

# Analysis of Energy Efficient Approach of WSN

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**Abstract** - The wireless sensor networks is the decentralized type of network in which sensor nodes can join the network. The size of the sensor nodes is very small and also it is deployed on far places. Due to such unique properties of the network, energy consumption is the major issue of WSN. The various techniques are used to improve lifetime of the wireless sensor networks. Among the various proposed techniques, clustering is the efficient approach to improve network lifetime. In this paper, various techniques are reviewed to improve lifetime of wireless sensor networks

**Keywords** - LEACH, WSN, Lifetime

## I. INTRODUCTION

Wireless sensor network is one of the most important and popular advancement of the technology. It is made up of interconnected sensor a node which provides excellent services not only in sensing the data but also in the interaction between the user and the sensor nodes [1]. Recently, it is widely popular because of the introduced advanced smart sensors which are specialized with the Micro-Electro-Mechanical Systems (MEMS) technology. As, the sensor nodes are battery device which is responsible for the battery consumption and battery lifespan of the network. These sensor networks get exhausted very soon and it is not easy to change and replace these batteries. So, it because of this limitation is affects the energy consumption and the network lifetime. An energy model is required to keep a eye on the usage of battery and to check the amount of energy consumed during whole process. Several routing protocols have been introduced to increase the network lifetime and to reduce the energy consumption. Out of all, the hierarchical routing protocol is the one which divides the complete network into small clusters and these groups are controlled and managed by the node known as the Cluster head node. This cluster head is used to transmit and forward the collected data and information and filters the data before forwarding it to the base station. The power conservation is categorized into two parts in WSN [2]:

- a) It schedules the sensor nodes between the active and sleep node.
- b) It adjusts the transmitted data and senses the radius of the wireless networks.

The Wireless sensor networks has been developing widely day by day and introduced some latest interesting areas which is used in infinite applications. These networks contains large amount of small sensor nodes that manages their environment according to their requirements. These sensor nodes process data whenever required by using microprocessor and forwards/receives these processed data from the other neighboring sensor nodes. These nodes are uniformly distributed inside the network and are connected to the sink node. The centralized network collects the data which should be used by the user. The sinkhole is also activates the sensing nodes through broadcasting by forwarding them network policy and controlling the information.

## Characteristics of a Wireless sensor networks

Wireless sensor network is very large fields and contains many components in which sensor node is very important although, it is smallest from all. The feature of excellent wireless sensor networks are their efficiency, scalability, responsiveness, reliability and many more. All the wireless sensor networks with all these features are considered to be most beneficial; and those which do [3] not have all these features suffer from the negligence from all the applications.

**Power efficiency in wireless sensor networks:** Power efficiency is the ability of the networks to handle the mobile nodes and changed paths of the datasets. According to the architecture of the wireless networks it is important to be highly responsive if they want to deal with the network's mobility. As the mobility is the ability of the network to control the moving nodes and automatically changing paths.

**Scalability in wireless sensor networks:** Scalability is the ability of any wireless network is to increase the number of nodes connected to the network which creating large number of overheads. The implementation of such type of networks having very small number of nodes and it is very essential to provide support to all the nodes with small sizes also.

**Wireless sensor networks responsiveness:** When the network quickly adapts all the changes occurred in the topology of the network then it is termed as the responsiveness of that network. However, the network is not that much responsive as expected so the network is willing to make compromise.

**Mobility in wireless sensor networks:** It is the ability of the network to handle moving nodes and continuous changing paths. The moving networks are not easy to handle [4] as they are randomly moving inside the network but they transmit the data as fast as other nodes.

### Applications of Wireless Sensor Networks

Wireless sensor network is one of the most standard advanced services introduced by the technology in terms of commercial and industrial applications. It is technically developed in a processor, communication and low-power consumption of the computing devices. The wireless sensor nodes contain small sensor nodes which are used to observe the surroundings of the networks like temperature, humidity, pressure, volume, vibrations and many more. These can also be used in some real time applications like smart detecting, monitor and controlling, discovery of neighbor nodes [5], data processing and storage, data collection, synchronization, effective routing between the base station and the nodes. It may compromise in the different types of sensors like low sampling rate, seismic, magnetic, thermal, visual, infrared, radar are some conditions which are difficult to observe. The objective of the sensor node is to constantly observe the event, event detection and control of actuators. The most important applications of WSN are the health, military, environmental conditions and so on.

