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A Review on Energy Efficient Routing Algorithms for WSN

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Abstract

A wireless Sensor Network also known as WSN is a pool of minute nodes which works on a very low levels of energy turned out to be an integral part of todays communication systems and an essential component of industrial and Educational purpose. Energy plays an important role in WSN and hence its design in the community of researchers entirely depends on efficiency of energy and energy consumption of node became a bigger challenge to improve the lifespan of WSN. It may not be financially efficient and or even charging and replacing consumed batteries may become impossible due to challenging environment. Various energy efficient techniques are proposed in this article reduce the consumption of energy, to enhance performance of the network and to improve the lifespan of the network.

IndexTerms*—Routing Algorithms, WSN, Energy Consumption, WSN Lifetime.*

I. INTRODUCTION

The wireless Sensor Network is a group of small power, having many function and communication nods with observing and recording facility at various entities, then converting the data into the various signal levels for processing. These are arbitrarily then applied on an enormous and very small scale. As these network finds its place enormously in various industrial and consumer applications, like healthcare, military, agriculture, transportation, system securities and underwater sensors they became an important field of study by the researchers.

For larger area monitoring with higher precision large amount of sensors are used thereby increasing the cost and complication for charging and replacing the batteries in very challenging surrounding. The dispersed nodes of sensors are efficient in gathering and sending back the data to the internal

base station or other sensor network, the process of receiving and transmitting the data over the network reduces

the energy drastically. Hence to increase the life span of WSN, selecting the best route and balancing the load between the various nodes can be implemented. The base station either may be a fixed or mobile node which joins the sensor network to the existing structure for communicating or to the internet. In 21st century the WSN have become an integral part of the modern communication systems[1]. So as to the deliver the information efficiently to their destination, the consumption of power and the maximum network life had turned out to be the very important characteristics of parameter in routing protocols.

Keeping track of energy efficiency related problems have to be done by keeping in mind the application terms and conditions into consideration, hence the selection of routing protocols rely on network

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architecture and application specification. The nodes are activated by the applications for a longer period of time hence the battery of the nodes loses its charging.This protocols reduces the issues of energy drainage. Extra overhead and difficulties in implementation which leads to high energy consumption occurs in WSN routing. Energy controlled sensors are used to operate autonomously for prolonged time period.While preserving the expected network operation the effective protocol cannot be selected to preserve the node energy by the WSN designer. The explanations for sensor drainage throughout the detection, reception or transmission, processing, important energy waste are presented in this paper so as to achieve the task expected from the implementation. With respect to the communication, energy consumption occurs in different entities such as,

Collision: Allpackets If a nodes receives multiple packets of information at the same time then those packets which causes the collision must be retransmitted after ignoring.

Overhearing: Nodes which are present at the senders spectrum of transmission receives the sent packet, although the packet is not sent to it, hence consumption of energy happens even though its not required.

II.LITERATUREREVIEW

2.1. Energy Consumption

Many of the researches are undergoing to minimize the application of energy in sensors with battery restricted systems. Keeping in mind the network architecture and application requirement these protocols are designed. However some features should be kept in mind while designing the WSN routing protocols. The main features is the energy efficiency of the sensors that 4416effects the network's life.

The research in [2] emphasizes on the consumption of energy that depends on a distinct parts of the nodes sensors hardware. The writers categorizes the sensor nodes into four main parts that are processing subsystem, a sensor subsystem, radio subsystems and power supply. The writers in [3] have taken in to account in latest study the issues with energy conscious broadcast/ multiple case so as to categorize the algorithm into two sections: the lifetime issues in highest multicast/broadcast (MLB/MLM) in wireless ad-hoc networks and lowest; and the
(MLB/MEM) issues in terms of lowest energy multicast/broadcast. The main energy conscious metrics decreases the complete energy consumption of all the nodes involved in the multi cast session and increases the time taken for processing until the battery exhaustion of the first multi cast nodes takes place.

The writer of [4] explains the complications associated withthe Medium Access Control (MAC) in designing energy efficient WSN protocols. Moreover advantages and disadvantages of some of the MAC protocols of WSN are discussed. Three categories of problems are addressed in [5] by the writers: implementation, delivery, network services, stack protocol of communication, inner platform and operating systems. Energy balance protocol has been put forth by the writers in [6] which is achieved by forming a cluster among the sensor nodes.

