

Quality Enhancement in Traffic Congestion of Sensor Network Through Pass-Process Model

Rian Muhammad Malik
E-mail: mrianmalik@gmail.com

Abstract— sensor has increasingly become one of the widely used networks over the past several years. It is being used in many fields i.e. military security surveillance, habitat monitor the environmental conditions such as temperature, pressure and sound, target tracking and medical application etc. Like the other networking threats and challenges, the sensor network also face some important threat, one of them is traffic congestion in the network which always remains a problem and finding the best solution for this is still a research issue. The main challenge is to take all the possible solution in consideration and make the network more reliable. This research "Quality Enhancement in Traffic Congestion of Sensor Network through Pass-Process Model" is suggested. This proposed research is applicable to reduce the traffic congestion on sensor network.

This new proposed framework model will offer quality enhancement in sensor network by reducing the traffic congestion through Pass-Process method, each Sink Node will observe the traffic and take a decision according the situation

Keywords—sensor network, traffic congestion, quality enhancement, Pass-process Method, queuing

I. INTRODUCTION

Sensor networking is used increasingly in many industrial and consumer i.e. security surveillance, under water exploration and in many research fields. Sensor Network need highly enhancement in this field to fulfill today's requirements. So the enhancement in this field is still a research challenge.

By establishing the sensor network we can get the required mission and this network can be very helpful to gain many purposes which are not possible without sensor network. We can use it for a security purpose where to get information is worst and tireless job and is not an easy task even not possible some time. We can also use the sensor network for different purposes i.e. research based activities. Though it has many advantages and makes some impossible situation possible but there are many problems still challenging and to eradicate them is still tedious job.

Some important considerations in this sensor network are; the security of the sensor network which can occur in the form of malicious node attack at some occasions due to which the security will become insecure and the hacker can easily disclose and keep strong holds on the activities that are being performed through under sensor network. Another important consideration about sensors is, the sensors cannot be recollected from their position where these sensor had been spread over the surface, during which these sensor going down into the water stream, below the soil surface. So it is helpful to face such a situation and to make it robust and more resistant and to make it able to handle such a worst situation. Power capacity is also an issue in sensor network because the sensor is with limited resources in term of power and battery energy so sensor network are more

vulnerable to resource depletion attacks. To develop such a mechanism where the power consumption will be less and less but the sensor working condition should be 100% reliable with any condition which has to face is still a challenging task. While keeping these all into count the system should be developed in such a way that will be able to process quickly and gives abrupt response, but the network some time faces many problems during performing and generating results through which the decision can not be taken on the spot. Sometimes a Sink node need more processes with the limited memory buffer, power etc.

When this node faces many activities to perform in this situation, it become stuck and can not be in a position to process the data packets and may cause traffic congestion and data packet lost. So the main problem from the many problems reasons is traffic congestion problem.

The term network congestion is actually is the name of reduced quality of services and occurs when a network or the receiving device receives more data than their capacity. Due to congestion it affects delay in response, packet loss or blocking of new coming data for processing.

There are many types of the traffic congestion i.e. link congestion which may occurs when huge data take the same route to travel and the Node congestion may occurs when data arrive at device having full buffer memory, and then it must wait for its turn that is also known "queuing".

Third is device performance i.e. if the band width is not enough then the router or switch is not able to keep up w the traffic rate with low bandwidth.

Third is the over utilization of a link may also cause congestion problem. There are many type of strategies are using to reduce these problems which are , Congestion Avoidance and Detection(CODA), Congestion Control and

Fairness(CCF),Adoptive Rate Control (ARC),Priority Base Congestion Control Protocol(PCCP), Fusion and many more being use either to get rid from or to reduce the traffic congestion in the network.

Here in this research I introduce a new method to reduce the congestion process more frequently and easily. This new method is known as “Quality Enhancement in Traffic Congestion of Sensor Network by through Pass-Process Model” or in briefly PPM Model, this is a new and more efficient phenomena being introduced in this research.

II. RELATED WORKD

A. Background

The term sensor is using for this because of its nature ,this device has the capability to sensing and detection when any object move or pass through on it.This sensor networking is using in many areas almost with the same purposes i.e. sensing and to take decision on it. And many strategies and developments have been done on it but still it faces many problems and the bottlenecks have to removes to make the network stronger and more reliable.

