A Review of Wireless Sensor Networks

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Abstract: *A wireless sensor network is a network of hundreds of sensor nodes, which are generally positioned in a close neioghborhood to provide wireless sensing capabilities to the establishment. The nodes consist of fixed resources of their operation thus effective utilization of the battery is an important factor. This requires optimum routing methods. A review of Wireless Sensor Networks routing protocols was provided in this research paper. Energy-efficient routing methods were used to keep long-term service life of the sensors and the network in turn. This is this paper's primary study goal.*

I. INTRODUCTION

In many apps such as volcano and fire tracking, urban sensing, and perimeter surveillance, wireless sensor networks are increasingly being used. There are many sensor devices in a wireless sensor network that send their information for further processing to the sink or base station. This is referred to as direct communication. But this leads to heavy network traffic and as the nodes are restricted by energy, this reduces the network's lifetime. Data aggregation in a big WSN i.e. combining partial outcomes at intermediate nodes during message routing considerably decreases the quantity of overhead communication and energy consumption in a big WSN. It is feasible to acquire information on physical events that was hard or impossible to achieve in more standard ways by networking big numbers of small sensor nodes. The nodes are implemented randomly either within or very near to the area where a specific phenomenon is to be controlled. On the other side, this also implies that protocols and algorithms for the sensor network must have self-organizing capacities because the big amount of nodes in a WSN makes a user directly manipulate the network organization. The network setup and clustering could not be directed by a user through thousands of nodes. Only when performed in a safe way can data aggregation method effectively minimize information traffic and energy consumption.
The sensor network consists of the sensor sector where the sensor units or nodes in this field are distributed. Here, each of these nodes will be able to collect data and then return data to sink and end customers. The data is transmitted back to the final customer through sink with the assistance of multi-hop infrastructure and less architecture as shown in Figure 1.

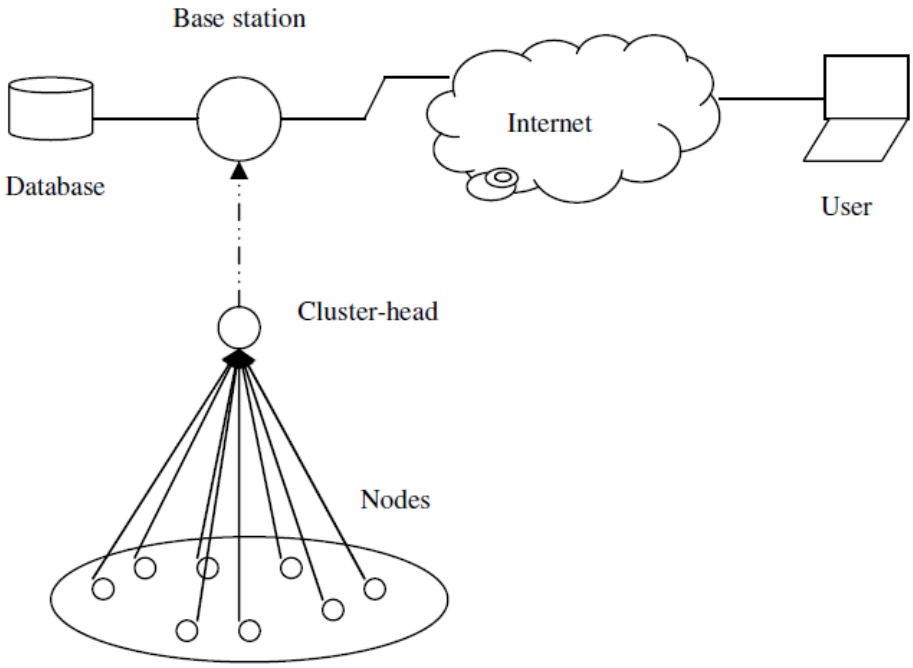

Figure 1:**Wireless Sensor Networks**

The nodes detect the data through an intermediate node called the cluster-head node and transmit it to the base station. The cluster head aggregates, compresses, and then transmits the information to the base station. The base station sends the information to the other network as a gateway. The base station-connected database offers the means of updating and retrieving information on demand.
It should be noted that the sensor networks share with the overall ad hoc networks some commonalities. Thus, the protocol design for sensor networks, including the following, must take into account the properties of ad hoc networks.

