Department of Physics

Periyar Arts College, Cuddalore

II M.Sc. PHYSICS

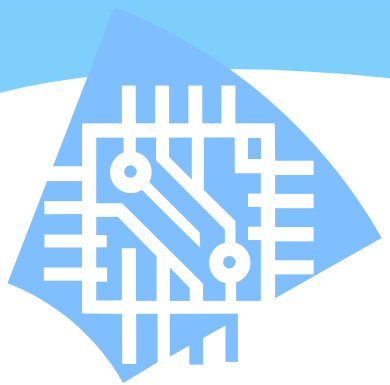
Microprocessor and Microcontroller

8-8-2020 11 AM- 12 Noon

Unit -5

Embedded Microcontroller System

J A, Physics, PACC



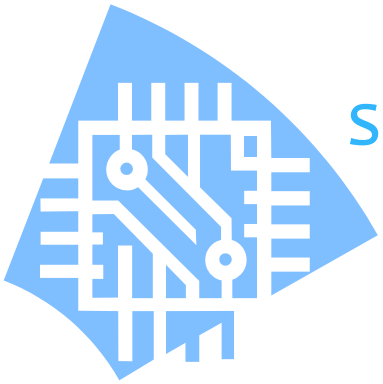
Embedded Microcontroller System

* An embedded microcontroller 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.

What an “Embedded System” is ?

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.



Components of Embedded System

1. Hardware.
2. Application software.
3. Real Time Operating system (RTOS)

NOTE : A small scale embedded system may not have RTOS.

What is RTOS ?

* RTOS 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.
* RTOS defines the way the system works. It sets the rules during the execution of application program.

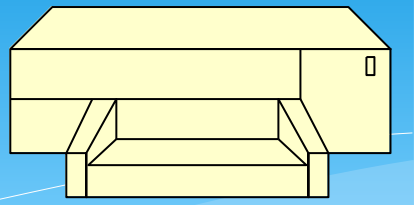
How to define ES ?

An Embedded System is a Microcontroller based, software driven, reliable and real-time control system.

Characteristics of an Embedded Microcontroller System

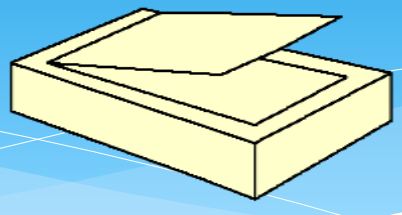
* **Single-functioned**
  * specialized operation and does the same repeatedly.
* Example:
  * An iPod always functions as an iPod.

Tightly constrained
Design constraints



* **Size** (must fit on a single chip)
* **Speed** (fast enough to process data in real time)
* **Power** (consume low power to extend battery life.)

Reactive and Real time



* Many embedded systems must continually react to changes in the system's environment
* compute certain results in real time without any delay.

