International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 9 Issue 2 ǁ 2021 ǁ PP. 41-49

"Analysis of Load Balancing Techniques for Maximizing Life Time in Wireless Sensor Network"

Shamit Kumar, Dr.Awadhesh Kumar,Dr.D.L.Gupta
Department of Computer Science and Engineering KNIT Sultanpur
Department of Computer Science and Engineering KNIT Sultanpur

ABSTRACT
Wireless sensor networks denote a set of little, less weighted wireless nodes. In this type of network, the nodes which sense are dispersed in large physical regions to sense the data and the sink node is used to gather data from various sensor nodes, therefore data collection is vital factor in wireless sensor network. Each node in this comprises of three subparts or subcomponents first sensor subpart which sense and locate environment, second subpart which perform local manipulation on sensed data and third subpart which is responsible for exchanging the message.

KEYWORDS
WSN *Wireless Sensor Network*
BS *Base Station*
PDR *Packet Delivery Ratio*
STCP *Sensor Transmission Control Protocol*
PORT *Price-Oriented Reliable Transport Protocol*
PSFQ *Pump Slow Fetch Quick*

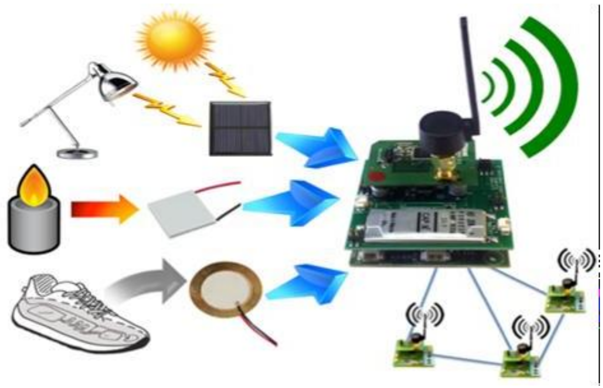
Date of Submission: 10-02-2021 Date of acceptance: 24-02-2021

I. INTRODUCTION

Because of low usage of power of embedded computing devices and technical development in the processor and communication, WSN (Wireless sensor network) is the most basic service applicable in commercial areas. They comprise of nodes which sense the parameters like temperature, humidity, pressure, position, vibration, sound etc. Nodes can be used in numerous applications to execute number of tasks like detecting smart devices, discovering neighbor nodes, processing of data and its storage, tracking of the target and locating the node.

The technology of wireless sensor networks is comprised of huge scope for many application areas like medical, environmental, transportation, military, entertainment, homeland defense, crisis management and smart spaces.

A Wireless Sensor Network includes numerous circulating, self-directed, small devices with low power named sensor nodes called motes. Nodes are the small computers, which perform tasks in a combination to result in the networks.



Nodes which sense are versatile and energy utility device.There are numerous applications of motes in the industry. Sensor nodes, collectively, gather data from thenear by areas.In the wireless sensor network, motes can be in hundreds or even thousands.

1.1. Wireless Sensor Network Architecture

The most general WSN architecture follows the OSI architecture model. The architecture of the WSN includes five layers and three cross layers. Specifically, in sensor network we require five layers, namely application, transport, network, data link and physical layer. The three cross layers are namely power management, mobility management and task management.

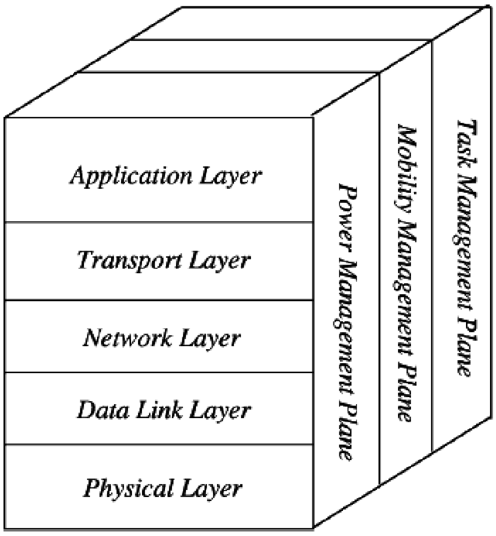


Fig 2: Wireless Sensor Network Architecture

Application Layer

This is responsible for monitoring of traffic and offers solutions for many services that transform the data in a transparent form to find concrete resultant.

