

# TODAY'S TOPIC

**Embedded  
system**

**Mircrocontroller**

**EPS**

# 1. Embedded System

## Q. What is it about?

An embedded system is a computer system that is programmed to perform specific functions within larger electronic devices or systems.

## Q. Examples of Embedded Systems

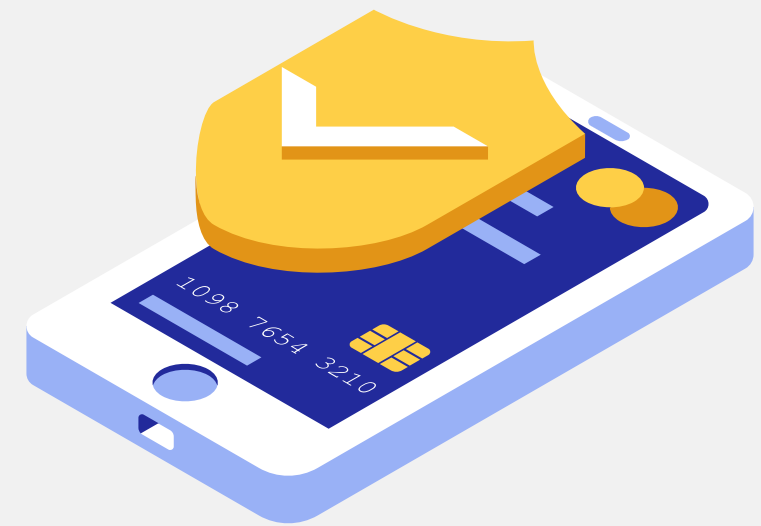
Industrial machines: Programmable Logic Controllers, SCADA Systems, CNC Machines, RFID systems, Temperature Controllers, etc.

Automobiles: Modern cars consist of embedded systems that can perform several tasks within the vehicle.

Medical equipment: control mechanisms. Patient monitoring systems, infusion pumps, imaging equipment, ventilators

## Q. Types of Embedded Systems

- Standalone embedded systems
- Real-time Embedded System
- Network Embedded System



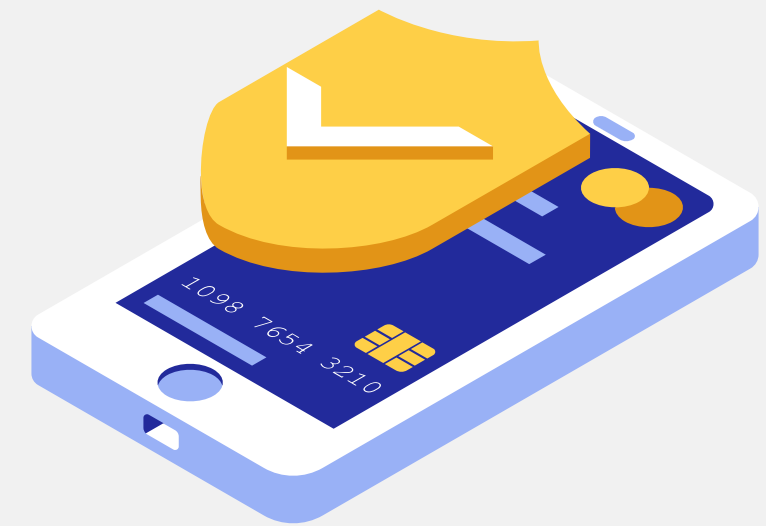
# 1. Embedded System

## Q. Characteristics of an Embedded System

- **Dedicated Functionality:** Embedded systems are designed for performing a specific task or set of tasks, often with real-time constraints.
- **Integration with Hardware:** They are closely integrated with the physical hardware they control and often have minimal user interfaces.
- **Real-Time Operation:** Many embedded systems operate in real-time, meaning they must complete their tasks within strictly defined time constraints.
- **Limited Resources:** They typically have limited processing power, memory, and storage, requiring efficient use of resources.
- **Cost-Effectiveness:** They are often cost-effective solutions for controlling devices and processes, balancing performance and functionality against cost constraints.