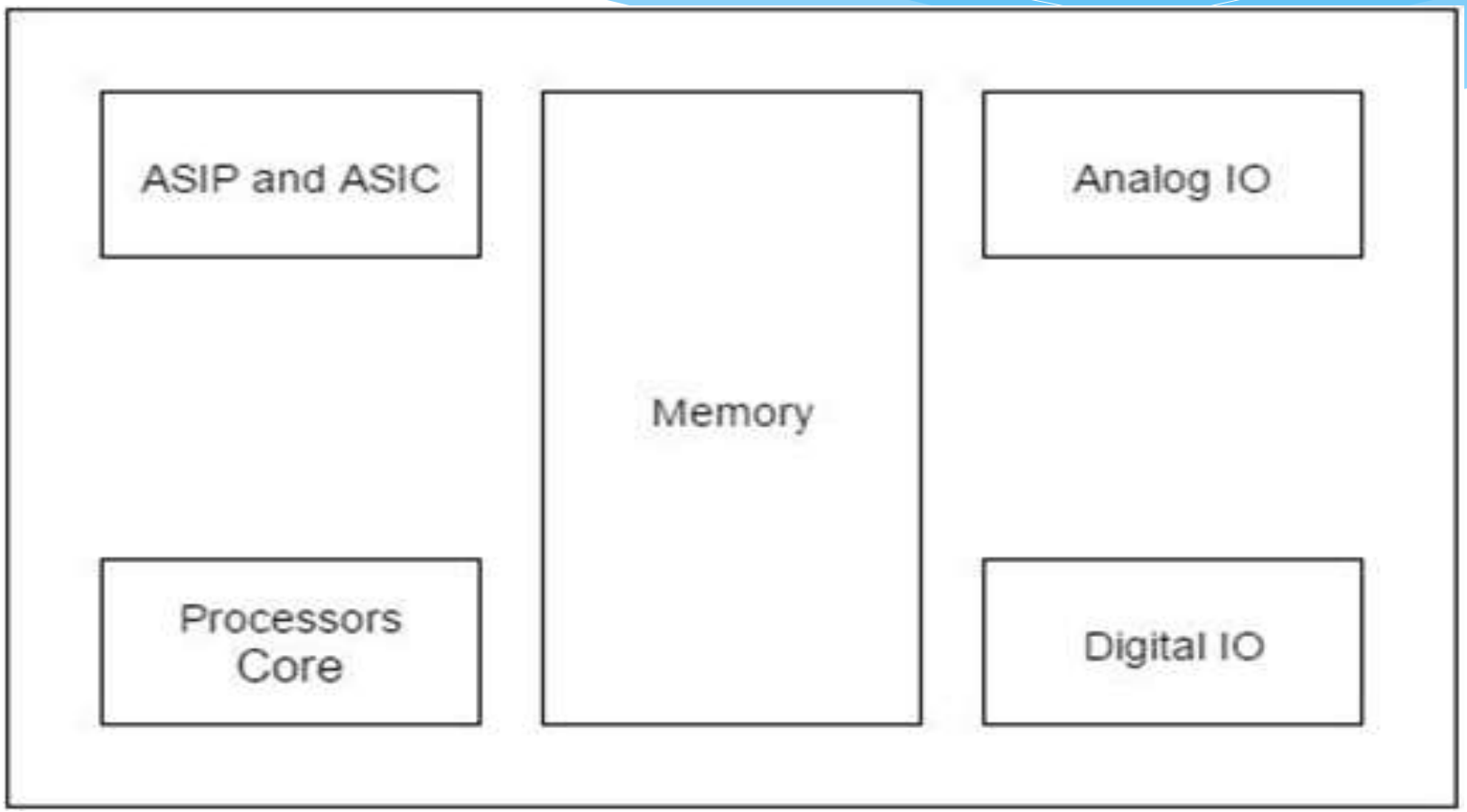
Microprocessors based and Memory

* **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.

Connected I/O & Hardware-Software systems

* **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.

