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Analysis of Energy Efficient Techniques of WSN

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ABSTRACT

The wireless sensor networks is the decentralized type of network in which sensor devices sense information and pass it to base station. Due to dynamic topology of the network security, data aggregation and energy consumption are the major issue which affects network performance. In the past years many techniques are designed to improve lifetime of lifetime of sensor networks. In this review paper, energy efficient techniques of wireless sensor networks are reviewed in terms of certain parameters

Keywords *: WSN, Energy Consumption, LEACH*

I. INTRODUCTION

A network which is generated by gathering numerous small-sized and light-weighted sensors is known as a wireless sensor network. The cost of these nodes is very less along with the less energy and number of processing capabilities. The wireless sensor networks are deployed within various applications in order to gather important information from the surroundings [1]. The various measures such as temperature, pressure and humid of the surroundings are calculated by the sensors deployed in those regions. There are numerous applications such as in military areas, intelligent communications, wildlife monitoring, observing critical infrastructures and so on in which these networks have been deployed in order to observe surroundings and take appropriate actions. There is a sensing unit, a processing unit, a communication unit as well as a power unit present within the wireless sensor node's architecture. The data can be sensed, collected, processed and then communicated to other nodes by each of the node present within the network. The environment is sensed by the sensing unit present within these nodes. The permutations of the sensed data are confined by the processing unit [2]. Further, the processed information is exchanged amongst the neighboring sensor nodes through the communication unit. In order to provide an energy source, a battery is present within the sensor nodes. However, there is very limited amount of power present within the batteries and the replacement of the batteries that have no energy left is impractical. Thus, within the wireless sensor networks, the consumption of power in efficient manner is a major research area. In order to increase the lifetime of the network,

numerous energy efficient techniques are presented by various researchers. On the basis of number of queries generated per mean time, the traffic of WSN depends. A query is sent to the complete sensor field by sink node in order to transmit the information which has been sensed. The data that is gathered by the sensors is sent as a response to the query by sensor nodes. With the help of a routing protocol, the sensor node will reply to the sink node with the help of injected query [3]. A single response is sent back to all the queries by sensor node which results in saving the number of packets that are being transmitted.There are large numbers of distributed nodes present within the network which include numerous sensors, embedded processor as well as low-power radio which includes battery in it. One of the major issues that arise during the planning of sensor network is the management of power consumption. There is a need to provide operation of sensor nodes with highest energy efficiency and ensure that there is least amount of energy wastage by the battery present within the nodes. The most consuming tasks amongst the sensor node are the transmission and reception. In order to increase the performance of WSN, there is a need to provide proper configuration of these networks. The efficiency of overall network can be minimized by utilizing the transmission power that is higher than the requirement. The interferences amongst the nodes can be generated along with the increment in overall consumption of power with the higher retransmission probability involved [4]. The link quality that increases the error rate will be degraded when the transmission power is very less. Due to the requirement of higher number of retransmission the overall energy consumption in also increasing.There are various routing protocols that have been introduced in order to ensure that there is less energy being consumed in the networks. In order to handle the energy conservation, some of routing protocols and algorithms are proposed. In order to discover the path and disseminate the information between the wired and wireless ad hoc networks, a commonly utilized technique is flooding. This technique includes very simple routing strategy and the maintenance of network topology and designing of route discovery algorithms that are highly complex is not included within the overall cost [5][15]. A reactive technique is utilized by flooding in which the data or control packets that are being received by each node are sent to the neighboring nodes further.Gossiping technique has been introduced in order to solve the issues arising within the flooding method. Here, a simple forwarding rule is utilized by gossiping and there is no need of maintaining the topology or any complex route discovery methods within this approach.Protocols for Information via Negotiation (SPIN) are data-centric negotiation-based family of information dissemination protocols that is used within the WSNs. The observations that are collected by individual sensor nodes are disseminated to all the other nodes present in the network with the help of this protocol.Low-Energy Adaptive Clustering Hierarchy (LEACH) helps in the gathering and delivering of data to the sink which is also known as a base station is done. There are two hierarchical-based routing protocols proposed by researchers which are TEEN (Threshold-sensitive Energy Efficient sensor Network protocol), and APTEEN (Adaptive Periodic Threshold-sensitive Energy Efficient sensor Network protocol) which are utilized within the various time-critical application areas [6]. There is a continuous sensing of the medium by the sensor nodes when TEEN is applied. However, there is frequent transmission of data here. A hard threshold which is the threshold value of sensed attribute is however sent by the cluster head sensor to its members. The node to switch on transmitter of the sensed attribute and transmit results in a small change in the value which is known as soft threshold which is also defined here.Within the various routing and information-gathering protocols present in WSNS, the Power-efficient gathering in sensor information systems (PEGASIS) and hierarchical PEGASIS which is its extension are present [7]. There are twofold objectives provided by this protocol. High level of energy efficiency is achieved in order to extend the lifetime of the network in the first objective of this protocol.