## Q. Advantages of Embedded System

Cost-Effective, Size Efficiency, Real-time Operations, Low Power consumption  
Fast performance, Ease of Management



# 2. Microcontroller basic

## Q. What is it about?

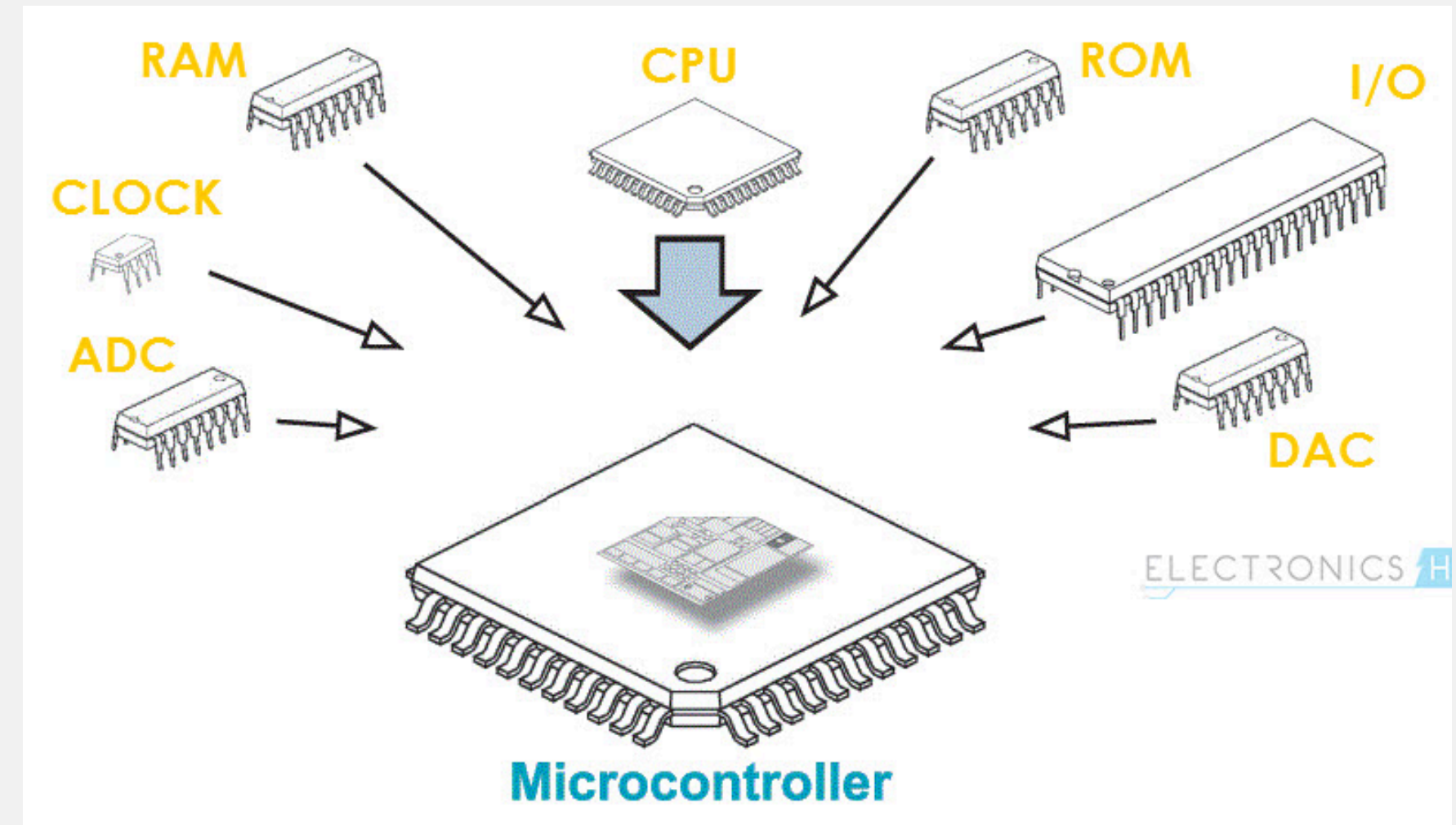
A microcontroller is a compact integrated circuit designed to govern a specific operation in an embbed system.

## Q. How do microcontrollers work?

A microcontroller is a compact integrated circuit designed to govern a specific operation in an embbed system.