B. Traditional Techinques

There are so many techniques which are using for the same purpose i.e. to reduce the traffic congestion in the sensor network is the given the name, traditional techniques. All the previous research techniques will be called Traditional Technique in this research paper.

CODA is the most popular method that detects congestion by checking the buffer size and transmission rate. If these two exceed from the pre-define threshold, it inform the neighbor sensor to decrease the transmission rate. But their still a problem, though it reduce the traffic congestion but on the other hand it's not giving permission data packet to enter in as a result it may cause response delay for some activities has to perform quickly .So this is not quite enough technique to rely on.by taking another mechanism.

Priority Based Congestion Control Protocol (PCCP), is also another famous technique that is working on the base of priority index and perform the task using index table and always given more importance to that node which are more near to the Sink node. But this method also a drawback that is, this is not necessary that the neighbor node of the sink Node always should be on priority.Priority depends on the activity detects and have to perform by any node.

Pump slowly and Fetch Quickly (PSFQ) is control protocol using with the purpose to distribute the data from sink node to sensor node. PSFQ is a proposed to reduce the congestion for downward stream reliability .PSFQ is based on slowly injects packet into the network “Pump Operation” and hop by hop recovery in the case of packet loss “fetch Operation”. The disadvantages of PSFQ are,1) It cannot be used in forward direction and does not address packet loss due to congestion,2) the transmission of data packet is relatively slow in operation and hence there is large delay in the system, 3) cannot detect a single loss packet individually

as it uses NACK signal for indication and the entire block is re-transmitted upon request.

III. PROPOSED MODEL

The two main issues have been taken under consideration In my research that are link congestion which occurs when the data arrival of much traffic and having limited buffer memory space at device and this is also known as queuing, due to which it affects delay in response, packet loss or blocking new coming data for processing.

Another main issue in the sensor is the power depletion, because when the sensor get ready and thrown in the required location or space, these wireless sensors never gain back and cannot provide the power again and again .So there should be such a mechanism which look after the power (battery capacity) and if the power is not enough to process the data, at least it can supervise and tackle the situation from that limited power until it is live.

To reduce these kind of problems which may lead the situation to congestion problem(either due to link congestion or congestion which occurs due to not processing the data traffic due to low power) .

With the hope and struggle to overcome on these main problems I have proposed the new model which is known as “Quality Enhancement in Traffic Congestion of Sensor Network through Pass-Process Model” or in short PPM .This proposed model will look the two main parameters (data traffic rate and power capacity) which help them to make a on decision making. The decision will be taken on the algorithms which always take the data traffic and power as a parameters.

For more clear understanding this model has been divided in to two phases .The phase-I shows the Pass-Method while the phase-II shows the Process Method.

A. Phase-I

Consider in the below figure 1, scenario shows the general method being used in the sensor networking.

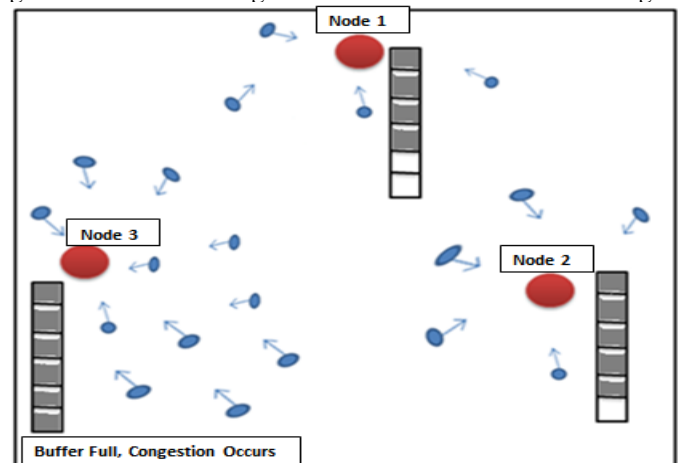


Figure :1.1

As this scenario shows that due to more data packets receiving in the Node-II, congestion occurs. This kind of network can not take support of the neighbor and always process on their own data packets which some time come under the huge traffic and stuck there.

Now taking the same situation into new PPM model to process. The same processes to perform by using PPM model.