The clustering approach includes the remaining power of the sensors nodes and nodes spaces into consideration. The writers in [7], discusses the difference amongst many popular protocols like,Power-Efficient Gathering in Sensor Information Systems (PEGASIS), Adaptive Periodic Threshold Sensitive Energy Efficient Sensor Network Protocol (APTEEN), Hybrid Energy-Efficient Distributed Clustering (HEED), Threshold sensitive energy-efficient sensor network protocol [TEEN], Low energy adaptive

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clustering hierarchy [LEACH]. So as to explore the concrete technique to resolve the problems of implementation from an actual point of view, the Relay Node Placement Problem (RNPP) protocol [8] in WSNs of two multi-objective formulation is put forth by the writer, that comprises of network reliability, average sensitivity and energy cost.

2.2. Routing Algorithms

Several studies based on routing protocols of WSN is undertaken as follows. The research on wireless sensor network routing protocols is focused by the Writers in [9], this study distinguishes network dependent routing methods into three categories: the location based routing, flat and the hierarchical protocols. These protocols can also be categorized into QoS-based protocol routing methods, query-based, multi-path and negotiation-based methods.

The categorization of design problems and routing protocols, along with routing protocols which depends on the mechanism and feature is presented by the writes in [10], lacking any information about individual protocols described.An Environment-fusion multipath routing protocol (EFMRP) multi-path environment-fusion routing, which includes an important field modeling technique for instructing data packet to reach the sink is proposed by the writer in [11]. Retreat design mechanism, traffic distribution and maintenance. The problems related to energy minimization and energy balance in the consumption of WSN is put forth by the authors in [12]. For selecting the high energy nodes dynamically as source routing nodes, the authors had constructed an energy distributed area algorithm. Thusthe calculation for finding out the route for other common nodes is done by these algorithm.

For Searching a unique origin route for every mentioned node,the writer presents the effective distance as the condition for the minimum transmission distance and proposes an efficient ant colony optimization algorithm.

2.3. Design and Architecture

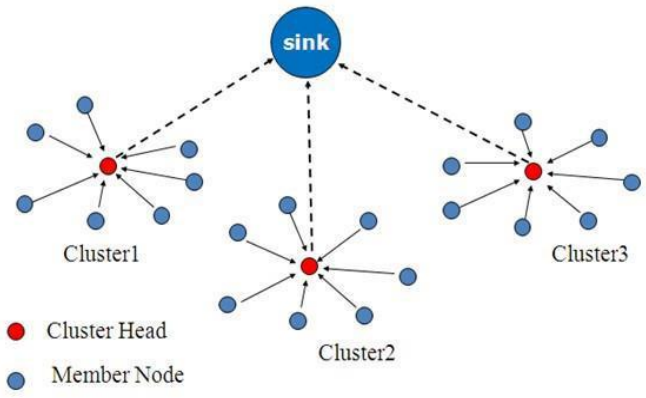

Fig. 1. Clustering in the wireless sensor network

The WSN design problems and methods are discussedby the writers in [13], by discussing the physical constraint and put forth the protocols for all the sensor nodes network stack layers, possible implementation of WSNs is also discussed. Some of the network protocols discussed in [14] research are

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categorized them into location based, hierarchical and data centric protocols. Nonetheless the research does not emphasized on the strategies of energy efficiency, except WSN routing protocols.

To achieve the effective energy consumption, WSN Hierarchical routing protocols had been put forth in advance by the architecture of cluster. The sensor nodes are catogorised into different sets; each set are known as the cluster as shown in the figure1, A selected node or leader called as the Cluster Head (CH) is preserved for every cluster.

For energy savings and to provide network topology stability, for resources efficient use and sharing of resources and to improve the network scalability WSNs uses the clustering technique. With the help of Clustering techniques, the drain of energy decreases by restricting the communication diversity as almost all the nodes are communicating with the Cluster head which acts as a local sink which needs low energy, as there is a very thin band range amongst the local sink and the sensors, than the range amongst the worldwide sink and the sensors, to permit some of the nodes to power-off inside the cluster and to decrease the usage of energy the cluster heads sends the detected information to the worldwide sink.

2.4. Objectives of Clustering

More Scalability: Scalability is very crucial and very essential in WSNs design of protocols routing. The protocols of routing are effective if it is dynamic and varies in network topologies as and when required with good behavior .if we can add the nodes after the design then the WSNs can be extended [15].

a. Data aggregation: optimization is required to extend the network life, which is the important features of WSN that provides the data aggregation which gathers the useful information form the nodes. The useless recurring information is omitted so as to attain the energy saving for effective data aggregation [10].

The complete data aggregation algorithm is shown in Figure 2.

b. Collision Avoidance: It can effects the whole system efficiently , hence we must avoid collision to increase the network lifetime, as extensive collision will result in repeated transmission, wastage of resources and losses. The outcome would jeopardize the intensive WSNs with latency and costs[16].