### ROUTING PROTOCOLS FOR SENSOR NETWORKS

The interaction between the routers is defined in terms of the routing protocol. Each and every individual router has superior knowledge of network which is directly attached to it. This information is shared among all the neighbors first and after that with the entire network. This process continues and hence routers gain knowledge about the network's topology. Meta-data is established to find the path from source to destination by using data centric routing algorithm. This is primarily used for the transmission of data by eradicating the redundancy in the transmission process. The [6] location based routing algorithm is used to store the information regarding location of the sensor nodes. On the other hand hierarchical routing algorithm is established to divide the whole network into small clusters and selects the cluster heads for every cluster. The main function of the cluster head is to collect all the data from every cluster and transmit it to the sink for the further process.

## II. LITERATURE SURVEY

**Fouad El Hajji et.al (2018)** proposed [7] a novel adaptive and dynamic routing protocol in this paper particularly for multi-constraint scenarios. The state of network and preferences of user keep changing which cannot be monitored

by applying the existing solutions. A routing technique is presented in this paper through which a routing tree is generated depending upon various criteria evaluations that include the length of path, the estimation of amount of power consumed, the topologic metrics of the neighboring nodes and so on. The outputs achieved after performing simulation experiments show that in comparison to other already existing protocols, the performance of MCRP is better in terms of network lifetime and energy saving.

**Vandna Arya et.al (2018)** presented [8] a study that aims to increase the lifetime and minimize the amount of energy being consumed by the network. In comparison to the other existing protocols, better results have been achieved when NEAHC is applied with the help of firefly algorithm. Compressed sensing and optimization are hybridized to approve the lifespan of a network. The MATLAB2010 wireless data analysis toolbox is used to implement this proposed technique. For performing experimental simulations data packet delivery, number of packets transmitted to the cluster head, number of packets transmitted to the base station, the remaining energy, and the lifetime of a network are few of the parameters to be considered. Higher amount of energy is consumed when the data is transmitted amongst the nodes as per the evaluations made by making comparisons against the techniques.

**Shahab Tayeb et.al (2018)** proposed [9] an improvement in the Energy Efficient Credit-Based routing algorithm. Here, the priority of relay nodes is used to choose the most optimal cluster head. Experiments are conducted which show that in terms of load balancing, lifetime as well as energy consumption, the performance of proposed mechanism is better. However, there is a minimal increment in the packet loss and the data delivery rate also reduces to some extent here. Comparisons against standard LEACH protocol and the proposed protocol are made to evaluate the performance of proposed protocol. In comparison to LEACH, higher data-delivery is achieved during the initiation of the network. However, the performance of LEACH with respect to data delivery and packet loss is better when the 100<sup>th</sup> time slice arrives. In future, the cluster heads and nodes of WSNs can be used to optimize the energy utilization of proposed approach.

**Hajer Ben Fradj et.al (2018)** proposed [10] a novel approach for providing control over the energy consumption of WSNs. The energy consumption and reliability of WSN are enhanced by proposing Opportunistic routing (OR). There is limited number of non-rechargeable battery power available within the sensor nodes deployed in these networks. So, the most difficult task here in these networks is to apply an optimal routing mechanism. Reducing the energy consumption and maximizing the network's lifespan are the two major objectives here. It is possible to balance the energy

consumption even though a novel approach known as ECS-OR (Energy Candidate Set-opportunistic Routing) was proposed. Thus, it is seen through the simulation results that in comparison to previously proposed mechanisms, the performance of network is enhanced in terms of wireless connectivity and energy consumption.

**Huseyin Ugur Yildiz et.al (2018)** proposed [11] a novel approach in which the solar and electromagnetic energies were exploited. The energy dissipation of sensor nodes is reduced by the development of a Mixed Integer Programming (MIP) technique through this newly proposed hybrid energy harvesting approach. The effects of proposed technique are calculated using the MIP framework along with the management of energy consumption by handling the transmission power. The energy consumption was minimized by adjusting the powers as per the natural scenarios by applying power transmission control. Therefore, it is seen that in case when solar energy is used, there is reduction in the amount of energy being consumed. However, there is reduction in the rate of energy consumption of proposed approach when the usage of solar energy is not involved.

**Satyasen Panda et.al (2018)** proposed [12] a novel mechanism through which the capacity of energy can be increased in WSNs. Here, the clustering model is applied for proposing an Artificial Bee Colony algorithm. The internal dynamics of cluster heads and sensor nodes are enhanced by applying the proposed technique. The amount of energy consumed by nodes is reduced; the energy consumption is balanced as well as the lifetime of network is increased by applying this algorithm. Utilizing fewer numbers of parameters in comparison to other techniques is the major objective of energy harvesting. Therefore, applying this approach on other clustered networks is very easy. The energy being consumed is balanced, the energy is conserved and the lifetime of the clustered network is improved by applying the proposed technique. Thus, the lifetime of clustered networks is increased which result in increasing the number of

communication rounds and thus optimizing the network. There are several applications in which this proposed network can be applied to achieve better outcomes.