## Q. What are the elements of a microcontroller?

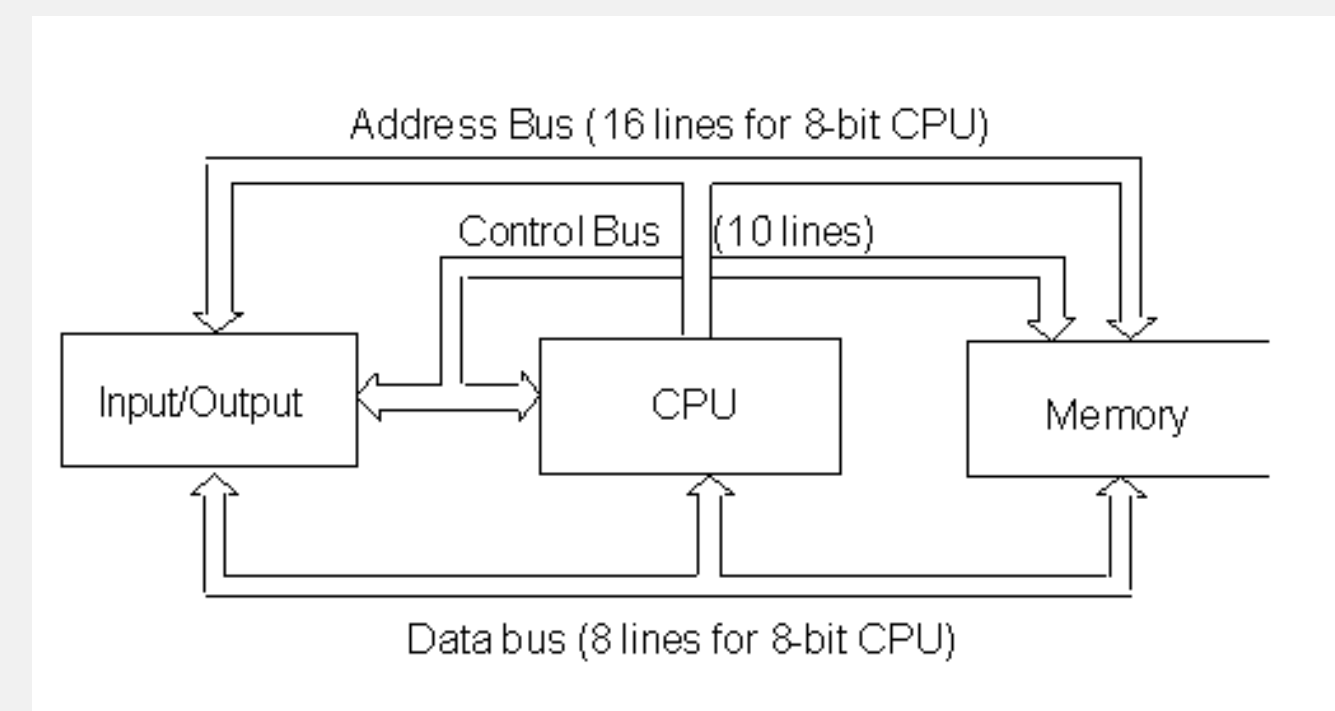
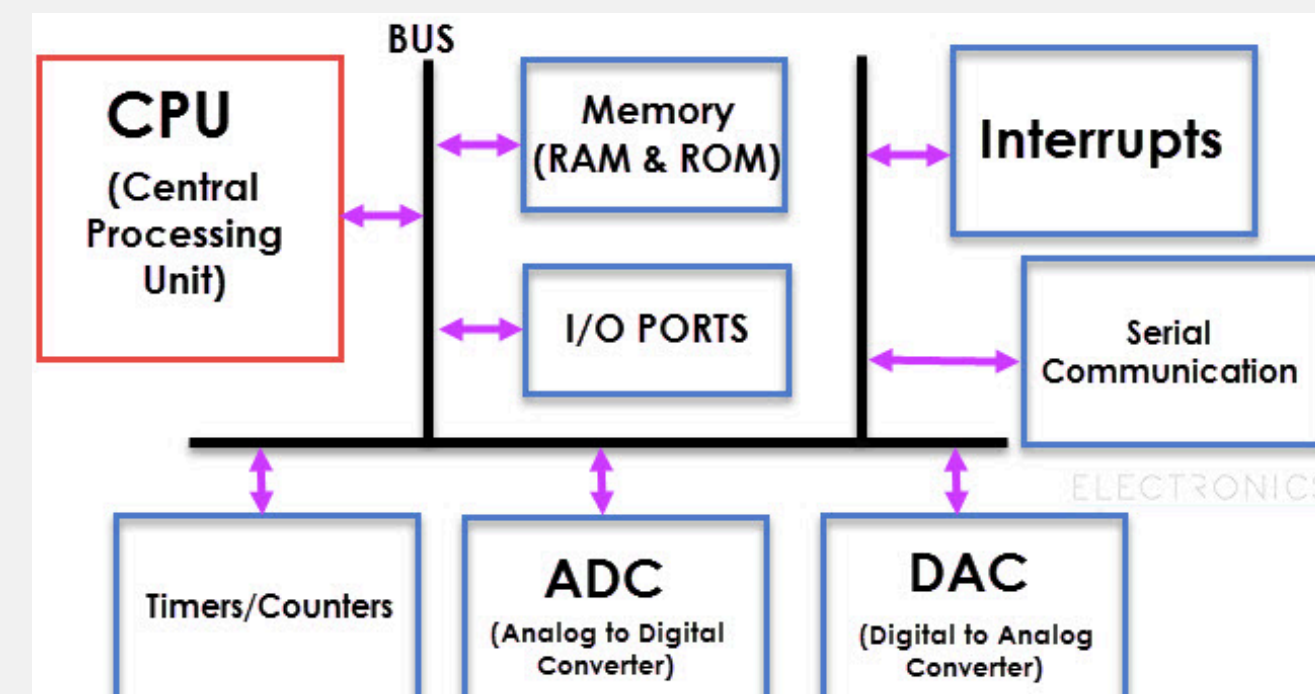
- The processor(CPU) - It processes and responds to various instructions that direct the microcontroller's function. This involves performing basic arithmetic, logic and I/O operations.
- Memory - A microcontroller's memory is used to store the data that the processor receives and uses to respond to instructions that it's been programmed to carry out.
- I/O - The input ports receive information and send it to the processor in the form of binary data. The processor receives that data and sends the necessary instructions to output devices that execute tasks external to the microcontroller.
- Timer and Counters / Clock Circuit / DAC/ ADC / Interrupt Mechanism