• Lifetime limitations imposed by the network's restricted supply of electricity to nodes.
• Wireless communication is unreliable.
• Need self-configuration, requiring some human intervention or no intervention.

In the WSNs, however, there are several distinctive characteristics that do not occur in general ad hoc networks. These characteristics pose the fresh difficulties and require design modifications for traditional ad hoc networks.

• Sensor nodes are typically immobile, meaning that the processes used in traditional mobility management ad hoc network protocols may be unnecessary and excessive.
• Since nodes can be deployed under severe circumstances of the environment, unexpected node failure may be prevalent.
• Sensor nodes in traditional ad hoc networks (e.g. PDAs, laptop computers) may be much lower than nodes, with lower batteries leading to shorter life, less computing energy, and less memory.
• Additional services may be needed in wireless sensor networks, such as location data.

II. LITERATURE SURVEY

Wireless sensor network typically consists of a big amount of sensor nodes which, based on their area of use, can be densely deployed either within or very near to the phenomenon. It is not necessary to design or predetermine the position of the sensor nodes. This provides for random deployment in inaccessible terrains or activities for disaster relief. On the other side, this also shows that protocols and algorithms for the sensor network need to have self-organizing capacities. The collaborative effort of sensor nodes is another distinctive characteristic of sensor networks. Instead of sending raw information to the fusion nodes, sensor nodes use their processing capabilities to perform easy computations locally and only transmit the necessary and partly processed information. Wireless ad hoc networking methods are required for the realization of these and other sensor network apps. The distinctions between sensor networks and ad hoc networks are described below:• In a sensor network, the amount of sensor nodes is greater than in an ad hoc network.
• Compared to ad-hoc nodes, sensor nodes are densely implemented.
• Sensor nodes are more likely to fail.
• Sensor network topology shifts very often.
• Sensor nodes primarily use a broadcast or multi-hop communication paradigm, while most ad hoc networks use point-to-point communication.
• Sensor nodes have energy, computing and memory constraints.
• Due to the large amount of overhead and large number of sensors, sensor nodes may not have global identification (ID).

Many scientists such as LEACH (Low Energy Adaptive Clustering Hierarchy), TEEN (Threshold Sensitive Energy Efficient Sensor Network), SEP (Stable Election Protocol) etc. have suggested various cluster-based protocols. Multiple routes are formed between the source and the destination in the multi-hop or multi-path communication protocol, through which the information can reach the target i.e. sink or base station[2]. Now how these connections are used is based on the network's individual routing strategy For example, some routing algorithms use the best route to send information, keep the other alternative routes as a backup, and use them if the main route fails, some use all the routes to send information simultaneously, and so on. Multi-path routing method has been widely used over the previous few years for various network management reasons, such as offering fault tolerant routing, enhancing transmission reliability, congestion control and service quality (QoS) Supported in wired and wireless networks, but distinctive features of wireless sensor networks and short-range communications characteristics present fresh difficulties that should be resolved in the design of multi-path routing protocols. The primary goal of cluster-based routing is to keep the energy use of sensor nodes effectively by involving them within a specific cluster in multi-hop communication.