Transport Layer

The function of this layer is to provide avoidance of large amount of traffic and reliability.This layer is needed when a system is supposed to establish communication with other networks.

On a common note, transport layer can be divided into Packet driven and Event driven. STCP (Sensor Transmission Control Protocol), PORT (Price-Oriented Reliable Transport Protocol and PSFQ (Pump Slow FetchQuick) are some of the famous protocols in the transport layer.

Network Layer

Routing is the main task of the network layer. Apart from routing, the main tasks are conserving of power, partial memory and buffers.

Data LinkLayer

The main task of this layer are combining different data signals into one frame and detecting it, data streams, Medium Access Control and error control.It may be noted here that the Data Link Layer controls the probability of error from occurring and hence is efficient to account for avoidance of error.

Physical Layer

Selection of frequency, generation of a carrier frequency, signal detection, modulation and data encryption are the main task of physical layer.

1.2. Characteristics of Wireless Sensor Network

The characteristics of WSN include the following.

- The utilization of power for nodes operating with batteries.
- Ability to manage failure of the node.
- Easy movement and Heterogeneity ofnodes.
- Scalability implying distribution of large scale.
- Simple touse.

1.3. Advantages of Wireless Sensor Networks

The advantages of WSN include the following

- Suited for places which are difficult to reach.
- Flexible in nature.
- Price of the execution is cheap.
- Avoids physical wiring.
- Provides space for new devices at any instant of time.
- Can be operated by using a monitoring method specific to centralized control.

1.4. Wireless Sensor Network Applications

The applications of wireless sensor network mainly include health, military, environmental, home and other commercial areas. It may also be noted that wireless sensor network can be used in disaster management by identifying the seismic vibration of earthquake in a bridge.

II. PROPOSED WORK

In our proposed work, we have created 50 nodes grid with a sink. This grid has 7x7 format scenario and a sink. In this grid each node has a power of watt. They are connected with each other and with the sink. In this scenario sink plays a very important role. In wireless **sensor** networks (WSNs), the data is gathered by the sensor nodes and given to a sink node. Hence, positioning of the sink node has a great impact on the energy consumption and life time WSNs. **Sink nodes** are used to collect and process data which are gathered from regular **sensor nodes**. The sensor nodes are source information, they may also forward message in network. As shown in the figure there are 49 sensor nodes and a sink. As we have found in the previous study, the sink was in a center and collects all the information from all sensor nodes.

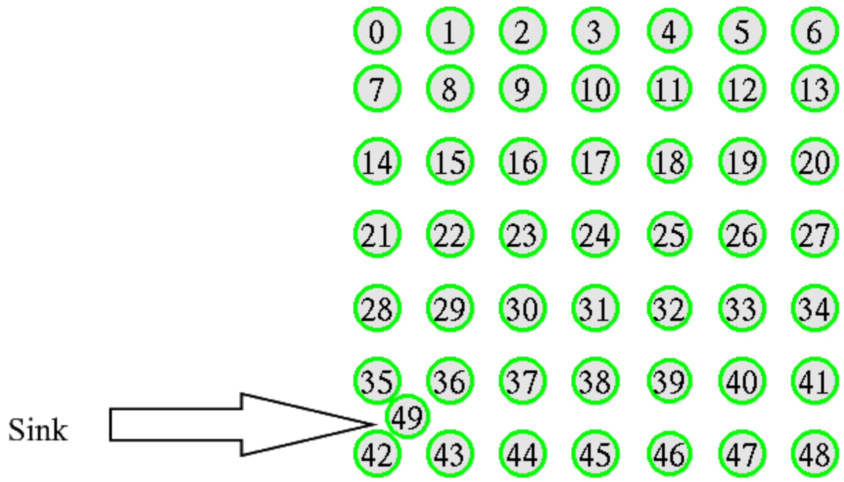


Fig 3: 7x7 Grid scenario with a sink.