# 2. Microcontroller basic

## Q. What's the difference between Microcontroller and Microprocessor?

Microprocessor	Microcontroller
Since memory and I/O are connected externally, the circuit becomes large in size.	Since memory and I/O are present together, the internal circuit is small in size.
It cannot be used in compact systems	It can be used in compact systems.
Cost is high	Cost is low
It is not suitable for devices that run on stored power since total power consumption is high due to external components.	It can be used on devices that use stored power since total power consumption is low due to less external components.
RAM, ROM, I/O units, and other peripherals are not embedded on a single chip.	RAM, ROM, CPU and other peripherals are embedded on a single chip.
Do not have power saving mode.	Have a power-saving mode.
Used in personal computers.	Used in embedded systems.
Less number of registers.	More number of registers.
Uses an external bus.	Uses an internal controlling bus.
Based on the Von Neumann model	Based on the Harvard architecture
It is a central processing unit on a single silicon-based integrated chip.	It is a byproduct of the development of microprocessors with a CPU along with other peripherals.
Complex and expensive due to a large number of instructions to process.	Simple and inexpensive due to less number of instructions to process.
Can run at a very high speed.	Can run up to 200MHz or more.





# 3. EPS

## Q. What is it about?

Electric Power Steering (EPS) is a system that uses an electric motor to assist the driver in steering the vehicle.

## Q. How it Works?

When the driver turns the steering wheel, sensors detect this movement and send signals to the ECU. The ECU analyzes the vehicle's speed, steering angle, and other factors to calculate the necessary steering assistance.

The electric motor provides the required amount of force to assist in steering based on the ECU's commands.

## Q. Types of EPS?

Column Assist EPS . Pinion Assist EPS, Rack Assist EPS, Direct Drive EPS

## Q. Component?

Electric Motor: The main component that assists with steering, connected to the steering wheel.

