 | 0.000439 | 0.000439 | 0.000439 | 0.000439 | 0.000451 | 0.000451 |
| 1.17851 | 0.000439 | 0.000439 | 0.000439 | 0.000439 | 0.000451 | 0.000451 |
| 1.22565 | 0.000439 | 0.000439 | 0.000439 | 0.000439 | 0.000451 | 0.000451 |

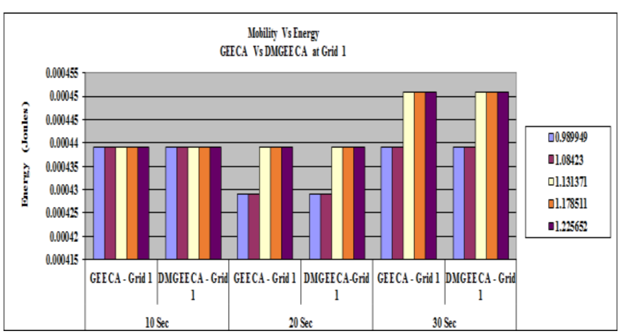


Figure. 6: Energy Consumption Vs Mobility at Grid-1 based on Time

Table 8 represents the comparison of energy consumption with mobility based on time in GEECA and DMGEECA at Grid 2. Figure.7 depicts the energy consumption of EEECA and GEECA during mobility for a duration of 10 Seconds, 20 Seconds and 30 Seconds in Grid 2. The Figure represent that the energy consumption is similar.

Table 8. Comparison Of Energy Consumption With Mobility Based On Time At Grid 2

| Mobility Vs Energy | | | | | | |
|---|---|---|---|---|---|---|
| GEECA Vs DMGEECA at Grid 2 | | | | | | |
| Mobility | Energy (Joules) | | | | | |
| | 10 Sec | | 20 Sec | | 30 Sec | |
| | GEECA - Grid 2 | DMGEECA - Grid 2 | GEECA - Grid2 | DMGEECA - Grid2 | GEECA - Grid 2 | DMGEECA - Grid 2 |
| 0.989949 | 0.000439 | 0.000439 | 0.000439 | 0.000439 | 0.000439 | 0.000439 |
| 1.08423 | 0.000439 | 0.000439 | 0.000439 | 0.000439 | 0.000439 | 0.000439 |
| 1.131371 | 0.000451 | 0.000451 | 0.000439 | 0.000439 | 0.000439 | 0.000439 |
| 1.178511 | 0.000451 | 0.000451 | 0.000439 | 0.000439 | 0.000451 | 0.000451 |
| 1.225652 | 0.000465 | 0.000465 | 0.000439 | 0.000439 | 0.000451 | 0.000451 |

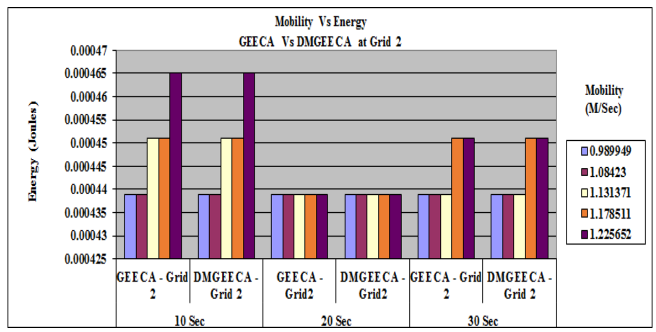


Figure. 7: Energy Consumption Vs Mobility at Grid-2 based on Time

Table 9 represents the comparison of energy consumption with mobility based on time in EEECA and GEECA at Grid 3. Figure.8 depicts the energy consumption of EEECA and GEECA during mobility for a duration of 10 Seconds, 20 Seconds and 30 Seconds in Grid 3. The Figure shows that the energy consumption remains the same.