In the related work, the sink in the center get all the information with the help of the sensor node. The communication from node to node is called multi hop communication. In **wireless multihop networks**, nodes communicate with each other using **wireless** channels and do not have the essence for common infrastructure or centralized control. Nodes may cooperate with each other by forwarding or relaying each other's' packets, possibly involving many intermediate relay nodes.

In the proposed work we have positioned the sink in the lower left. The sink has moved from lower left to upper left side and collect the data from sensor nodes in its range shown in the figure.

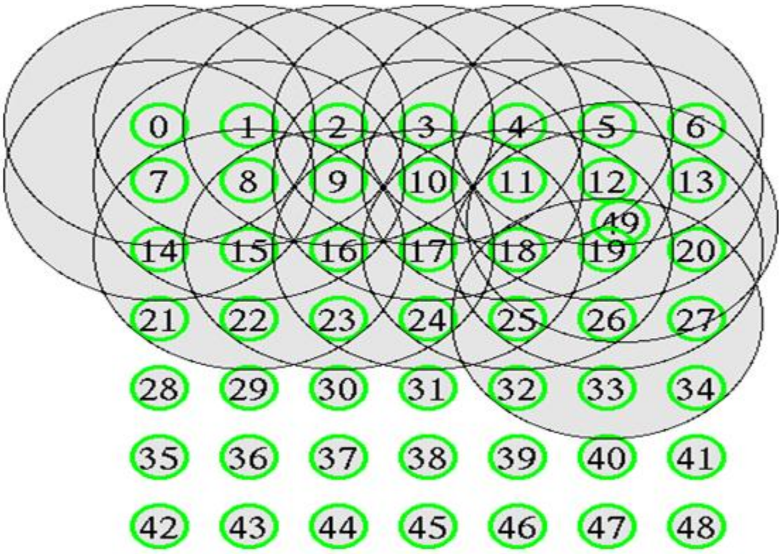


Fig 4 (a) : Sink movement from lower left to upper left

As shown in the figure 9 (a), the sink has moved from lower left to upper left and collect the information from sensor nodes within its range.

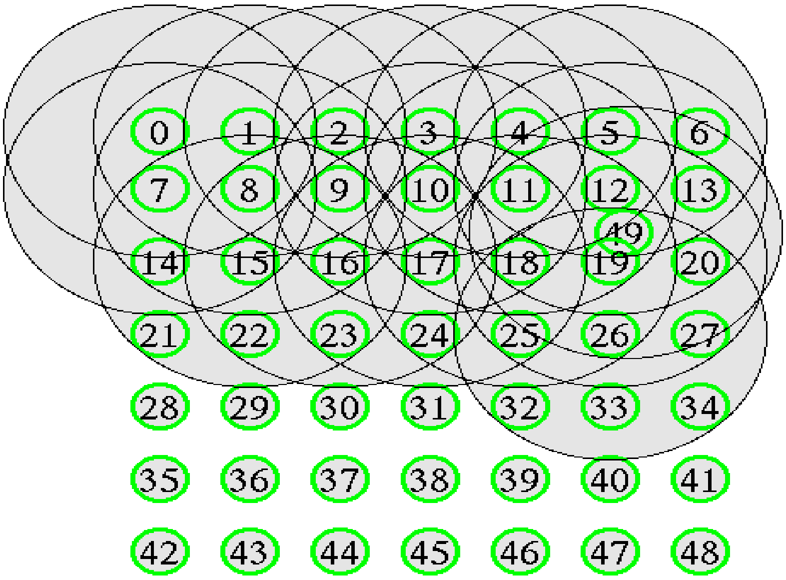


Fig 4 (b): Sink movement from upper Left to upper right.