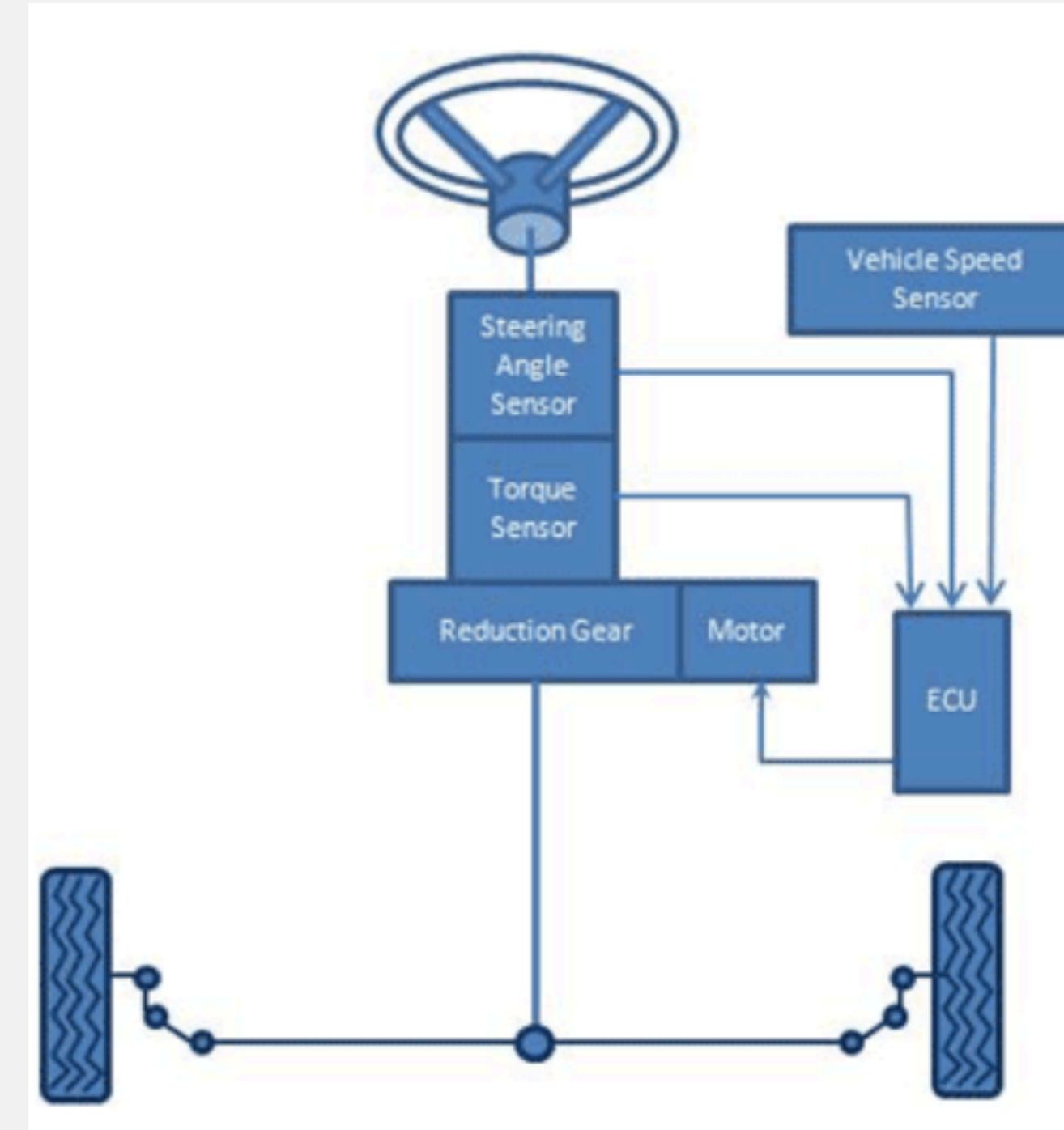
Electronic Control Unit (ECU): Monitors and adjusts the steering angle and force.

Sensors: Measure the steering angle, speed, torque, and send information to the ECU.

# 3. EPS

## Q. Advantages?

- Greater fuel efficiency – the motor draws power only when the vehicle turns
- Eliminates hydraulic fluid maintenance/restocking from time-to-time
- Enables a variety of features
- Enables any driver-assist or convenience feature involving turning of the wheels without steering input
- Empowers other features like lane-keep assist, automated parking, lane changes, and guiding the vehicle around obstacles



## Q. What's the difference between Power steering and Electric Steering?

- Hydraulic power steering is more complicated.
- Electric Steering is more costly.
- Electric Steering can response better at varying speeds.
- Electric Steering's maintance cost is low.

