Wireless Sensor Networks (WSNs) are networks consisting of a collection of small, autonomous devices known as sensors that are equipped with various types of sensors, wireless communication capabilities, and sometimes limited processing power. These sensors are strategically deployed in physical environments to monitor and collect data from the surroundings, such as temperature, humidity, light, motion, sound, or any other relevant environmental parameter.

Key characteristics of wireless sensor networks include:

**Wireless Communication**: Sensors in a WSN communicate with each other and sometimes with a central base station or sink node through wireless communication protocols. This allows them to transmit data, receive commands, and collaborate in sharing information across the networnk.

**Distributed Deployment**: Sensors are typically deployed in a distributed manner across a geographical area or a physical space. The placement of sensors is determined based on the monitoring objectives and the specific application requirements.

**Energy Constraints**: Many wireless sensors are powered by batteries and have limited energy resources. Energy efficiency is a critical concern in WSN design since sensor nodes often need to operate for extended periods without battery replacement or recharging.

**Data Aggregation**: In order to conserve energy and optimize bandwidth usage, data collected by individual sensors can be aggregated or compressed before transmission. This reduces redundant data and minimizes communication overhead.

**Self-Organization**: WSNs are designed to adapt to changes in the network topology, such as the addition or removal of nodes. Self-organizing algorithms help in maintaining network connectivity and operation even in dynamic environments.

**Data Processing at the Edge**: In some cases, sensors are equipped with limited processing capabilities and can perform basic data processing tasks locally. This reduces the amount of data that needs to be transmitted, saving energy and bandwidth.

**Applications**: WSNs have a wide range of applications, including environmental monitoring, industrial automation, healthcare, agriculture, disaster management, home automation, and more. They enable real-time data collection, remote monitoring, and decision-making based on the collected data.

**Challenges**: Despite their many advantages, WSNs also face challenges such as limited energy resources, communication reliability in harsh environments, network scalability, security concerns, and maintaining data accuracy over time.