

ELECTRONIC PRINCIPLES AND DEVICES

Unit 4 –DIGITAL ELECTRONICS

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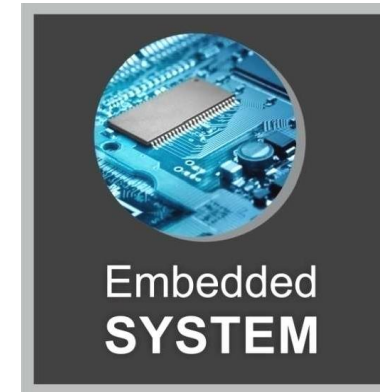
Introduction to Embedded Systems: Definition, Block Diagram of Embedded System

Department of Electronics and Communication.

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Introduction to Embedded System

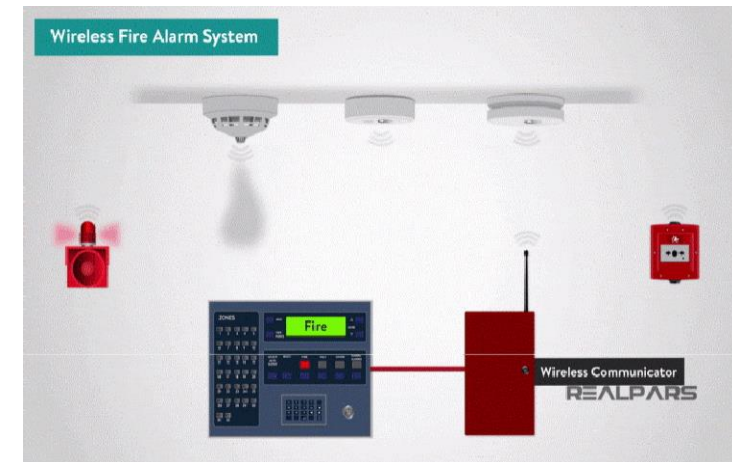
- ❖ Embedded means something that is attached to another thing
- ❖ A system is an arrangement in which all its unit assemble work together according to a set of rules
- ‘An embedded system is a special-purpose system in which the computer is completely encapsulated by the device it controls’
- ❖ Unlike a general-purpose computer, such as a personal computer, an embedded system performs pre-defined tasks, usually with very specific requirements



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Introduction to Embedded System

- ❖ An embedded system can be thought of as a computer hardware system having software embedded in it
- ❖ An embedded system can be an independent system or it can be a part of a large system
- ❖ An embedded system is a microcontroller or microprocessor based system which is designed to perform a specific task
- ❖ For example, a fire alarm is an embedded system; it will sense only smoke



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What is an Embedded Systems

An Embedded System is an integrated system including both hardware and software is not enough

An embedded system is a dedicated computer system, designed to work for single or few specific functions often within a larger system

Embedded Systems, therefore, are

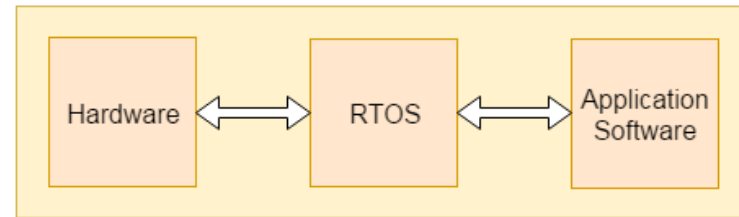
- ❖ Built to function with little or no human intervention
- ❖ Specially designed keeping in consideration the tasks that need completion in the most efficient way



Main Parts of an Embedded System

An embedded system has three components

- ❖ It has hardware
- ❖ It has application software
- ❖ It has Real Time Operating system (RTOS) that supervises the application software and provide mechanism to let the processor run a process as per scheduling by following a plan to control the latencies



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Main Parts of an Embedded System