PPM proposed Model

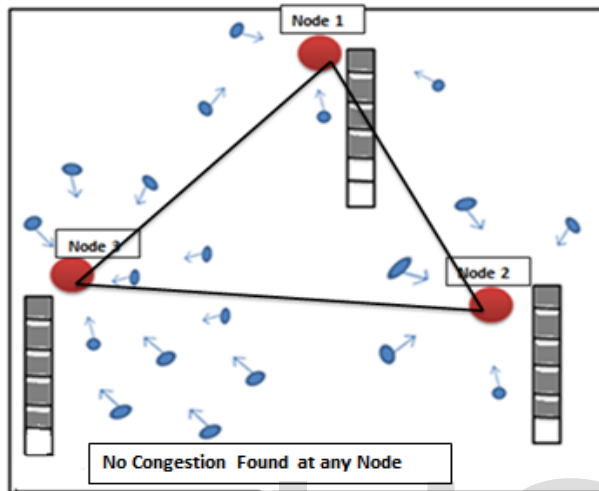


Figure :2

As the figure 2 shows that it has not be congestion state in any situation even in larger data receiving Node.

Phase-II

This phase shows the performance comparison between general method and PPM Model. Consider below the given activity has to perform by general Method. The other entire model except PPM model has been put in the general method.

Scenario-1

Each sink node has the capacity to store 5 tasks in his buffer memory. Sink Node-I Receives 4 data packets from the surrounding, Sink Node-II receives 8 data packets from the surroundings and Sink Node-III receives 2 data packets from its surrounding, so what will be the situation in general condition.

N-I

Sink Node-II

Traffic (Packets)	Filled Space	Remaining Space	Remaining Packets	Status
8	5	0	3	Congestion

N-II

Sink Node-I

Traffic (Packets)	Filled Space	Remaining Space	Remaining Packets	Status
4	4	1	0	No Congestion

N-III

Sink Node-III

Traffic (Packets)	Filled Space	Remaining Space	Remaining Packets	Status
2	2	3	0	No Congestion

Summary

Congestion Occurred=1

Lost Packets= 3

Now the same situation has to perform by PPM Model

The diagram illustrates a network topology with three Sink Nodes (N-I, N-II, and N-III) connected in a triangular configuration. Each Sink Node is associated with a table showing its current state:

- Sink Node-I:**

Traffic (Packets)	Filled Space	Remaining Space	Remaining Packets	Status
4	4	1	0	No Congestion
- Sink Node-II:**

Traffic (Packets)	Filled Space	Remaining Space	Remaining Packets	Status
5	5	0	0	No Congestion
- Sink Node-III:**

Traffic (Packets)	Filled Space	Remaining Space	Remaining Packets	Status
5	5	0	0	No Congestion

Connections are shown between Sink Node-I and Sink Node-II, Sink Node-I and Sink Node-III, and Sink Node-II and Sink Node-III.

Summary

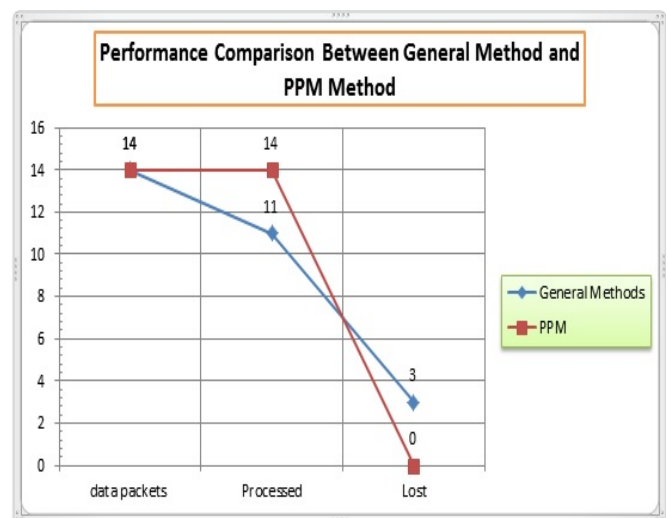
Congestion Occurred =0

Lost Packets=0

Figure: 4

B. Phase-III

Graphical representation of Phase-II



IV. PROPOSED MECHANISM

This section gives the detail of the working mechanism of the proposed model. This proposed model will use Pass-

Process method for the data packet receiving and processing it accordingly.

PPM take the update and supervise the memory buffers of all the working Sink Node, if the data traffic is normal and the power of the node is enough then the data packet will be at normal position, save in buffer and process accordingly. This is also called process phase. To perform the task for every node it is necessary to fulfill both parameters (data rate and power capacity). When the data traffic rate is not normal and the data packets are going to be overflow then there is a chance of link congestion then this PPM will start to take action on that node.

