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# Study of Wireless Sensor Networks Topological Protocol and Its Applications

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**ABSTRACT**

In this paper we studied about the wireless sensor networks and topology protocols and applications of wireless sensor networks (WSN). Many applications of RFID and Wireless Sensors Networks (WSN) in diverse areas including intelligent transport vehicles, defense, environmental monitoring and forecasting such as air pollution monitoring, structural health monitoring, intelligent home, and warehouse management were offered [1-4]. The integration infrastructure of WSN and RFID system with a network was dedicated. Furthermore, the architecture framework of Electronic Production Code (EPC) global sensor network was proposed aiming to establish the infrastructure of global network which is able to aggregate various data [6]. However, RFID and WSN integration was developed by [7]. This research strives to elaborate accurate traceability of different objects by means of RFID which are not conveniently identifiable by applying ordinary sensors. Notwithstanding the fact that the condition of items cannot be monitored by RFID, the environmental condition as well as condition of items can be achieved by sensor nodes. To address this issue, both RFID system and WSN are applied together to overcome some difficulties in industrial environment.

Keywords : WSN, RFID, Protocols, Topology.

## I. INTRODUCTION

Wireless sensor networks (WSNs) consist of sensing, computing, and communication elements and are used for monitoring environment's temperature, humidity, pressure, etc. In other words, WSN is a network which is made up by nodes that sense and control the environment cooperatively. Nowadays, WSN is used in many areas such as traffic control, health care monitoring, healthcare applications, and supply chain. The main WSN characteristics: limited power, tolerate harsh situation, capable of managing the node errors, mobility of nodes, changeable topology of network, failures of communication, nodes dissimilarity, spreading in huge scale criterion, proceeds without assist [8].

### 1.1 Sensor Nodes

A sensor node, also called mote, has the ability to collect sensed environmental conditions, accomplish processing, and communicate with other nodes. A sensor node consists of sensors, communication devices, memories, processing units, and a power supply. The phenomenon is observed (sensed) by the sensor and analog signals are produced. An Analog to Digital Convertor converts analog signals into digital signals. The processing unit corresponds to memory section and manages the collaboration between the nodes. Nodes with communication devices connect to the network. Power supplies of sensor nodes are very important and may be obtained by solar cells [9].

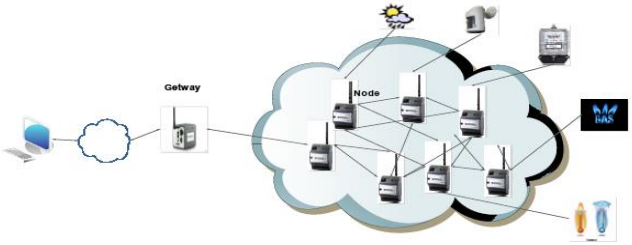


Fig. 1: Components of Wireless Sensor Networks

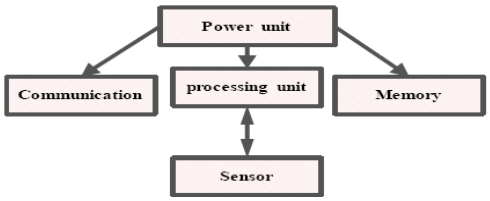


Fig. 2: Parts of a Node

## II. NETWORK TOPOLOGIES

Quantity and quality services are very important in communication networks. Delay in message, BER, message due dates, losing of packet, power and cost of transmission are all represented as quality of service. Topology of the network is defined according to some conditions like environment of installation, application, and quality of service Nodes constitute the entire communication network. The main network topologies are referred to as star, ring, bus, tree, fully connected, and mesh [10].

### 2.1 Fully Connected Networks

A fully connected network is a topology in which every node is connected to one other. It cannot be used in large networks because of the large number of connections.

### 2.2 Mesh Network

In this topology, transmission is usually between the nodes that are in nearest neighborhood. It is also called peer to peer nets. In large scale networks, it is a significant topology. In case there is a failure in leader of a group another node can do its job.

### 2.3 Star Topology

All the nodes are linked to a single hub. If a node and hub are disconnected, it does not affect any other nodes. However, if the hub is not working, the network fails.

### 2.4 Ring Topology

There isn't any leader node, each node has a duty. The data moves in a circle from one node to another. Therefore, a cut in one connection disrupts the whole system.

### 2.5 Bus Topology

Nodes are connected by a shared communication line which is called the bus. When message is put on the bus, header is checked in the destination address via each node.

### 2.6 Base Station

Base station is usually used as a central part to collect information from the nodes. This is a useful approach which makes an easy way for users to control their products. Based on the base station, routing and data processing the information can be shared globally and in the WSN network. Base station provides an interface between the user and internet. It basically acts as a gateway. Data are transmitted to the internet by the gateway. Asset master can connect to the internet directly [11].

## III. PROTOCOL STACK

Protocol stack of WSN provides five levels: Physical, data link, network, transport, and application [12-13].

**Physical layer:** frequency selection, generation of carrier frequency, signal detection, modulation, and encryption are supported by the physical layer and the output power requirement is minimized.

**Data link layer:** sharing the data stream, detection of data frame, medium access and controlling of error are all supported by the data link layer. The data link consists of two sub-layers: media access control (MAC) and logic link control (LLC). Addressing as well as control mechanisms of channel access occurred in the

MAC. It provides the base of network which means that making communication links between the nodes and self-organizing in the network are the duties of the MAC sub-layer. Sharing communicator resources (frequency) in an efficient way amongst the nodes is another role of the MAC. Therefore, the link layer handles how the nodes can communicate with each other.

**Network layer:** Inter networking is provided by the network layer for external networks. Determining which node should talk is the duty of the network layer.

**Transport layer:** Transport layer determines when the system requires to link with outside.

**Application layer:** There is a sensor management protocol (SMP) in the application layer by which the hardware and software in the lower layers for managing applications of the sensor network is made. Applications and sensor networks can act and react by the rules provided by the SMP [14-16].

## IV. APPLICATIONS OF WIRELESS SENSOR NETWORKS

Wireless sensor networks have a wide range of applications in different areas. Usually, they are used for emergency services. Nowadays, WSNs are applied for national security as well by employing chemical and biological sensors. Defense, air traffic control, industrial and manufacturing automation, environment monitoring, and structures and building monitoring are some of the important applications of WSNs [17-20].

**Environmental data collection:** The large number of nodes collects the data from the environment continuously and transfers them to the base station.

**Supply chain management:** The process efficiency is improved by the WSN in the supply chain. Sensors can monitor the temperature of the products which should be maintained all the time. Each product's node can communicate with other nodes. It is noteworthy that smart nodes detect products types in order to store them in particular places when they negatively affect one another.

**Security monitoring:** Nodes are fixed in a certain location and continuously check the status of the sensors. In this case, the nodes send a data report only in the case of security violation which is the difference between the environmental monitoring and security monitoring.

**Node tracking scenarios:** A sensor node is attached to the object for tracking when it enters in a field of sensor nodes placed in the environment at a particular location.

**Health applications:** physical conditions of patients in the hospital can be monitored by using wireless sensor networks.

**Home applications:** wireless sensor networks are helpful to work intelligently at home. People do not need nurse and body guard anymore.

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