When it moves from upper left to upper right it again collects the information of the sensor nodes and also check the energy level of the sensor nodes within its range. One more thing must be discuss here that after collecting the information from sensor nodes, the sink also consumes its energy and has low level of energy. But in this case the sink continues to collect the information from the sensor nodes and communicate with them shown in the figure [18].

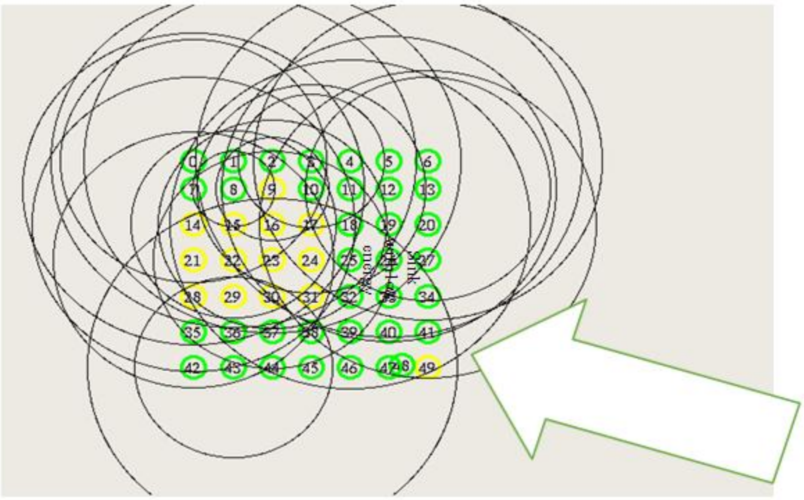


Fig 4 (c): Sink movement from upper right to lower right

In the figure 9 (c) the sink lost all his energy and become dead but before the death of the sink, it checks the most energy level sensor node. After finding the sensor node it transfers all the information to this sensor node and this sensor node will be the new sink [17] [18] [19].

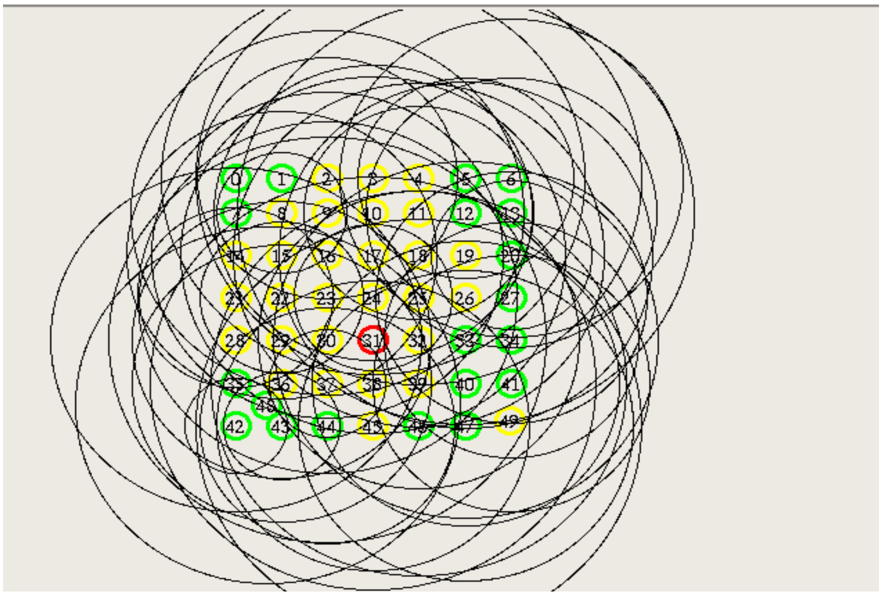


Fig 4 (d): New Sink movement from lower right to lower left.

As shown in the figure, the new sensor node works as a new sink and collects all the information from the active sensor nodes [20] [21].

III. SIMUALTION AND RESULT ANALYSIS

Simulation Parameters

These are the parameters in our proposed work. They indicate the parameters which help us determine that our proposed system works efficiently, effectively and in the best possible way, be it in energy consumption or throughput.

