



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution



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Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT312 – EMBEDDED SYSTEM DESIGN

III YEAR/ VI SEMESTER
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UNIT 1 – INTRODUCTION TO EMBEDDED SYSTEMS

TOPIC 1.1 - INTRODUCTION TO EMBEDDED SYSTEMS



INTRODUCTION TO EMBEDDED SYSTEMS



Embedded System

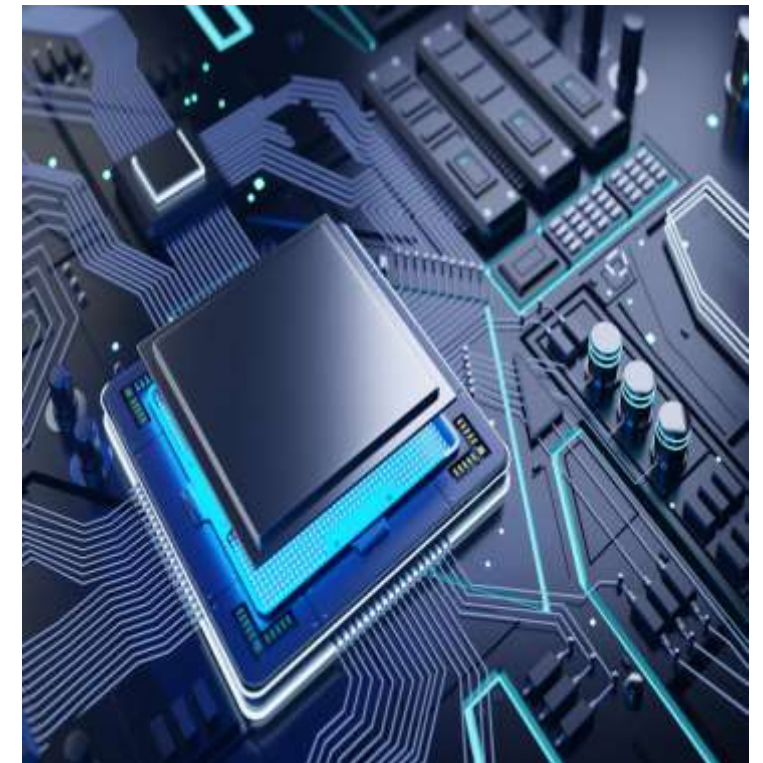
- An embedded system is an electronic system that has a software and is embedded in computer hardware
- It is programmable or non programmable depending on the application.
- An embedded system is defined as a way of working, organizing, performing single or multiple tasks according to a set of rules
- In an embedded system, all the units assemble and work together according to the program

Examples

- ✓ microwave ovens
- ✓ washing machine
- ✓ Printers
- ✓ Automobiles
- ✓ cameras, etc.
- ✓ These systems use microprocessors and microcontrollers

An embedded system has three components

- ✓ It has hardware
- ✓ It has application software
- ✓ It has Real Time Operating System (RTOS)





INTRODUCTION TO EMBEDDED SYSTEMS



Advantages

- ❖ Small size
- ❖ Low power consumption
- ❖ Low cost
- ❖ Enhanced performance
- ❖ Easily customizable

