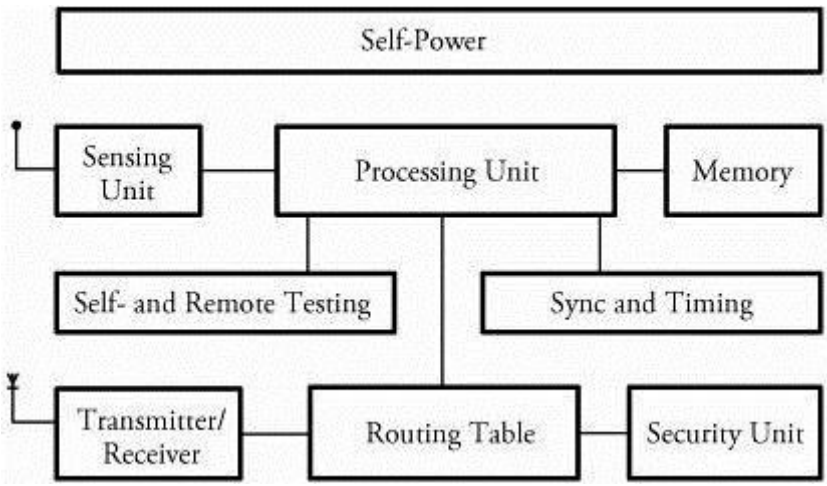
SENSOR NODE STRUCTURE

Figure 8.3 shows a typical sensor node. A node consists mainly of a sensing unit, a processing unit and memory, a self-power unit, and a wireless transceiver component, as well as a self- and remote-testing unit, a synchronizing and timing unit, a routing table, and security units. Since nodes in a network are not physically accessible once they are deployed in the field, they are not worth being brought under test. An option is an on-board remote self-testing unit for the node on a routine basis.

Figure 8.3. A typical wireless sensor node



Each node must determine its location. This task is carried out by a location-finding system based on the global positioning system (GPS). All the processes within the sensor node are synchronized by a local clocking and synchronizing system. The communication and security protocol units are in fact part of the processing unit. These two units are responsible for computing the best path for networking and security of the data being transmitted. The three main blocks of the sensor nodesensing unit, processing and memory unit, and power unitare described in more detail in the following subsections.

Sensing Unit

The sensing unit consists of a sensor and an analog-to-digital converter. A smart sensor node consists of a combination of multiple sensors. The analog signals produced by the sensors, based on the observed event, are converted to digital signals by the converter and then fed into the processing unit. The sensing unit collects data externally and interacts with the central processor at the heart of the node.

Processing and Memory Unit

The processing unit performs certain computations on the data and, depending on how it is programmed, may send the resulting information out to the network. The processing unit, which is generally associated with memory, manages the procedures that make the sensor node collaborate with the other nodes to carry out the assigned sensing task. The central processor determines what data needs to be analyzed, stored, or compared with the data stored in memory. The streamed data from the sensor input is processed as it arrives. The database in memory stores an indexed data list to be used as a reference to detect an event. Since sensing nodes are typically tiny and many nodes are engaged in a network, the communication structure makes use of a hierarchically arranged self-routing network through cluster heads.

In smart wireless sensor networks, a tiny processor and a tiny database are used in a node. Thousands of such nodes are spread on fields to power up the sensing task, as in the deployment of numerous small intelligent sensor nodes in a battlefield to monitor enemy movements. By inserting self-organizing capability into a sensor network, a smart node can extract data, compare it with

the data stored in its memory database, and process it for relevance before relaying it to its central base station.

Self-Power Unit

A sensor node is supposed to be mounted in a small physical unit, limiting space for the battery. Moreover, the random distribution of sensors makes it impossible to periodically recharge or exchange batteries. In most types of sensor networks, the power unit in a sensor node is the most important unit of the node because the liveliness and existence of a node depend on the energy left in the node, and the routing in the sensor network is based on the algorithm that finds a path with the most energy. Thus, it is essential to use energy-efficient algorithms to prolong the life of sensor networks. The main task of the sensor node is to identify events, to process data, and then to transmit the data. The power of a node is consumed mainly in the transmitter and receiver unit. The sensor node can be supplied by a self-power unit, self-power unitbattery, or solar cells.