Embedded System Block Diagram

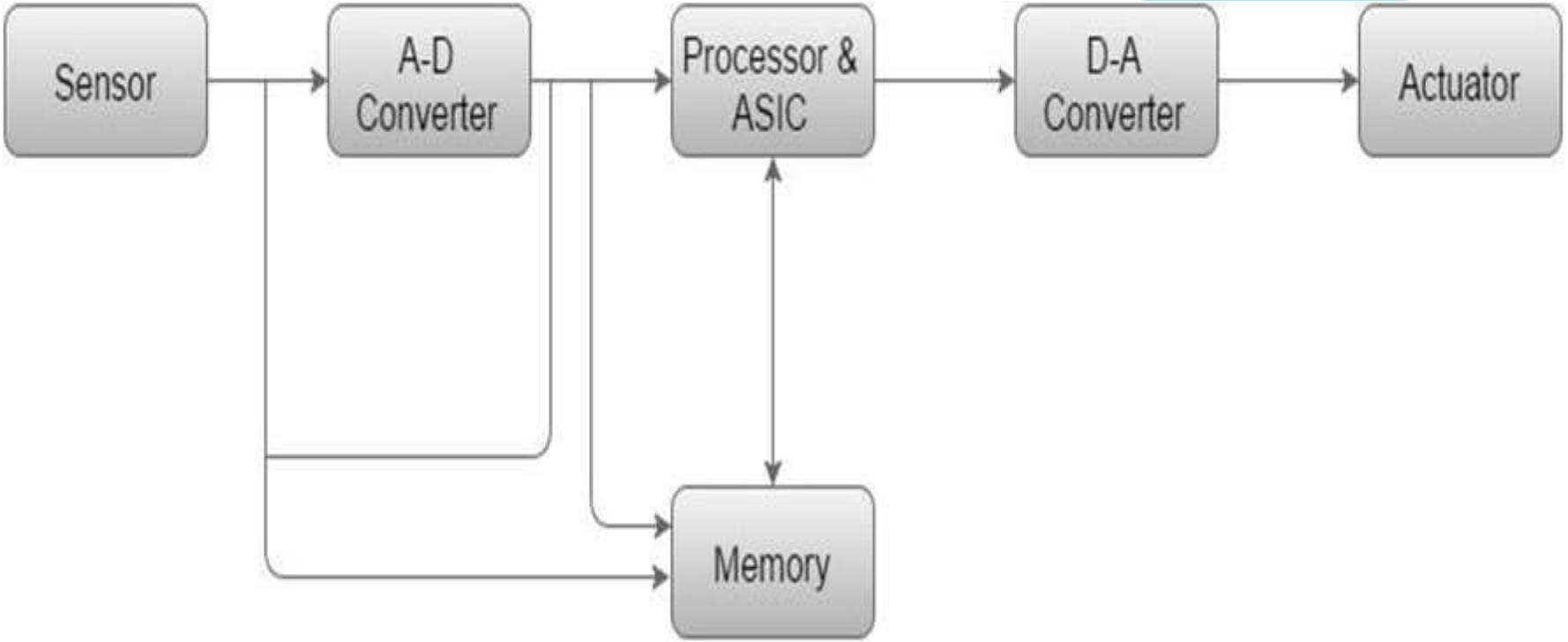


Embedded System

* **Advantages**
* **Easily Customizable**
* **Low power consumption**
* **Low cost**
* **Enhanced performance**

* **Disadvantages**
* **High development effort**
* Larger time to market

Basic Structure of an Embedded System



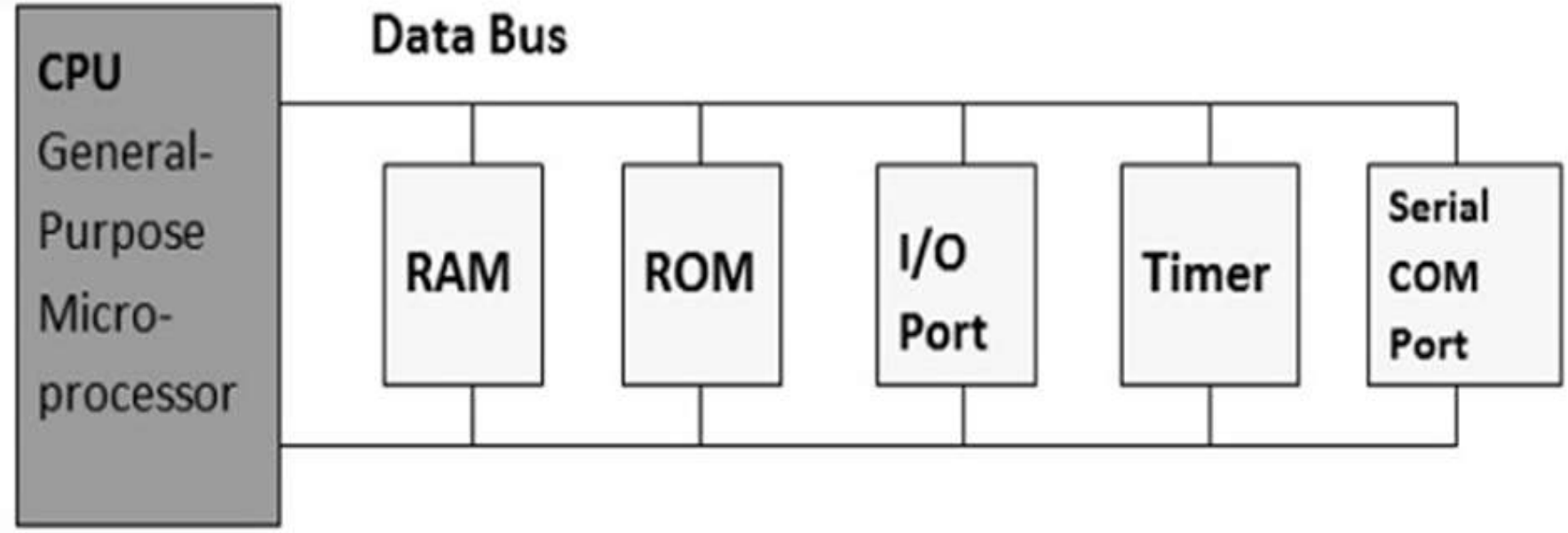
Processors in a System has two essential units