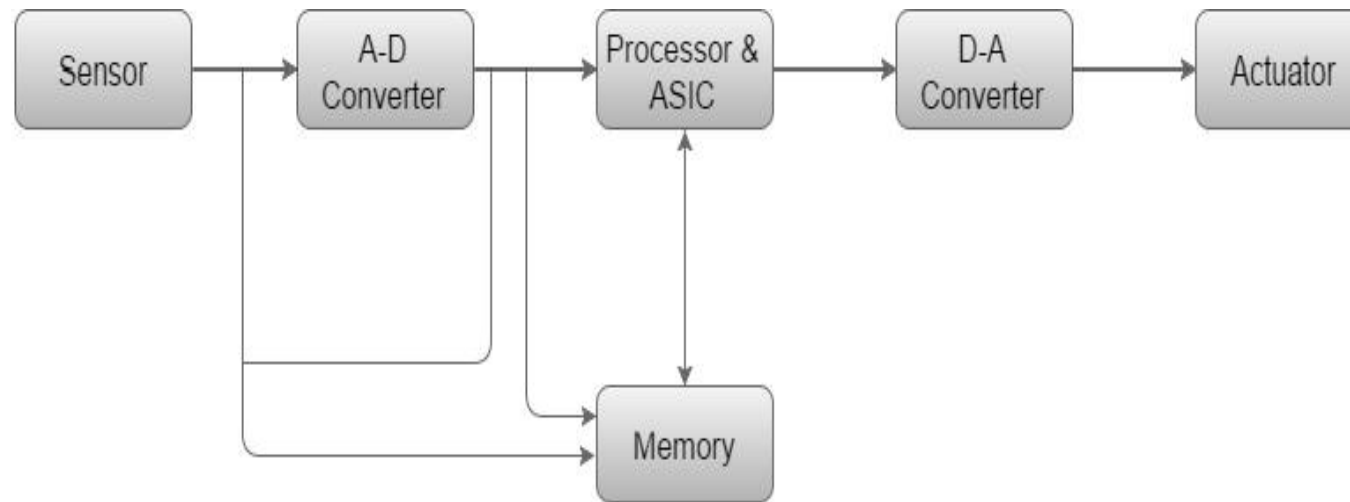
❖ RTOS defines the way the system works. It sets the rules during the execution of application program. A small scale embedded system may not have RTOS

An embedded system as a Microcontroller based, software driven, and reliable, real-time control system



Basic Structure an Embedded System

The following illustration shows the basic structure of an embedded system



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Basic Structure 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 A2D 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

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Features of an Embedded System

❖ **Single-functioned** – an embedded system usually performs a specialized operation and does the same repeatedly

For example: A pager always functions as a pager

❖ **Tightly constrained** – All computing systems have constraints on design metrics, but those on an embedded system can be especially tight

- Design metrics is a measure of an implementation's features such as its cost, size, power, and performance
- It must be of a size to fit on a single chip, must perform fast enough to process data in real time and consume minimum power to extend battery life



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Features of an Embedded System Continued...

❖ **Reactive and Real time** – Many embedded systems must continually react to changes in the system's environment and must compute certain results in real time without any delay

Consider an example of a car cruise controller; it continually monitors and reacts to speed and brake sensors. It must compute acceleration or decelerations repeatedly within a limited time; a delayed computation can result in failure to control of the car

❖ **Microprocessors based** – It must be microprocessor or microcontroller based

❖ **Memory** – It must have a memory, as its software usually embeds in ROM. It does not need any secondary memories in the computer

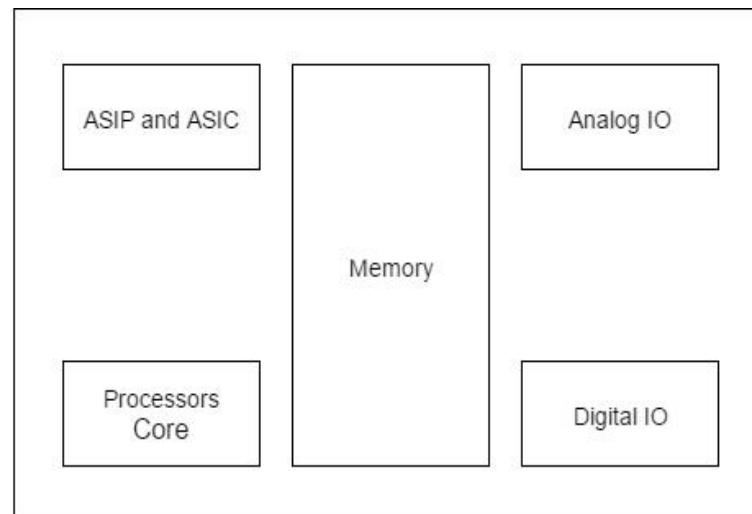


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Features of an Embedded System Continued...

❖ **Connected** – It must have connected peripherals to connect input and output devices

❖ **HW-SW systems** – Software is used for more features and flexibility. Hardware is used for performance and security





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