Disadvantages

- ❖ High development effort
- ❖ Larger time to market



BASIC STRUCTURE OF AN EMBEDDED SYSTEM



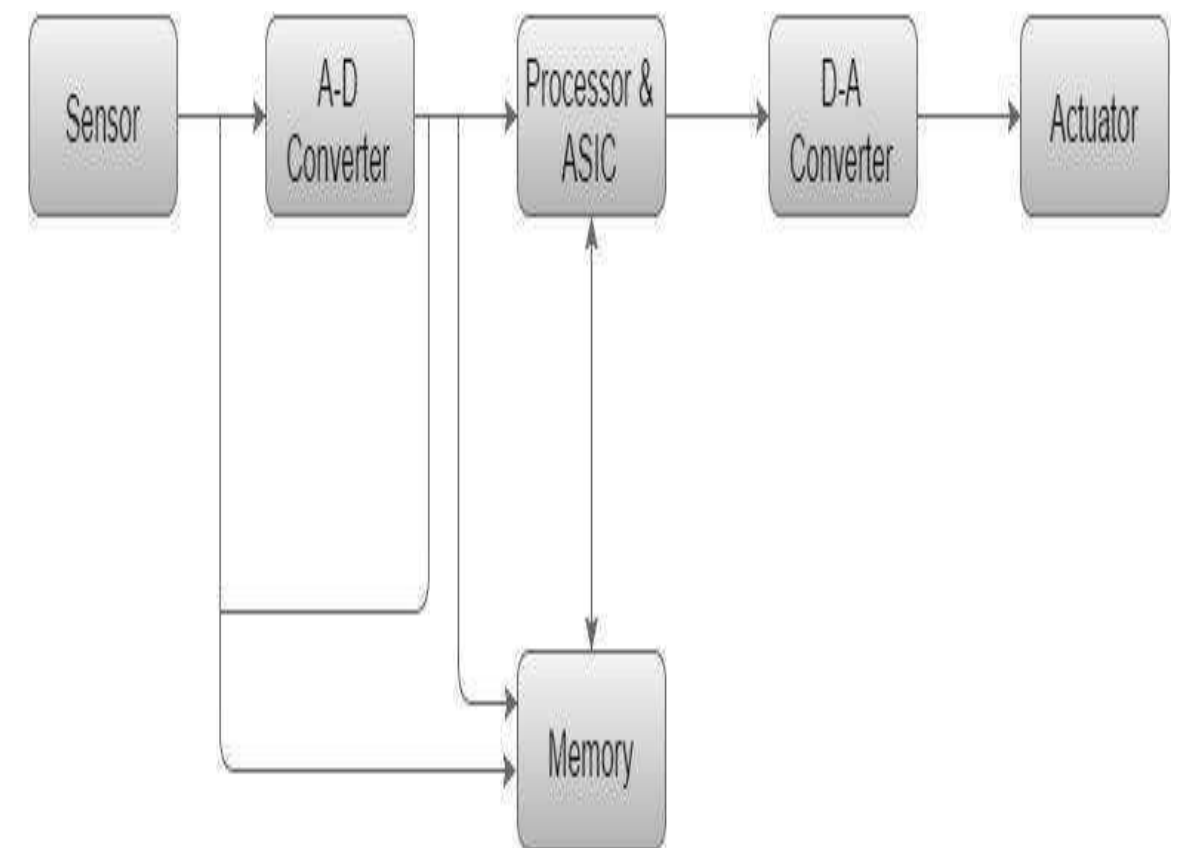
Sensor: It measures the physical quantity and converts it to an electrical signal which can be read by an observer or by any electronic instrument like an A-D converter. A sensor stores the measured quantity to the memory

A-D Converter: An analog-to-digital converter converts the analog signal sent by the sensor into a digital signal

Processor & ASICs : Processors process the data to measure the output and store it to the memory

D-A Converter : A digital-to-analog converter converts the digital data fed by the processor to analog data

Actuator : An actuator compares the output given by the D-A Converter to the actual (expected) output stored in it and stores the approved output.





DIFFERENCE BETWEEN GENERAL PURPOSE COMPUTER AND EMBEDDED SYSTEMS



General Purpose Computer	Embedded Systems
It is designed using a microprocessor as the main processing unit.	It is mostly designed using a microcontroller as the main processing unit.
It contains a large memory semiconductor memories like cache and RAM. It also contains secondary storage like hard disks etc.	It uses semiconductor memories but does not require secondary memories like hard disk, CD. It sometime has special memory called flash memory.
It is designed such that it can do multiple tasks as per requirement	It is designed such that it can do a particular predefined task.
It is mostly costlier compared to the embedded systems	It is cheaper compared to a computer.
It requires huge number of peripheral devices and their controllers	It is cheaper as it requires less no of peripheral devices and their controllers are microcontroller chip itself.
The Operating system and other software for the general purpose computers, are normally complicated and occupy more memory space.	The operating system (mostly RTOS i.e Real Time Operating System) and other software occupy less memory space.