Parameter	Value
Simulation Area	1000x1000
Total Sensor Nodes	50
Sensor Nodes Energy	5J

Sink Location	(70,375)
Rate of Transmission	10 Packets/s
Network setup time	20 Seconds
Data Packet Size	2000 bits
Cycle time	60 s

3.1 Maximum Energy Consumption:

Energy is an important factor and is consumed in all the three scenarios because of interaction of sink with other nodes. It may be noted here that as the sink moves energy consumption is minimized during its interaction with other nodes which is the objective of our research work.

The energy consumption if minimized result in enhancing the lifetime of the network. It may be noted here that this system works efficiently in battery powered systems. We attempt to minimize the power usage of the battery, thus increasing the lifetime of the network.

Fig 5: Maximum energy consumption by a node in a grid topology of (7x7) with Sink in the lower left

As shown in the figure 10, there are comparison between optimal solution, heuristic and proposed system.Energy consumption of optimal solution is very high where heuristic approach is also high.Our proposed system has low energy consumption.

The energy consumption of the nodes is balanced to ensure the maximum network lifetime by balancing the traffic load as equally as possible. First we derive an optimal load balancing solution. Subsequently, we propose a heuristic solution to approximate the optimal solution and then compare both optimal and heuristic solutions with shortest path and equiproportional routing. Furthermore, the energy consumption of the proposed system is analysed and is found to be better than optimal and heuristic solutions due to the role of movement of the sink and its interaction with the other nodes.

3.2 Packet delivery Ratio:

A **Packet delivery ratio**: **Packet delivery ratio** (PDR) can be measured as the **ratio** of number of **packets** delivered in total to the total number of **packets** sent from source node to destination node in the network. It is desired that maximum number of data **packets** has to be reached to the destination.

$$\text{PacketDeliveryRatio} = \frac{\sum \text{Number of packet received}}{\sum \text{Number of packet send}}$$

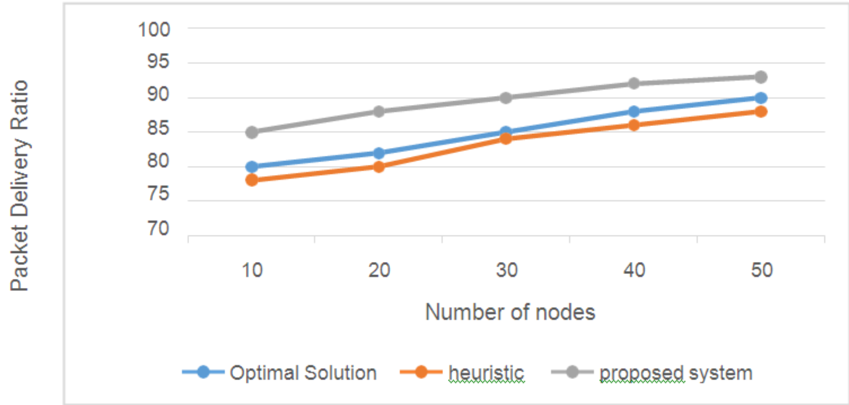


Fig 6: PDR vs. Number of Nodes

As shown in the figure, packet delivery ratio is best in our proposed system as compare to other algorithms like optimal solution and heuristicalgorithm.

3.3 Throughput:

Network throughput is the amount of data moved successfully from one place to another in a given time period, and typically measured in bits persecond (bps), as in megabits per second (Mbps) or gigabits per second (Gbps).