* **Program Flow Control Unit (CU)**
* **Execution Unit (EU)**
* **EU includes the Arithmetic and Logical Unit (ALU)**

Types of Processors

* Microprocessor (µP)
* Microcontroller (µC)
* Digital Signal Processor (DSP)
* Media Processor

Microprocessor is a single VLSI chip having a CPU



A SIMPLE BLOCK DIAGRAM OF A MICROPROCESSOR

Microcontroller

is a single-chip VLSI unit, having limited computational capabilities, possesses enhanced input/output capability and a number of on-chip functional units.

CPU	RAM	ROM
I/O Port	Timer	Serial COM Port

Microprocessor	Microcontroller
Microprocessors are **multitasking** in nature. Can perform multiple tasks at a time. For example, on computer we can play music while writing text in text editor.	**Single task oriented**. For example, a washing machine is designed for washing clothes only.

Microprocessor	Microcontroller
RAM, ROM, I/O Ports, and Timers can be added externally and can vary in numbers.	RAM, ROM, I/O Ports, and Timers cannot be added externally. These components are to be embedded together on a chip and are fixed in numbers.
Designers can decide the number of memory or I/O ports needed.	Fixed number for memory or I/O makes a microcontroller ideal for a limited but specific task.

Microprocessor	Microcontroller
External support of external memory and I/O ports makes a microprocessor-based system heavier and costlier.	Microcontrollers are lightweight and cheaper than a microprocessor.
External devices require more space and their power consumption is higher.	A microcontroller-based system consumes less power and takes less space.

EMBEDDED PRODUCTS

* Digital alarm clocks
* Electronic parking meters and parking pay stations
* Robotic vacuum cleaners Smart watches and digital wrist watches
* Washing machines and dishwashers
* Home security systems
* Air-conditioners and thermostats
* Electric stoves, pressure cookers, and tea/coffee machines
* Traffic lights
* Vending machines
* Fire alarms and carbon monoxide detectors
* Printers, photocopy, fax machines and scanners
* Digital and video cameras
* Calculators

SOME MORE PRODUCTS

* Remote control gate keys
* Digital thermometers
* Motion sensors
* PDAs and hand-held computers
* Lighting systems
* GPS navigation devices
* Heart rate monitors and pacemakers
* CD players, iPods and MP3 players
* Parking lot ticket machines
* Cash registers
* Digital signature pads
* Electronic toys
* Refrigerators and freezers
* Electronic safes
* Wi-Fi routers
* Automobile systems (cruise control, anti-lock braking system (ABS), transmission control, electronic fuel injection, suspensions systems, in-vehicle entertainment systems and so on…

YOUR ATTENTION PLEASE

Hello Students !

Please type your “Name” followed by “Present Sir” in the chat box for marking attendance.

E.g: [Name] space [Present Sir]

TIME FOR QUESTIONS

Students can ask questions/ clarifications now

THANK YOU !!!