Literature Review

Sheikh Tahir Bakhsh, et.al, (2017), proposed in this paper [8] a new novel algorithm that is designed to improve the scheduling in the wireless sensor network, this algorithm is Adaptive Sleep Efficient Hybrid Medium Access Control (AEH-MAC) that reduced the scheduling time by adjusting the sleep time of the nodes. This protocol is utilized in order to increase the lifetime of the network and efficiency of energy. this proposed method, dynamically adjust the sleep time in accordance with the traffic load and wake up time of the neighbor nodes. For the further improvement in the waiting time of the source code, ACK packets

are generated that are transferred to the receiver as they take short packets. Using this proposed scheme, each node maps a conflict-free time slot for itself up to two-hop neighboring nodes. As per simulations results, it is concluded that the proposed algorithm has high performance in terms of runtime, number or rounds energy consumption, and slot reservation.

Meirui Ren, et.al, (2017), have presented in this paper [9] that sensor nodes are used in various applications currently, due to the presence of the large amount of data in every field. When density in the WSN is high, it becomes more difficult to handle the large amount of the data. Therefore, it is necessary to propose a scheme that overcomes all the issue such as latency of data aggregation and NP-hard problem. Author proposed a scheme in this paper that is a cluster- based distribution data aggregation algorithm (DMPMC). This technique is used to minimize the data aggregation latency in case of both multi- channel and multi-power WSNs. In order to transfer the packets inside the cluster low transmission power is utilized and for the transfer of the packets outside the cluster high power is utilized. It is concluded that the proposed algorithm performs better in term of lowest average latency.

Imen Ben Arbi, et.al, (2017) proposed in this paper [10], the major issue of the energy consumption as it degrades the quality of the packets delivery from the source node to the destination node in the wireless sensor networks. Energy consumption rate is higher, as it is utilized foe the communication purpose therefore, it is necessary to reduce the transfer rate of the packets from source to sink node. Data reduction methods have been developed in order to measure the value both at the source and sink node. It is required to measure the difference between the sensed value and predicted value on the basis of the threshold. Techniques have been utilized on the basis of the type of sensed data such as for the data present in the non-linear system. Author proposed in this paper a Self-Exciting Threshold Autoregressive (SETAR) model with the combination nonlinear systems to overcome that problem as it is utilized as a forecasting way on time basis.

Saleh Bouarafa et.al, (2016) have presented in this paper [11], for the minimization of the energy consummation rate in the network, it is necessary to introduce the optimal topology. Many schemes has been introduces so far such as topology directed routing, cooperating schemes, sensor coverage based topology control and many more and all the introduced schemes provide the good communication performance, increase in the lifetime of the network and network monitoring. This proposed method utilized the Generalized Pythagorean Theorem. Proposed method is evaluated using various experiments such as to measure the network lifetime and the energy consumed by nodes, a set of simulation using Matlab is provided. It is concluded that proposed method provide better performance as compared to other topology.

Hiren Patel et.al, (2016) have presented in this paper [12], with the advent of the new technologies wireless sensor networks has achieved a great success in the field of remote sensing. Sensor nodes deployed in the network in order to sense the data, it provides the major application in the area where it is difficult for a human to operate every time. Hardware resources are embedded in the sensor nodes that are considered as the key component of the sensor nodes as they use the limited energy for the assigned task. Therefore, with the improvement in the energy consumption in the sensor network leads to increase in the lifetime of the network. Various changes has been deployed at each layer of the sensor node, so far in the existing techniques in order to increase the lifetime of the sensor nodes that ultimately increase the lifetime of the whole network.