III. WSN ROUTING PROTOCOLS

Some higher-energy nodes can be used in the hierarchical architecture to process and send the data to the base station while lower-energy nodes can conduct the sensing in the target region. The network is divided into many clusters, in other words. A node is chosen as a cluster head with some members of the cluster in each cluster. There is a two-tier hierarchy where cluster heads are in the greater level while a reduced level is created for cluster members. Members of the cluster sense the physical environment information and send it

to their corresponding heads of the cluster. Cluster heads process the information and either straight or multi-hoply convey it to the sink. Heinzelman et al. suggested the Low-Energy Adaptive Clustering Hierarchy (LEACH) protocol[6]. It is the WSN's first hierarchical approach to clustering. The procedure is made up of many rounds in the LEACH protocol. There are two stages in each round; the stage of set-up and the phase of steady-state. The cluster is created during the setup stage and information is transferred to the base station in the steady-state stage. The head of the cluster is chosen based on the predefined percentage of cluster heads and how many times in previous rounds the node has been a cluster head. To some extent, LEACH can balance the load between the heads of the cluster.

Younis and Fahmy suggested a routing protocol for Hybrid Energy Efficient Distributed Clustering (HEED)[7]. For wireless sensor networks, it is a multi-hop clustering algorithm that focuses on effective clustering by correct choice of cluster heads. On the basis of criteria such as residual energy and intra-cluster communication costs, the cluster head is chosen. HEED is a fully distributed technique of clustering and offers uniform network-wide distribution of CH. Communications are between CHs and the base station in a multi-hop manner. It generates more CHs than the expected number, however, which reduces the lifetime of the network.

Intanagonwiwat et al. have suggested a Directed Diffusion routing protocol[8]. It is a multi-path routing protocol based on question where the sink initializes the method of routing. The sink fills the network with interest. All intermediate nodes store the interest message obtained from the neighbors for subsequent use during the interest message flooding and create a gradient towards the sender node. Multiple routes can be found between each source-sink couple during this phase. The source then transmits the information via the chosen route. In addition, the sink continues to send low-rate interest signal over the remaining paths, this is achieved to preserve the freshness of the intermediate node interest tables and also to retain the routes that have been found. The information can be forwarded via the other accessible routes if the active route fails. Although it offers fault-tolerant routing, in route discovery it evolves all nodes. As a consequence, this impacts the lifetime of the network.

A distributed, scalable and localized routing algorithm was suggested by Ye Ming Lu et al.[9]. It finds multiple node-disjoint paths between the sink and the nodes of the source. It also uses an algorithm for load balancing to distribute traffic across multiple paths. When an event is identified, a node is selected as the source node from the event region. Then the source node begins the process of route discovery. The sink sends multiple route request messages to its neighboring nodes to create node-disjoint paths with a distinct path Id. The sink begins a timer after obtaining the first route application from the source node.

Wang et al.[10] have suggested a multi-path routing protocol that is energy-efficient and collision-aware. It's a protocol for reactive routing. It uses location data from all sensor nodes to create two collision-free routes between the source and the sink. Each node sends a route discovery message with adequate data on the strength and position of the node in this protocol. All nodes are assumed to have a transmission range of 0 to R, and all nodes are aware of their neighboring information within that range R. Therefore, all routing routes are constructed above this range to reduce the opportunity of interference. Broadcasting is used for collision detection, and nodes overhearing from other routes cannot be on any path. The network deployment price, however, is more due to the demands of the GPS device for each node within the network.

A hierarchical cluster-based data delivery protocol was suggested by Lin et al.[11]. It utilizes a clustering system to monitor the portable sinks place and find the routes for data transmission from the source to the sink. Each cluster comprises of one head of the cluster, several nodes of the gateway, and common nodes. The mobile sink registers to the nearest head of the cluster, and then a notification is distributed to all heads of the cluster. In this phase, for the transmission of information, each cluster head makes a reverse link to the sender node.

V.CONCLUSION

Increasing energy efficiency in the Wireless Sensor Networks region is a significant problem. It has a direct impact on the lifetime of the network, i.e. the amount of moment that the network remains active. As has been placed throughout this study job, the Wireless Sensor Networks are fitted with fixed non-rechargeable batteries, so it is of utmost importance to select those techniques that will decrease the nodes ' energy usage. As is obvious from the literature study of multiple clustering-based routing methods, the clustering-based methods have been created with this concern and have been discovered to be effective in attaining a significant increase in network lifetime.

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