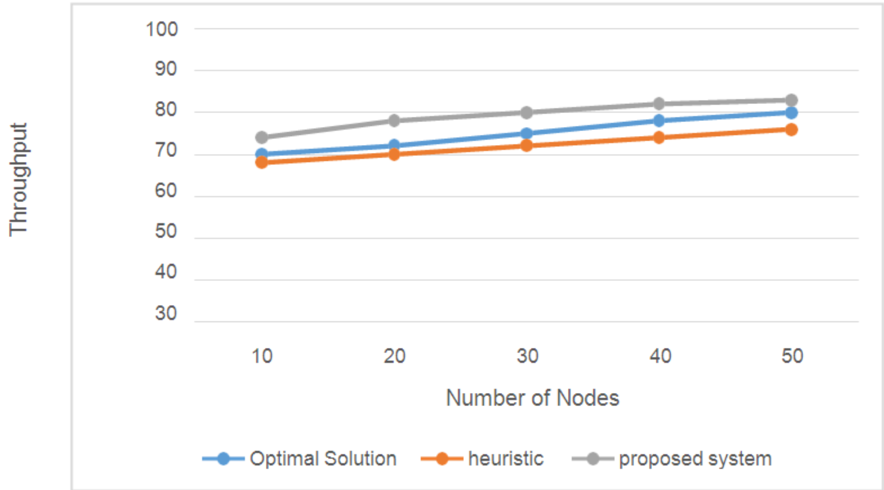


Fig 7:Throughput vsnumber of nodes

As shown in the figure 12, heuristic algorithm has lowest throughput whereas optimal solution algorithm is better than heuristic. Our proposed system has best throughput among all the algorithm. We calculate it against the number of nodes.

3.4 Energy(Units):

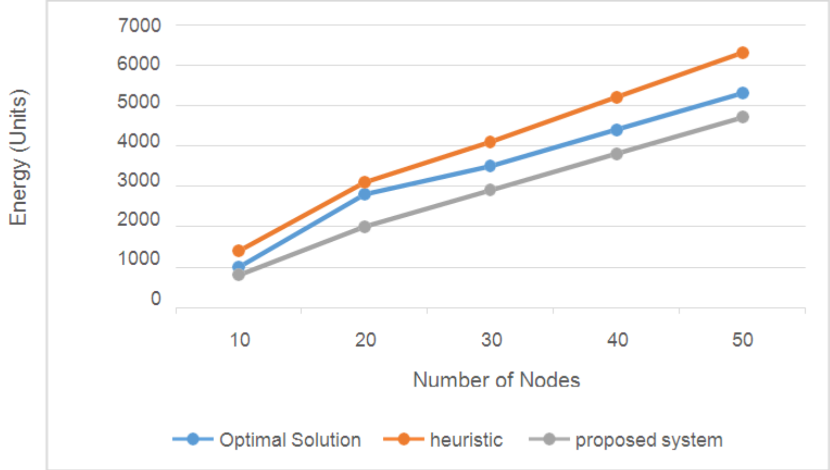


Fig 8: Energy vs. Number of Nodes

As shown in the figure 13, we have calculated energy of number of nodes of a 7x7 grid. In this figure, the heuristic system has consumed more energy whereas the optimal solution has given better results. In our proposed system, the energy remains till the end of the simulation. So the proposed system has given more energy efficiency as compare to other algorithms.

3.5 Network connectivity with Sink:

As shown in the figure 14, we showed the network connectivity of the sensor nodes to sink. If we compared to other algorithms, we found that our proposed system has much better network connectivity with thesink.

