# C.1 Embedded Systems

Return to Hardware Architectures

An **Embedded System** is a computer custom built to serve a specific purpose. Some examples of special purpose computers are cash registers, calculators, smart thermostats, and engine monitors in vehicles. A general purpose computer is one designed to perform general tasks such as tablets, laptops, desktops, workstations and serves. Recently, smart phones have crossed over from being special purpose computers to general purpose computers performing lots of tasks such as browsing the internet, playing songs, watching films, gaming and taking photos. They are no longer limited to making and receiving phone calls.

Although the general purpose computers are almost ubiquitous and they can solve many problems associated with embedded computers. Yet the need for specialized microprocessors has increased dramatically. General purpose computers are not necessarily best when it comes to specialized needs. They are often cumbersome, expensive and not well suited to handle specific needs. For example, a smart thermostat, a calculator or security sensors are best left to specialized computers.

Embedded systems can be classified into three categories:

- **Subsystems** - is part of a larger system. For example, the temperature sensor in refrigerators and freezers, the rain sensor in windshield wipers or a motion detector in a light. As a standalone, independent system, the subsystems are of little value, its only when they are incorporated into a large system that the bcome valuable.
- **Standalone Systems** - are devices that can perform tasks on their own, but can be used as part of a larger system. Some examples are USB Devices which can store data and can exist indepently of other systes, but can also be part of a larger system to perform operations like data storage. Other examples might be digital watches or bathroom scales.
- **Networked Systems** - is where devices are networked together as peers to provide a “system”. Some examples would be the sensors in a home security or home automation system. Some networked systems can contain hundreds of thousands of peers all working in harmony to monitor large operations such as a dam, an airtraffic control system, or a hospital.

Often these systems use a Microcontroller or microprocessor.

A microcontroller is a chip optimized to control electronic devices. It is stored in a single integrated circuit which is dedicated to performing a particular task and execute one specific application.

It is specially designed circuits for embedded applications and is widely used in automatically controlled electronic devices. It contains memory, processor, and programmable I/O.

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