**Madiha Razzaq et.al (2018)** proposed [13] a novel routing protocol based on k-means clustering algorithm. Depending upon the radio parameters and conditions of channel of the transceiver, an optimal fixed packet size is considered here. For each node, the energy consumption value of proposed approach is minimized. Further, for the complete network, the lifetime is enhanced here. In order to transmit the data from cluster head to cluster member and base station, different amount of power is needed. For energy conservation and increment in the lifetime of network, an optimal fixed packet size is needed to transmit the data. Thus, large amount of energy is conserved and the lifetime of network is increased as per the results achieved after implementing the proposed approach. In comparison to rest of the traditional algorithms, the proposed algorithm provides better results and improves the security of complete network.

**Sohail Jabbar et.al (2018)** presented [14] a study related to the analysis of routing that is performed in WSN. The WSN technology is comprehended along with the energy aware routing and other factors that highly affect the energy aware routing of these networks. As it is possible to demonstrate the algebraic and graphical modeling of these factors, the designing of similar algorithms is very easy. Further, it is also easy to evaluate the authenticity and extend the previously introduced algorithms by making improvements in them. This study also presents different techniques that can be applied by previous routing algorithms such that the various energy aware factors can be handled. Along with the enhancements of researchers, analysis of proposed techniques is done. This paper also presented a study related to several techniques and algorithms proposed in different scenarios to provide a well-structured and energy efficient communication in the networks.

Authors' Names	Year	Description	Outcome
Fouad El Hajji	2018	Proposed a novel adaptive and dynamic routing protocol in this paper particularly for multi-constraint scenarios.	The outputs achieved after performing simulation experiments show that in comparison to other already existing protocols, the performance of MCRP is better in terms of network lifetime and energy saving.
Vandna Arya	2018	Presented a study that aims to increase the lifetime and minimize the amount of energy being consumed by the network. In comparison to the other existing protocols, better results have been achieved when NEAHC is applied with the help of firefly algorithm.	Higher amount of energy is consumed when the data is transmitted amongst the nodes as per the evaluations made by making comparisons against the techniques.

Shahab Tayeb	2018	Proposed an improvement in the Energy Efficient Credit-Based routing algorithm.	The performance of LEACH with respect to data delivery and packet loss is better when the 100 <sup>th</sup> time slice arrives. In future, the cluster heads and nodes of WSNs can be used to optimize the energy utilization of proposed approach.
Hajer Ben Fradj	2018	Proposed a novel approach for providing control over the energy consumption of WSNs. The energy consumption and reliability of WSN are enhanced by proposing Opportunistic routing (OR).	It is seen through the simulation results that in comparison to previously proposed mechanisms, the performance of network is enhanced in terms of wireless connectivity and energy consumption.
Huseyin Ugur Yildiz	2018	Proposed a novel approach in which the solar and electromagnetic energies were exploited. The energy dissipation of sensor nodes is reduced by the development of a Mixed Integer Programming (MIP) technique through this newly proposed hybrid energy harvesting approach..	Therefore, it is seen that in case when solar energy is used, there is reduction in the amount of energy being consumed. However, there is reduction in the rate of energy consumption of proposed approach when the usage of solar energy is not involved.
Satyasen Panda	2018	Proposed a novel mechanism through which the capacity of energy can be increased in WSNs. Here, the clustering model is applied for proposing an Artificial Bee Colony algorithm.	The lifetime of clustered networks is increased which result in increasing the number of communication rounds and thus optimizing the network. There are several applications in which this proposed network can be applied to achieve better outcomes.
Madiha Razzaq	2018	Proposed a novel routing protocol based on k-means clustering algorithm. Depending upon the radio parameters and conditions of channel of the transceiver, an optimal fixed packet size is considered here.	large amount of energy is conserved and the lifetime of network is increased as per the results achieved after implementing the proposed approach. In comparison to rest of the traditional algorithms, the proposed algorithm provides better results and improves the security of complete network.
Stallin E. F. Silva	2018	Presented a study related to the analysis of routing that is performed in WSN. The WSN technology is comprehended along with the energy aware routing and other factors that highly affect the energy aware routing of these networks.	This paper also presented a study related to several techniques and algorithms proposed in different scenarios to provide a well-structured and energy efficient communication in the networks.

### III. CONCLUSION

The wireless sensor network is the self configuring type of network in which sensor nodes can join or leave the network when they want. Due to such type of network size of the sensor nodes is very small and network is deployed on the far places. Due to such type energy consumption is major issue of the network. In this review paper, various techniques are reviewed to improve energy consumption of WSN

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