First it will use the pass method to clear the traffic from the receiving node which may cause congestion further.

The third situation is that when the data rate is normal but the power of the node is not in such a position to process it completely due to low power capacity so in this situation it also prefers to send the data to the next node and keep itself as a supervisor position with the low power. So this process will also help to reduce the congestion chance from the node, though it has normal data rate but due to un-processed data it may give a chance of congestion further.

The fourth situation can be, when power is enough but the data traffic rate is very high than at this position, it prefers to use the pass method also as compared to process all, because when the data receiving rate is increasing to the process rate then it may cause a chance of network congestion.

When we look at the passing and processing mechanism of this model, the PPM will also prefer to process the queued data but there may be a chance of congestion that's why this model uses a strategy which has been given the name "Pass Even Index packet, Process Odd index Packet". This is the strategy which is preferable because the first data packet in the buffer will be at 1 and that is at high priority to process at any cost and also stood in first top from the index also. So the sink node entertains this packet at any cost and can send the next coming node to neighbor which has the chance to get higher priority in neighbor node. That's why this mechanism is highly preferable.

Further explanation, Let Node A has to send any data to Node B to avoid the congestion process. Now by using Pass even-index packet and Process Odd-index packet, it sends the 4th index packet to Node B. The situation in the Node B is, it is processing 1st indexed data and there is no more data packet to process so when Node A sends the data to Node B, the Node B will process their own data packet and give this space to the packet which has been sent from the Node A. Observe now the situation in the Node A had to process their own high index order and had send the packet from the low priority which was index 4, has to process at 4th priority but due to the pass-process mechanism it processes in the Node B at 2. So it means at two levels better and firstly it has been processed, this also shows the efficiency of the Pass-Process Model.

V. RESEARCH OBJECTIVES

There are some important characteristics of this research which show the quality and efficiency of the research.

1. Less Attack of Malicious Node

Malicious Node attack is one of the major issues in the sensor network. Which presents itself as a member node of the system and tries to disclose the secrecy of network and the data and information can be hacked through this malicious node. This new Pass Process Model (PPM) is very helpful to and less effective network model from the malicious node attack because this system believes in sharing data packets among itself so they clearly now form which node this data is being shared and if any malicious node enters to make itself the part of the network so that node clearly and easily understands through communication with each other. So this model is more trustful and reliable than other models.

2. Efficiency

This Proposed PPM model is more efficient than the other using general model i.e. CODA, PCCP because this model neither decreases the packet receiving speed nor processes on priority bases, all the data packets are dealt equally that are coming to the Node, equally important and have to process according to their receiving queue and there is more better chance to process data packet quickly on other Node due to receiving much better index position in another Node. By considering these characteristics, PPM is considered to be a much efficient model rather than other models.

3. Proper Utilization

The nature of PPM is to manage the data packet as well as the proper utilization of each Node. So each Sink node can properly utilize through this mechanism. One of the main problems in the sensor is power consumption problem because it is not possible to provide power to the sensor again and again so this mechanism utilizes almost all the sensors before the depletion of the battery power. When the power remaining is less and not enough to process any long data packet so at that time this node will become a supervisor, just receive the data and send these data to another node so in this situation it will utilize and manage more data packet and the congestion chance will also be reduced due to data passing.

4. Flexibility

PPM is more flexible than the other techniques because it never restricts on data receiving, it is always ready to accept the incoming data packets and never lets to build more burden on the single Node. This nature of PPM also the nature of carrying and sharing and the whole members of the network play their role for making the networking more reliable.

At any stage either with full of capacity of power or buffer memory or with limited amount of space and low power, always ready to process and facilitates the network according to the requirement.

5. Facilitated Process Preference Method

This new proposed PPM model gives much better data traffic rout as well as quick process and quick response to the system .The data processing rate is much greater compare to other existence general models. It reduces the response delay with high efficiency and quick process. One of the major concern and important parameter for a reliable and efficient network is that which accepts much request, much processes and quick response.