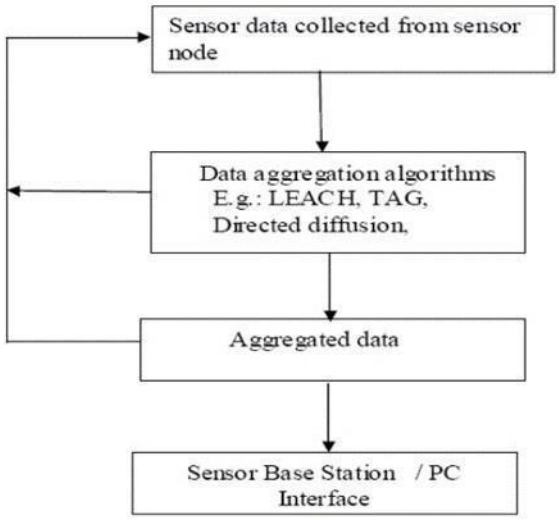

Fig. 2. The general architecture of data aggregation algorithm

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c. Latency Reduction: The WSNs are categorized into clusters, and every cluster has their own individual cluster head, only the cluster heads sends the information to the sink, the issues of latency and collision is reduced as the information transfer methods are omitted from the cluster. Using flooding as a flat routing system hob by hop information transmission if generally executed. To reduce the latency implementation of clustering routing which is used only by the CHs can reduces the hops to the base station from the information source [17].

d. Load Balancing: Identical in size executing clusters are important for enhanced network life as avoidance of precious energy consumption is achieved and we must stabilize the load amongst the cluster heads so as to get the necessary performance, as they are carefully chosen from the existing sensors [17]. Information from the each cluster heads are equipped for further jobs in the base as the clusters have equal quantity of nodes simultaneously.

e. Fault-Tolerance: The WSN nodes sometimes have to operate in the challenging environment, leading it to observe malicious attack, crash of hardware, delay or transfer of error, energy drainage, etc. Hence to avoid losing any important data packets fault tolerance is of utmost need. To revert from the Cluster head failure Re-clustering is the new innovative method [17].

f. Guarantee of Connectivity: Using single hop or mutli-hop routing technique the base station receive the data from the WSN Cluster heads. It should be confirmed if each nodes are attached to the next hop node so as to make sure that the information is passed
on to the Base station efficiently. If the node is incapable of sending the information to the Base station then no other nodes will send the information and the Base station will be quarantined from the information exchange arena.

2.5. Artificial Intelligence

For routing the packet efficiently between the entities over the network without loosing considerable amount of batteries an artificial intelligence algorithm is presented by the authors in [18].This paper put forth two protocols based on KNN and ANN artificial intelligence algorithms, by using the proposed algorithm an improved system performance is demonstrated by the authors. To maximize the lifespan of the WSN the protocol uses multivariable heuristic function by selecting the next-hop communication path as part of the Best First Search artificial intelligence Algorithm as put forth by the Authors in [19].More over to improve the average delivery rate and system reliability simulation is done and compared between OLSR and LASeR protocols. Depending upon the genetic algorithm for energy – aware multipath routing methods protocols is put forth by the authors in [20], introducing the cost function that considers the distance between the base station , the event area ,the center along with the node residual energy for selecting the cluster head. The proposed algorithm is put forth by the authors in [21] to find out the minimum number and the location of the implementation of the relay node that depends on the algorithm for practical optimization. The reduced number of possible primary conditions and the cost of creation is determined by the outcome of the proposed algorithm.

2.6. Sink Mobility

A new algorithm for sink mobility is presented by the authorsin [22] article that involves network coverage for routinginformation packet to mobile sinks in parts of many sinkWSNs.The writer presented

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that the network lifespan can be enhanced by the deployment of a sink operating in accordance with the design specification in the algorithm.Consumption of energy during the communication of information is reduced as the source range is made short.

For controlled mobile sinks the authors presented theLocation-Aware Routing (LARCMS) in [23] to help in reducing the delay in reporting , to control the sink location updates, enhanced network lifespan andtodeliver the regular consumption of power. For gathering of information for already defined routes and to provide better results than the existing technology, two portable sinks are used as proposedby the newly designed technology.

III. CONCLUSIONS

WSN is used by the vide variety of applications, on the other hand there is always the problem of power consumption, hence we have presented variety of network protocols to enhance the lifespan of Wireless network protocols. We have classified and briefed vide variety of techniques for categorizing and addressing difficulties of energy efficiency in wireless sensor networks. For every category of techniques we have shown which energy waste source it decreases.

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