Table 9. Comparison Of Energy Consumption With Mobility Based On Time At Grid 3

| Mobility Vs Energy | | | | | | |
|---|---|---|---|---|---|---|
| GEECA Vs DMGEECA at Grid 3 | | | | | | |
| Mobility | Energy (Joules) | | | | | |
| | 10 Sec | | 20 Sec | | 30 Sec | |
| | GEECA - Grid 3 | DMGEECA - Grid 3 | GEECA - Grid 3 | DMGEECA - Grid 3 | GEECA - Grid 3 | DMGEECA - Grid 3 |
| 0.989949 | 0.000439 | 0.000439 | 0.000429 | 0.000429 | 0.000429 | 0.000429 |
| 1.08423 | 0.000439 | 0.000439 | 0.000439 | 0.000439 | 0.000439 | 0.000439 |
| 1.131371 | 0.000451 | 0.000451 | 0.000439 | 0.000439 | 0.000439 | 0.000439 |
| 1.178511 | 0.000451 | 0.000451 | 0.000451 | 0.000451 | 0.000451 | 0.000451 |
| 1.225652 | 0.000465 | 0.000465 | 0.000451 | 0.000451 | 0.000451 | 0.000451 |

 

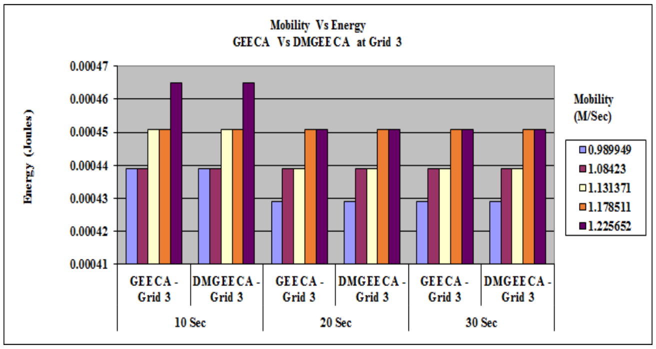


Figure. 8: Energy Consumption Vs Mobility at Grid-3 based on Time

Table 10 represents the comparison of energy consumption with mobility based on time in EEECA and GEECA at Grid 4. Figure.9 depicts the energy consumption of EEECA and GEECA during mobility for a duration of 10 Seconds, 20 Seconds and 30 Seconds in Grid 4. The energy consumption is similar.

Table 10. Comparison Of Energy Consumption With Mobility Based On Time At Grid 4

| Mobility Vs Energy<br>GEECA Vs DMGEECA at Grid 4 | | | | | | |
|---|---|---|---|---|---|---|
| Mobility | Energy (Joules) | | | | | |
| | 10 Sec | | 20 Sec | | 30 Sec | |
| | GEECA - Grid 4 | DMGEECA - Grid 4 | GEECA - Grid 4 | DMGEECA - Grid 4 | GEECA - Grid 4 | DMGEECA - Grid 4 |
| 0.989949 | 0.000439 | 0.000439 | 0.000429 | 0.000429 | 0.000429 | 0.000429 |
| 1.08423 | 0.000439 | 0.000439 | 0.000429 | 0.000429 | 0.000429 | 0.000429 |
| 1.131371 | 0.000451 | 0.000451 | 0.000439 | 0.000439 | 0.000439 | 0.000439 |
| 1.178511 | 0.000451 | 0.000451 | 0.000439 | 0.000439 | 0.000451 | 0.000451 |
| 1.225652 | 0.000465 | 0.000465 | 0.000439 | 0.000439 | 0.000451 | 0.000451 |

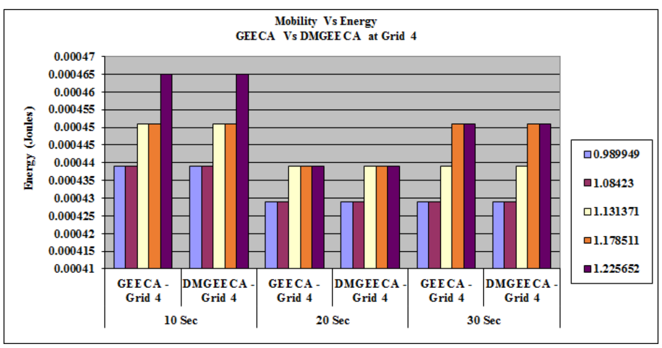


Figure. 9: Energy Consumption Vs Mobility at Grid-4 based on Time

## VI. Conclusion and Future Research Directions

In this paper, Density Based Mean Grid Energy Efficient Algorithm for Mobile Wireless Sensor Networks (DMGEECA) is proposed for reducing the energy consumption. Simulation results showed that the proposed contribution DMGEECA is more efficient in saving energy and reducing the energy consumption thereby increasing the lifetime of the nodes. The energy consumption during mobility remains the same which is the limitation of this algorithm and is subject to future enhancements.