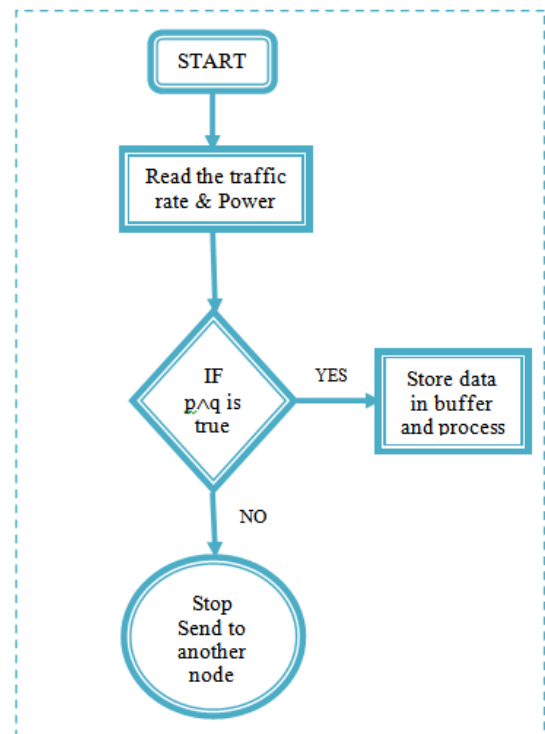
A system through which larger amount of data be taken processed but with slow response is never be consider reliable nor such a network will be more efficient network which processes less amount of date and gives quick response. The larger amount of data processing and quick response are the parts and parcel to be efficient and reliable network .So PPM is better facility providing model as compare to other Models being used before.

VI. PROPOSED ALGORITHM

PPM_Alogorith (Data Traffic Rate, Buffer Space, Power)

1. READ (Data Traffic Rate, Buffer Space, Power)
2. IF Data Traffic Rate is normal and Power is enough
THEN
 - 2.1 Keep the data in Buffer and process accordingly
 - 2.2 Update Buffer Status.
 - 2.3 Update the Data Traffic Rate.
 - 2.4 Check the power capacity.
3. ELSE
 - 2.4 Pass the data packet to the neighbor Node accordingly.

VII. FLOW CHART



The $p \wedge q$ is show the two conditions are the traffic rate (p) and enough power (q)

VIII. METHAMATICAL PROOF THROUGH TROUGH TABLE

General this mechanism take the data traffic rate and power of the node under consideration and make a decision on these two important parameters

The decision will take on the base of some condition that can also proof through conjunction in the truth table.

The two parameters are given below

1. Normal Data Traffic, denoted by (p).
2. Enough Power of the node, denoted by (q)

The both conditions must be check that, is the data traffic is normal and is the power of the node is enough.so through conjunction

$p \wedge q$ will be true if only if both conditions will be true otherwise it will be false so through truth table of the conjunction.

p	q	$p \wedge q$	Decision
t	t	t	Process on the same node accordingly
f	t	f	Pass to Neighbor Node accordingly
t	f	f	Pass to Neighbor Node accordingly

f f f Pass to Neighbor Node accordingly

IX. CONCLUSION

In this paper I proposed an efficient and flexible model to reduce the traffic congestion on sensor network. I used the new pass-process model for sharing and processing data packets among the Nodes which eliminate the bottle necks from the previous models. Because the traffic congestion may cause many problems.i.e packet loss due to unavailability of space in the buffer of the Node, the delay response due to long queuing waiting for a long time.

According to the need of the day, the PPM Model provides maximum utilization of the network and provides best services according to the demand. It is more reliable model then the others because it gives the real time processing and also best utilization of the components of the network with available power and memory capacity.

The battery power is one of the main issues in sensor network. If the battery depletes and un-able to process more data the PPM do not put Borden on that node, the node will just supervise to send and to receive data with available power capacity.

The PPM also avoids the malicious nod attack on the network because the available nodes in the system keep the record of one and they also know the status of each Node. When the malicious node enters into the system they will be identified easily and quickly.

Another main advantage of this research is, it provide best space for further research in this field.