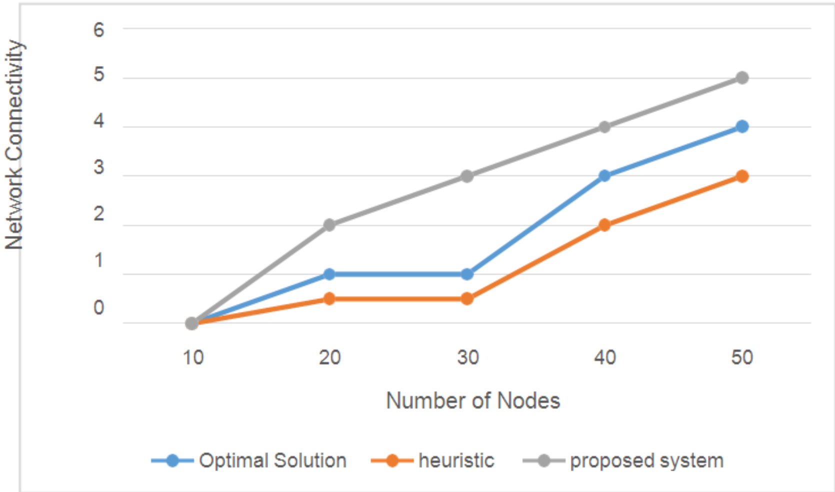


Fig 9: Network connectivity with Sink

IV. CONCLUSION

We analyzed lifetime maximization strategies based on sink movement. The idea is that protocolswith simple mechanisms can be designed for more balanced routing to ensure a longer network lifetime. We explore ways to maximize a sensor network lifetime. After defining the problem within a specific scenario, 7x7 sensor node grid with sink. The role of the sink is to collect all the data including the energy consumption of the sensor nodes with in its range. The movement of the sink is in the rectangular form. It start moving from lower left to upper left than upper left to upper right and then it moves in the downside. During the movement of the sink it collects the information and the communication parameters between sensor nodes. During the sink movement, the energy of the sink may be reduced and the sensor nodes may also reduce their energy. In case of the dead sink, it checks the energy of nearby sensor nodes and transfer all the information to it. The sensor node will now become the new sink and will start to move and collect the data within thegrid. After applying our algorithm, we found that the proposed system works better than optimal and heuristic solutions and consumes less energy compared to the other two techniques. Furthermore, our proposed system has the best throughput.

REFERENCES

[1]. Rahim Kacimi, RiadhDhaou, André-Luc Beylot. Load Balancing Techniques for Lifetime Maximizingin Wireless Sensor Networks. Ad Hoc Networks, Elsevier, 2013, vol. 11 (n° 8), pp.2172-2186.

[2]. F. Zhao, L.J. Guibas, Wireless Sensor Networks: An InformationProcessing Approach, Morgan Kaufmann Publishers,2004.

[3]. V. Raghunathan, C. Schurgers, S. Park, M.B. Srivastava, Energy- awarewirelessmicrosensor networks, IEEE Signal Processing Magazine 19(2) (2002) 40–50,http://dx.doi.org/10.1109/79.985679.

[4]. Jennifer Yick, Biswanath Mukherjee, DipakGhosal:"Wireless sensor network survey" Computer Networks(Elsevier) Journal, Vo1.52, pp. 2292-2330,2008.

[5]. I. F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E.Cayirci, "Wireless Sensor Networks: A Survey",Computer Networks (Elsevier) Journal, Vol. 38, No. 4,pp. 393-422,2002.

[6]. FarruhIshmanov, Sung Won Kim " DistributedClustering Algorithm with Load Balancing in WirelessSensor Network" IEEE World Congress on ComputerScience and Information Engineering 9,sep2009.

[7]. D.G.Anandl, Dr.H.G.Chandrakanth2and Dr. M. N.Giriprasad“challenges in maximizing the life of Wireless Sensor Network" Int. J Advanced Networkingand Applications, Volume: 03, Issue: 0 I, Pages:999-1005,2011.

[8]. CunqingHua and Tak-Shing Peter Yum, Senior Member,IEEE Optimal Routing and Data Aggregation forMaximizing Lifetime of Wireless Sensor Networks:IEEEIACM Transactions On Networking, Vol. 16, No. 4,August2008.\

[9]. W. Heinzelman, A. Chandrakasan, H. Balakrishnan,"Energy- Efficient Communication Protocol for Wireless Microsensor Networks". Proceedings of the 33rdInternational Conference on System Sciences (HTCSS'OO),2000.

[10]. S. Lindsey, C. Raghavendra, and K. M. Sivalingam,"Data gathering algorithms in sensor networks using energy metrics," IEEE Transactions on Parallel and Distributed Systems, vol. 13, no. 9, pp. 924- 935,2002.

[11]. O. Younis, S. Fahmy, HEED: A Hybrid, Energy Efficient, Distributed clustering approach for Ad Hoc sensor networks, IEEE Transaction on MobileComputing Vo1. 3, pp. 366-379 2004.