## REFERENCES


[1] Shantala Devi Patil, Vijayakumar B P, "*Clustering in Mobile Wireless Sensor Networks: A Review*", In the Proceedings of 1st International Conference on Innovations in Computing & Networking (ICICN16), May 2016.

[2] K. Juliet Catherine Angel, Dr. E. George Dharma Prakash Raj, "*Clustering Algorithms in Mobile Wireless Sensor Networks – A Survey*", International. Journal of Engineering Research and Application, Vol. 7, Issue 12, ( Part -6), pp.17-21, December 2017.

[3] A. Garg, N. Batra, I. Taneja, A. Bhatnagar, A. Yadav, S. Kumar, "*Cluster Formation based Comparison of Genetic Algorithm and Particle swarm Optimization Algorithm in Wireless Sensor Network*", International Journal of Scientific Research in Computer Science and Engineering, Vol.5, Issue.2, pp.14-20, 2017

[4] Fatiha Djemili Tolba ; Wessam Ajib ; Abdellatif Obaid, "*Distributed Clustering Algorithm for Mobile Wireless Sensors Networks*", SENSORS 2013, IEEE, 2013.

[5] Abhinav Gupta, Prabhdeep Singh, "*Improving The Performance Of Mobile Wireless Sensor Networks Using Modified DBSCAN*", International Journal of Computer Sciences and Engineering (IJCSE), Vol -3, Issue 8, ,pp. 06-10, 2015.

[6] Kavita Gupta, Aarti Singh, Rashmi Singh, Saurabh Mukherjee, "*An Improved Cluster Head Selection Algorithm for Mobile Wireless Sensor Networks*", Journal of Network Communications and Emerging Technologies (JNCET), Vol.5, Special Issue 2, December (2015).

[7] Dahane Amine, Berrached Nasr-Eddine, Loukil Abdelhamid, "*A Distributed and Safe Weighted Clustering Algorithm for Mobile Wireless Sensor Networks*", ELSEVIER, Procedia Computer Science, Vol. 52, pp. 641-646, 2015.

[8] Rehman, E., Sher, M., Naqvi, S. H. A., Badar Khan, K., & Ullah, K, "*Energy Efficient Secure Trust Based Clustering Algorithm for Mobile Wireless Sensor Network*", Journal of Computer Networks and Communications, Vol 2017, Article ID 1630673, 2017.

[9] K. Juliet Catherine Angel, Dr. E. George Dharma Prakash Raj, "*EEECA: Enhanced Energy Efficient Clustering Algorithm for Mobile Wireless Sensor Networks*", 2017 World Congress on Computing and Communication Technologies (WCCCT), IEEEXPlore Digital Library, pp. 2-4, Feb 2017.

[10] K. Juliet Catherine Angel, Dr. E. George Dharma Prakash Raj, "*GEECA: Grid Based Energy Efficient Clustering Algorithm for Mobile Wireless Sensor Networks*", Saudi Journal of Engineering and Technology (SJEAT), Vol-2, Iss-12, pp. 458-463, Dec, 2017.


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**Dr .E. George Dharma Prakash Raj** completed his Masters Degree in Computer Science and Masters of Philosophy in Computer Science in the years 1990 and 1998. He has also completed his Doctorate in Computer Science in the year 2008. He has around twenty seven years of Academic experience and twenty years of Research experience in the field of Computer Science. Currently he is working as an Asst. Professor in the School of Computer Science and Engineering at Bharathidasan University, Tiruchirappalli, India. He is an Editorial Board Member, Reviewer and International Programme Committee Member in many International Journals and Conferences. He has published several papers in International Journals and Conferences related to Computer Science He has convened many National and International Conferences related to Computer Science. His Areas of Interest are Computer Networks, Big Data, Cloud Computing and Internet of Things.

 