REFERENCES

- [1] Raheleh Hashemzahi1Reza Nourmandipour2,Farokh koroupi31 ,2 "Congestion in Wireless Sensor Networks and Mechanisms for Controlling Congestion" Department of Computer, Sirjan Branch, Islamic Azad University ,Sirjan,Iran ,3Department of Computer, Baft Branch, Islamic Azad University ,Baft,Iran Vol. 4 No.3 Jun-Jul 2013.
- [2] N. Thrimoorthy Assistant Professor, New Horizon College of Engineering Bangalore, India.T. Anuradha, PhD Associate Professor, Dept. of Computer Science,Dravidian University, Kuppam, A.P.,India," Congestion Avoidance Routing in Wireless Sensor Networks" International Journal of Computer Applications (0975 – 8887) Volume 141 – No.5, May 2016.
- [3] Bret Hull, Kyle Jamieson, Hari Balakrishnan," Mitigating Congestion in Wireless Sensor Networks" ,MIT Computer Science and Artificial Intelligence LaboratoryThe Stata Center, 32 Vassar St., Cambridge, MA 02139 .
- [4] Majid Gholipour1, Abolfazl Toroghi Haghighat2* and Mohammad Reza Meybodi3," Hop-by-hop traffic-aware routing to congestion, control in wireless sensor networks" Gholipour et al. EURASIP Journal on Wireless Communications and Networking (2015) 2015:15 DOI 10.1186/s13638-015-0241-5.
- [5] Nazbanoo Farzaneh · Mohammad Hossein Yaghmaee ,” An Adaptive Competitive Resource Control Protocol for Alleviating Congestion in Wireless Sensor Networks:An Evolutionary Game Theory Approach”, Published online: 21 November 2014© Springer Science+Business Media New York 2014 Wireless Pers Commun (2015) 82:123–42 DOI 10.1007/s11277-014-2198-9.
- [6] Shumaila Javaid1 · Hamza Fahim1 · Zara Hamid1 ·Faisal Bashir Hussain2 ,” Traffic-aware congestion control (TACC) for wirelessmultimedia sensor networks”Received: 19 October 2015 / Revised: 31 March 2016 / Accepted: 29 November 2016 © Springer Science+Business Media New York 2016.
- [7] KaiminWei1,5 · Song Guo2 · Xiangli Li3 · Deze Zeng4 · Ke Xu5,” Congestion control in social-based sensor networks: A social network perspective”,Received: 30 September 2014 / Accepted: 29 March 2015 / Published online: 17 April 2015 © Springer Science+Business Media New York 2015.
- [8] Jaeun Choi,1 Gisung Kim,2 and Sehun Kim3,Hindawi” A Congestion-Aware IDS Node SelectionMethod forWirelessSensor Networks” Publishing Corporation International Journal of Distributed Sensor Networks Volume 2012, Article ID 582139,
- [9] Claudia Bauzer Medeiros · Marc Joliveau ·Geneviève Jomier · Florian De Vuyst,”Managing sensor traffic data and forecasting unusual behaviour propagation”, Accepted: 4 January 2010 / Published online: 28 January 2010 © Springer Science+Business Media, LLC 2010.
- [10] G.Srinivasan1& S.Murugappan,” A SURVEY OF CONGESTION CONTROL TECHNIQUES IN WIRELESS SENSOR NETWORKS”, International Journal of Information Technology and Knowledge ManagementInternational Journal of Information Technology and Knowledge ManagementJuly-December 2011, Volume 4,No.2,pp.413-415.
- [11] Wei Ding1 · Liangrui Tang1 · Sen Feng1,” Traffic-Aware and Energy-Efficient Routing Algorithm for Wireless Sensor Networks” Published online: 19 July 2015, Springer Science+Business Media New York 2015.
- [12] Muhammad Mostafa Monowar ·Muhammad Mahbub Alam · Md. Obaidur Rahman ·Choong Seon Hong · Sungwon Lee,” A load-aware energy-efficient and throughput-maximized asynchronous duty cycle MAC for wireless sensor networks”, Received: 25 December 2009 / Accepted: 12 April 2010 / Published online: 7 May 2010,© Institut Télécom and Springer-Verlag 2010.
- [13] Jaewon Kang Æ Yanyong Zhang Æ Badri Nath,” An optimal resource control scheme under fidelity and energy constraints in sensor networks”, Published online: 11 September 2007 _ Springer Science+Business Media, LLC 2007.
- [14] Omer Chughtai1,2 · Nasreen Badruddin1 · Azlan Awang1 · Maaz Rehan2,” Congestion-aware and traffic load balancing scheme for routing in WSNs”, Published online: 15 January 2016,© Springer Science+Business Media New York 2016.
- [15] Fatma Hanafy El-Fouly1,• Rabie Abd Ramadan2,3• Mohamed I. Mahmoud4•Moawad I. Dessouky5,” Congestion-aware and traffic load balancing scheme for routing in WSNs”, Published online: 15 January 2016 © Springer Science+Business Media New York 2016