Embedded systems architecture

Design, Architecture

Arnold (2001) defines a computational embedded system as one whose principle system is not computational but is controlled by a computational system embedded within it. This is usually shortened as embedded system. Based on the function it performs, many authors have proposed definitions of embedded systems.

Raghavan, Lad, and Neelakandan (2005) define an embedded system as a specialized computer system that is designated to perform very small sets of designated activities. In other words it can be defined as an applied computer system (Noergaard, 2005). However, the definition of an embedded system is largely ambiguous and hence does not cover all the systems being designated as embedded systems. This is because of the dramatic increase in technology with a corresponding decrease in the cost of manufacturing of the various components of such a system.

Usually an embedded system is designed for performing specific function. Earlier, this used to differentiate an embedded system with other devices having software and hardware and performing general purpose functions like a desktop computer. However, in present day, this definition of embedded system cannot be said accurate, because of the development of devices like modern cell phones and Personal Digital Assistant, PDA etc. which perform multiple functions apart from the primary use for which they have been developed (Noergaard, 2005).

Features of Embedded Systems

Embedded systems share some common features as mentioned below:

• Hardware and Software – Any embedded system has both software and hardware components. Arnold (2001) says that the emphasis in the design varies depending on the constraints of the design specification.

• Physical design and size constraints – All the embedded systems are usually meant to be as small as possible while including the maximum functionality. In addition, the time constraints on the systems are also very rigid

• Reliability – As opposed to general purpose systems, embedded systems need to be reliable with zero bugs in the product.

• Portability and Flexibility – The application functions required by an embedded system change frequently due to the change in the hardware components towards better models. One of the examples is the Moore's law giving the time taken for the development of a new IC. In this case, application must be portable to the newer hardware. In addition, the system must also be flexible enough to add some features when required, without changing the complete product.

In addition to these primary features, embedded systems can also have additional features based on necessity like accuracy, low-cost, networked processors and internet enabled

Examples of Embedded Systems

Embedded systems are used in a variety of applications. Following are some categories of embedded systems based on the markets they cover:

• Consumer Electronic – Cameras and camcorders, Kitchen appliances like microwave ovens, washing machines etc., toys and games, Televisions etc.

• Industrial systems – Robotics and Control systems, Instrumentations systems

• Automotive systems – Ignition systems, Engine control, brake systems etc., train systems and also avionic systems

• Office automation systems – Fax machines, copiers, printers, scanners, monitorsetc Networking systems – Routers, Gateways, Hubs etc.

• Medical systems – Life-support systems, dialysis machines, diagnostic machines, infusion pumps, testing systems etc.