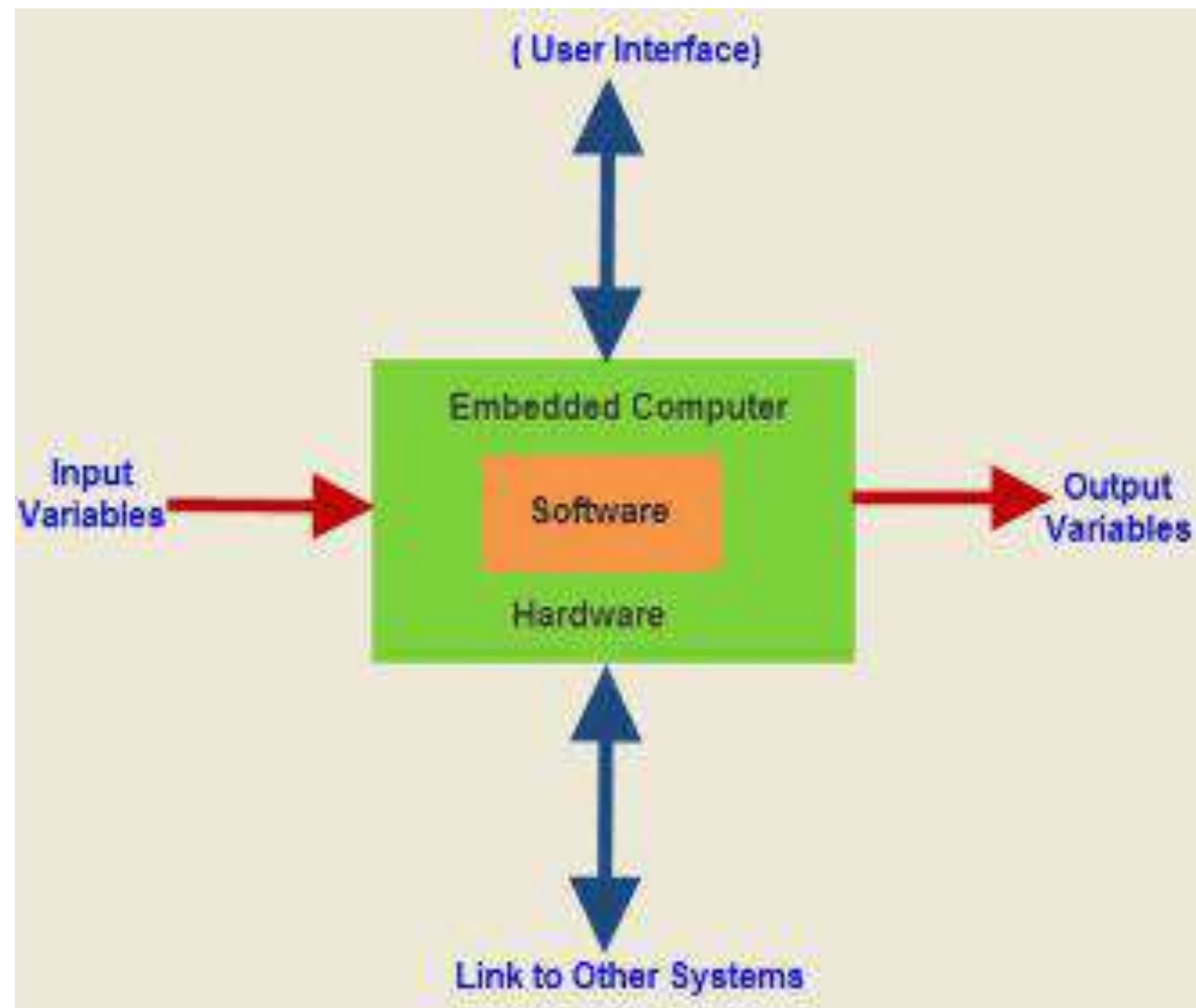


EMBEDDED SYSTEMS - HARDWARE



The Embedded system hardware includes elements like

- user interface
- input/output interfaces
- display and
- memory, etc.



