GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

A REVIEW ON WIRELESS SENSOR NETWORKS

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ABSTRACT

Wireless sensor networks are those networks which consist of numerous small devices mainly named as nodes. These nodes are incorporated with little battery time which is very difficult to replace or reinstate. For the sensing, assembly and processing capabilities, the usage of battery is must. Therefore, the battery life of Wireless Sensor Networks should be as large as possible in order to sense the information around it or in which the nodes are positioned. The theory of hierarchical routing is mainly highlighted in this paper along with the study of Wireless Sensor Networks in which the nodes work in a hierarchical manner by the formation of Cluster Head within a Cluster. These formed Cluster Heads then transfer the data or information in the form of packets from one cluster to another.

Keywords— *Wireless Sensor Network (WSN), Low Energy adaptive Clustering Hierarchy (LEACH), Cluster Head (CH), Base Station (BS).*

I. INTRODUCTION

The Wireless Sensor Networks (WSNs) in general, poised of massive extent of sensor nodes organized profusely over a definite appreciable region. The nodes or sensors necessitate minuscule power for their action and low-cost in nature also. These nodes or devices are abounding with entrenched micro-controllers, radio receivers and energy systems for the development of sensing and processing of information. The devices or nodes sense the information from the environment nearby them. The sensed data is then gathered by the node on intermediate side. The intermediate node then transmits the gathered data to the Base Station (BS) which is also called Main Node or Central Node This main node then makes contact with the client or user or also called end user. The end user is then contacted by the Base Station. The process of conveyance of information or data is done by using the technique named Routing. Routing mechanism plays a crucial role for the transmission of information because the path is provided by the routing [1]. The transmission becomes proficient if the routing is competent and becomes ineffectual by the exploitation of disorganized routing. Apart from the concept of routing, the passage of information also depends largely on the nature of protocol used. Various routing protocols are used in last decade which show an imperative role in enhancing the lifetime of network by providing the path which is efficient in nature [2]. The basic architecture of WSN is shown in the figure1.

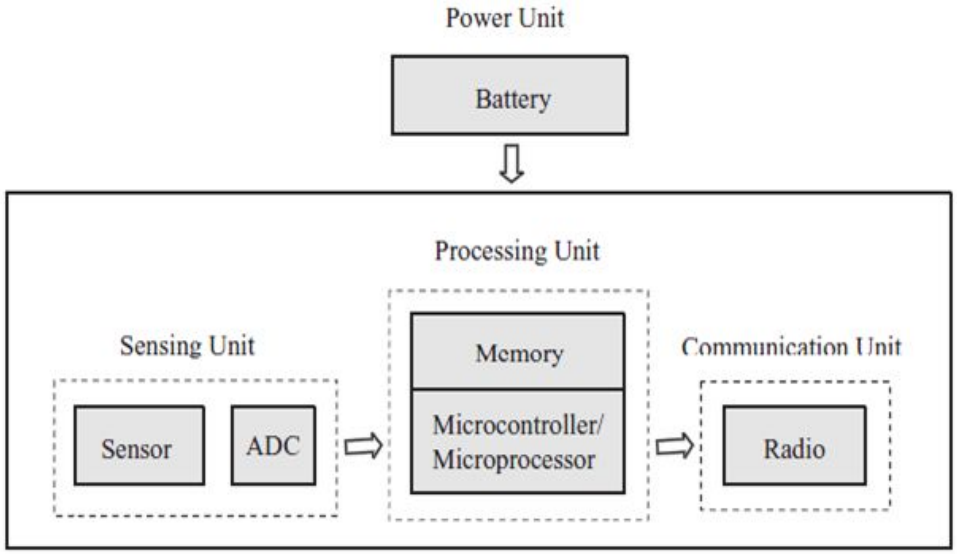
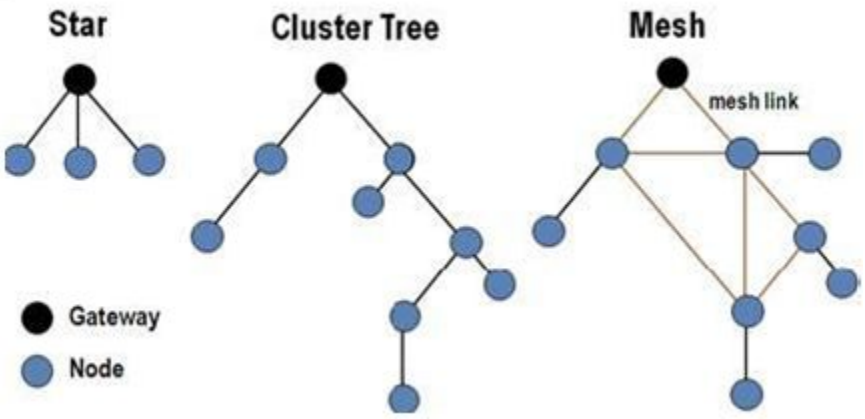


Figure 1 shows the fundamental architecture of Wireless Sensor Network which demonstrates the integration of a collection of components used for the development of WSN. The clarification of the components used for the formation of WSN is enlightened in the points below: a) A radio transceiver with an internal antenna or connection to an external antenna, b) Microcontroller, c) An electronic circuit to provide interfacing with the sensors and a power source, more often a battery or an embedded form of energy harvesting.

A. Topologies of Wireless Sensor Networks

Apart from this, the WSNs nodes are generally structured in one of three types of network topologies called Star Topology, Cluster Tree Topology and Mesh Topology.



In a star topology, each and every node makes contact directly to a gateway node. In a cluster tree network, each node connects to a node higher in the tree and then to the gateway, and data is routed from the lowest node on the tree to the gateway. Finally, to suggest improved reliability, Mesh Networks feature nodes which can unite to multiple natures of nodes in the system and pass data through the majority dependable route accessible. This mesh link is often referred to as a router [3] [4].