Hemant Kumar R et.al, (2016) proposed in this paper [13] that sensor nodes sense the data and this sensed data further routed towards the sink node using proper methodology. The data in the sensor nodes are routed towards the destination, where sink node is dynamic in nature rather than being mobile. Various parameters such as latency and energy have been used to compare the performance of the mobile sink and the dynamic sink. Dynamic sink node collects all data from the geographical region and after collecting all the data its performance is measured with that of mobile sink. Distance formula has been utilized, during the communication in dynamic sink in order to identify the path from the source to the sink node. For every virtual sink node the path is maintained and upgraded. Author used the open source network simulator in order to perform various operations.

Mohammed Abo-Zahhad et.al, (2015) proposed a technique that has been used to overcome this issue that is energy analysis technique, this technique consider the parameters of the physical layer [14]. Over a WGN channel all the consumed energy is transferred per payload without having

error in the network. In order to achieve energy-efficient communications over A WGN channel, it is necessary to choose transmission power. It provides the closed-form expression for optimum transmission power. There are many schemes in which the energy consumption can be minimized using various optimal transmission powers. Proposed models have been utilized to analyze the consumption of energy in the WSNs network and the evaluation of the communication protocols. This method is also used determine the lifetime of the network and energy consumption.

Table 1:Table of Comparison

Authors' Names	Year	Description	Outcomes
Sheikh Tahir Bakhsh,	2017	A new novel algorithm was designed to improve the scheduling in the wireless sensor network which was known as Adaptive Sleep Efficient Hybrid Medium Access Control (AEH-MAC) that reduced the scheduling time by adjusting the sleep time of the nodes.	As per simulations results, it is concluded that the proposed algorithm has high performance in terms of runtime, number or rounds energy consumption, and slot reservation.
Meirui Ren,	2017	Author proposed a scheme in this paper that is a cluster- based distribution data aggregation algorithm (DMPMC). This technique is used to minimize the data aggregation latency in case of both multi- channel and multi-power WSNs.	It is concluded that the proposed algorithm performs better in term of lowest average latency.
Imen Ben Arbi,	2017	Author proposed in this paper a Self-Exciting Threshold Autoregressive (SETAR) model with the combination nonlinear systems to overcome that problem as it is utilized as a forecasting way on time basis.	It is shown through the experimental results that the energy consumption is minimized due to which the quality of data packets being delivered is improved.
Saleh Bouarafa	2016	The proposed method utilized the Generalized Pythagorean Theorem. Proposed method is evaluated using various experiments such as to measure the network lifetime and the energy consumed by nodes, a set of simulation using Matlab is provided.	It is concluded that proposed method provide better performance as compared to other topology.
Hiren Patel	2016	Hardware resources are embedded in the sensor nodes that are considered as the key component of the sensor nodes as they use the limited energy for the assigned task. Therefore, with the improvement in the energy consumption in the sensor network leads to increase in the lifetime of the network.	Various changes has been deployed at each layer of the sensor node, so far in the existing techniques in order to increase the lifetime of the sensor nodes that ultimately increase the lifetime of the whole network.
Hemant Kumar R	2016	Dynamic sink node collects all data from the geographical region and after collecting all the data its performance is measured with that of mobile sink. Distance formula has been utilized, during the communication in dynamic sink in order to identify the path from the source to the sink node.	For every virtual sink node the path is maintained and upgraded. Author used the open source network simulator in order to perform various operations.
Mohammed Abo-Zahhad	2015	Author proposed a technique that has been used to overcome this issue that is energy analysis technique, this technique consider the parameters of the physical layer.	Proposed models have been utilized to analyze the consumption of energy in the WSNs network and the evaluation of the communication protocols. This method is also used determine the lifetime of the network and energy consumption.

CONCLUSION

In this work, it is concluded that due to dynamic topology of the network energy consumption is the major issue which affect network performance. Many technique are designed to improve lifetime of WSN. In this paper, energy efficient techniques of wireless sensor networks are reviewed in terms of various parameters

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