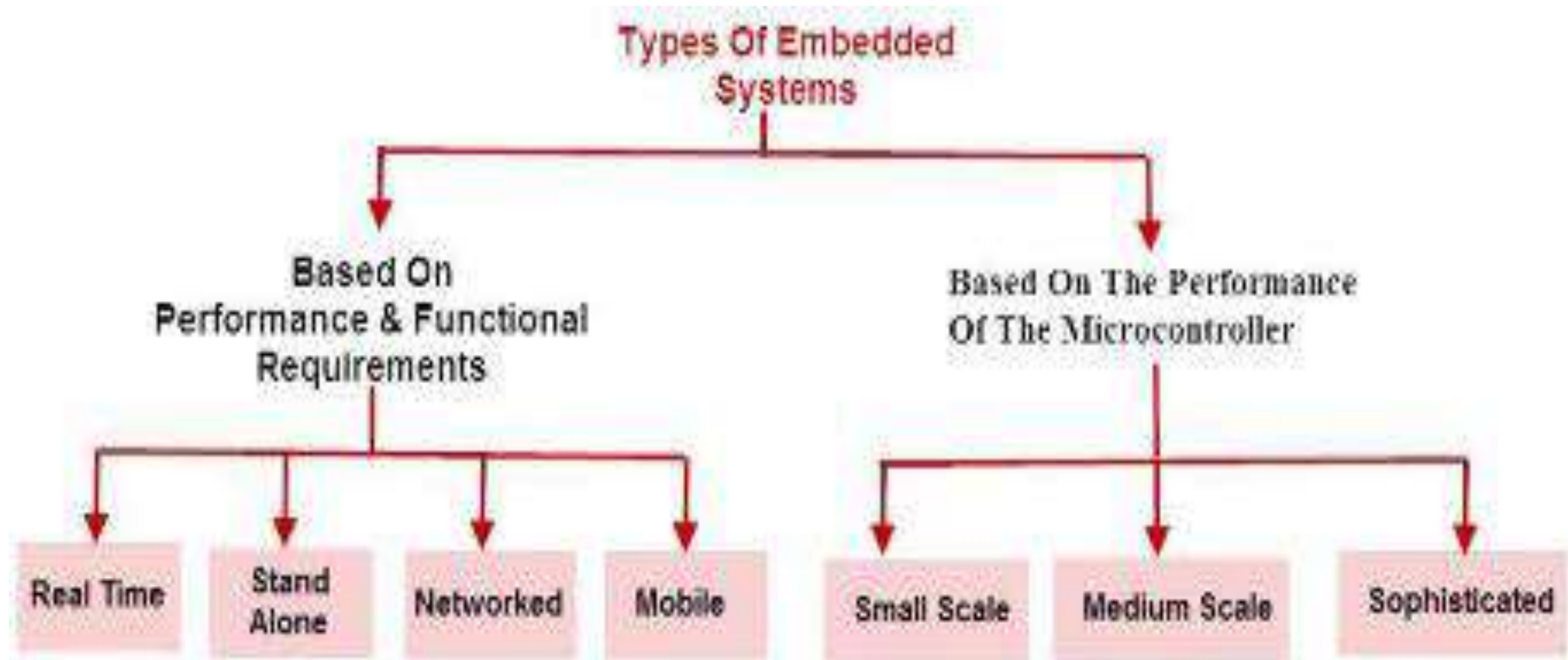


EMBEDDED SYSTEMS - TYPES



Embedded systems can be classified into different types based on

- Performance,
- functional requirements and
- performance of the microcontroller.





EMBEDDED SYSTEMS - TYPES

Embedded systems are classified into four categories based on their performance and functional requirements

Stand alone embedded systems

- They do not require a host system like a computer, it works by itself. It takes the input from the input ports either analog or digital and processes, calculates and converts the data and gives the resulting data through the connected device-Which either controls, drives and displays the connected devices.

Eg: mp3 players, digital cameras, video game consoles, microwave ovens and temperature measurement systems.

Real time embedded systems

- a system which gives a required o/p in a particular time. These types of embedded systems follow the time deadlines for completion of a task. Real time embedded systems are classified into two types such as soft and hard real time systems

Networked embedded systems

- related to a network to access the resources. The connected network can be LAN, WAN or the internet. The connection can be any wired or wireless. fastest growing area in embedded system applications

Mobile embedded systems

- Mobile embedded systems are used in portable embedded devices like cell phones, mobiles, digital cameras, mp3 players and personal digital assistants, etc. The basic limitation of these devices is the other resources and limitation of memory



EMBEDDED SYSTEMS - TYPES



Embedded Systems are classified into three types based on the performance of the microcontroller such as

Small scale embedded systems

- designed with a single 8 or 16-bit microcontroller, that may even be activated by a battery. For developing embedded software for small scale embedded systems, the main programming tools are an editor, assembler, cross assembler and integrated development environment (IDE)

Medium scale embedded systems

- designed with a single or 16 or 32 bit microcontroller, RISCs or DSPs. These types of embedded systems have both hardware and software complexities. For developing embedded software for medium scale embedded systems, the main programming tools are C, C++, JAVA, Visual C++, RTOS, debugger, source code engineering tool, simulator and IDE

Sophisticated embedded systems

- These types of embedded systems have enormous hardware and software complexities, that may need ASIPs, IPs, PLAs, scalable or configurable processors. They are used for cutting-edge applications that need hardware and software Co-design and components which have to assemble in the final system.



EMBEDDED SYSTEMS - APPLICATIONS



Embedded systems are used in different applications like

- automobiles
- telecommunications
- smart cards
- Missiles
- Satellites
- computer networking and
- digital consumer electronics