B. Routing and Various Routing Protocols in Wireless Sensor Networks

- **Flat networks -** The first type of routing protocols are the multi-hop at routing protocols. In at networks, each node usually exhibits the comparable role and sensor nodes work together to complete the sensing task. Because of large number of these nodes, it becomes infeasible to assign a global identifier to every node and led to data centric routing, where the BS releases some queries to certain areas and waits for the data or information from the sensors positioned in the preferred areas. Routing Information Protocol (RIP) is an example of a Flat routing protocol [4].

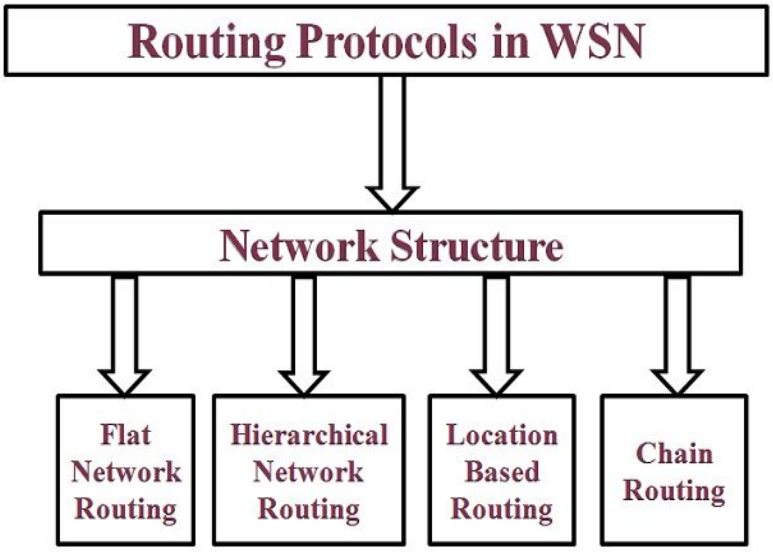


Fig. 3 Routing Techniques in Wireless Sensor Networks

- **Hierarchical networks** - Hierarchical routing is also called cluster-based routing, proposed mainly in wireline networks, is a well-known technique with special advantages related to scalability and proficient communication. As such, the concept of hierarchical routing is also used to perform energy-efficient routing in WSNs. In a hierarchical routing design, nodes with higher energy are used to process and convey the information while the nodes having lower energy nodes are be used to execute the sensing process within the immediacy of an aim. Low Energy Adaptive Clustering Hierarchy (LEACH) is an efficient and one of the most prominent protocols used in this concept of routing in which the formation of cluster heads takes place for the transference of data from source node to destination node [5].

- **Location-based networks** - In location-based clustering, the location or locality of the sensor nodes plays an imperative role. BSs are put forward for the routing of data to specific destinations. In these networks, the position awareness of the sensor nodes becomes important to route data to destinations. The distance between contiguous or neighboring nodes can be predictable on the foundation of potency of arriving signal. According to location-based routing's protocols, if there is no activity then nodes should go to sleep mode to save energy. Location-Aided Routing (LAR) and Distance Routing Effect Algorithm for Mobility (DREAM) are examples of location based protocols [6] [7].

II. STUDY OF VARIOUS PROTOCOLS

LOW ENERGY ADAPTIVE CLUSTERING HIERARCHY (LEACH)

Low Energy Adaptive Clustering Hierarchy (LEACH) is a hierarchical routing's an efficient routing protocol whose mechanism is based on the formation of CHs within a cluster. The CHs then make contact with each other for the transmission of data from one node to another until the data reaches to the ultimate node i.e. BS. LEACH was proposed in the year 2000 by Heinzelman [2] which is also known as Hierarchical Clustering algorithm for sensor networks [3]. The concept of distributed cluster formation in the implementation of LEACH protocol gives the about regarding its cluster-based nature. The working of LEACH protocol is based on the concept of hierarchical routing scheme in which the formation of two layered structure take place. The one layer is used for the selection of the CH while the second layer is used to route the data from one node to another [9]. LEACH protocol works on two phases which are named as setup phase and steady state phase. The work of setup phase is to select the CHs after the proper association of clusters. On the other hand, the transference of data from one node to another node takes place in the second phase named as steady state phase. To reduce the effect of overhead, the duration of second phase i.e. steady state phase is kept longer than that of setup phase [4].

The working of LEACH protocol in terms of transmitting and receiving of data is based on the allocation of diverse set of Code Division Multiple Access (CDMA) codes which helps in the secure interlink among the nodes. The data received by the CH from the node has to be compressed first before the transmission of data to the BS. This prevents the congestion within the network which helps in increasing the efficiency of the network [8]. The nodes in LEACH protocol are homogeneous in nature which means that all the nodes are equipped with same amount of energy levels and are capable to perform the same tasks of sensing, gathering or compressing and transmitting the data. This is one of the biggest disadvantages in LEACH protocol where the energy level of BS is same as that of other nodes deployed. This also reduces the efficiency of LEACH protocol because the communication at larger distances gets affected by the same energy level of BS as that of other nodes [9]. The equation used for the working of LEACH is shown beneath [10][11][12].

$$T(n) = \frac{p}{1 - p(r \bmod \left(\frac{1}{p}\right))} \quad if\ n \in G$$

III. CONCLUSION

In this paper study of wireless sensor network has been carried out. The study of various protocols has also been studied. Protocols should be efficient so as to perform proficient routing. The flow of signaling decides the efficiency of the network. By the use of energy efficient routing protocols, the lifetime of a network enhances and battery consumption becomes less.

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