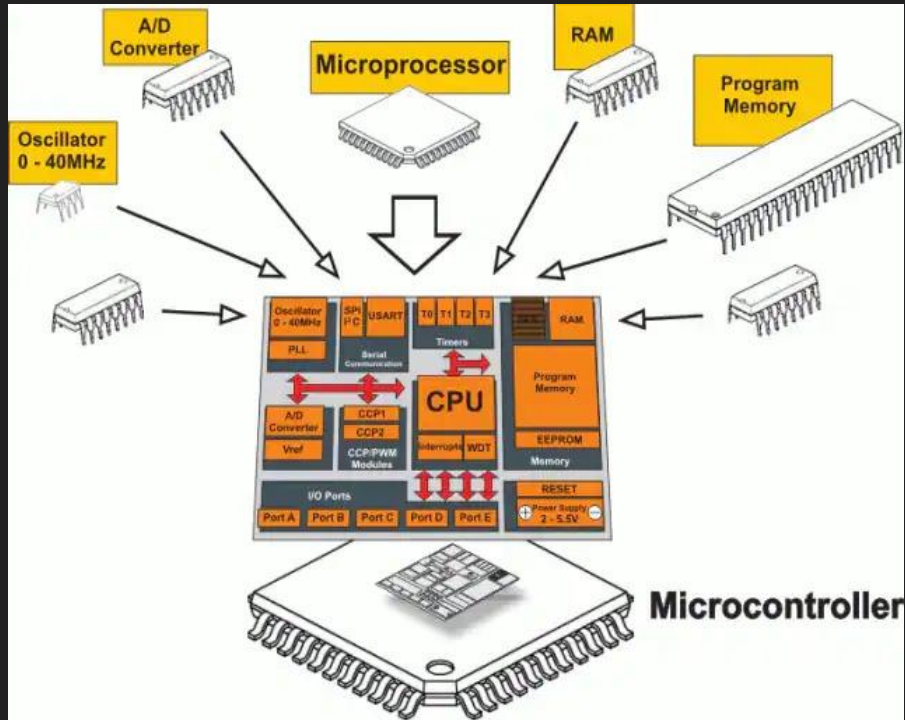




# *What is a Microcontroller*

- A microcontroller (sometimes called an MCU or Microcontroller Unit) is a single Integrated Circuit (IC) that is typically used for a specific application and designed to implement certain tasks.
- Products and devices that must be automatically controlled in certain situations, like appliances, power tools, automobile engine control systems, and computers are great examples
- “Microcontroller” is a well-chosen name because it emphasizes defining characteristics of this product category. The prefix “micro” implies smallness and the term “controller” here implies an enhanced ability to perform control functions

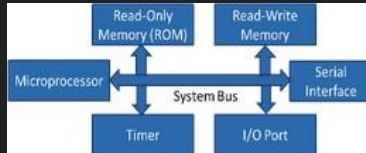
# Essential Components of a Microcontroller



- A microcontroller can be seen as a small computer, and this is because of the essential components inside of it.
- Central Processing Unit (CPU)
- Random-Access Memory (RAM)
- Flash Memory
- Input/Output Ports (I/O Ports)
- Electrical Erasable Programmable Read-Only Memory (EEPROM)

# Difference b/w Microcontroller and Microprocessor

## Microprocessor



Microprocessor is heart of Computer system.

It is just a processor. Memory and I/O components have to be connected externally

Since memory and I/O has to be connected externally, the circuit becomes large.

Cannot be used in compact systems and hence inefficient

Cost of the entire system increases

Due to external components, the entire power consumption is high. Hence it is not suitable to be used with devices running on stored power like batteries.

## Microcontroller



Micro Controller is a heart of embedded system.

Micro controller has external processor along with internal memory and i/O components

Since memory and I/O are present internally, the circuit is small.

Can be used in compact systems and hence it is an efficient technique

Cost of the entire system is low

Since external components are low, total power consumption is less and can be used with devices running on stored power like batteries.

# Families of Microcontrollers

<b><i>Based on 8051 architecture (1981 by intel)</i></b>	<b><i>AVR (Advanced Virtual RISC) (1996 by Atmel)</i></b>	<b><i>PIC (Peripheral Interface Controller) (1998 by Microchip)</i></b>	<b><i>ARM (Advanced RISC Machine) (1983 by Acorn computers)</i></b>
<ul style="list-style-type: none"><li>• Available in 8-bit only.</li><li>• Its family includes 8051 variants.</li><li>• Its manufacturer is Intel.</li></ul>	<ul style="list-style-type: none"><li>• AVR micro-controllers are available in 8-bit, and 32-bit.</li><li>• Its family includes Atmega, Tiny, Xmega.</li><li>• Manufacturer is Atmel.</li></ul>	<ul style="list-style-type: none"><li>• PIC micro-controllers are available in 8-bit, 16-bit and 32-bit.</li><li>• Its family includes PIC16, PIC17, PIC18, PIC24, PIC32.</li><li>• Its manufacturer is Microchip.</li></ul>	<ul style="list-style-type: none"><li>• ARM micro-controllers are available in 32-bit mostly also available in 64-bit.</li><li>• Its family includes ARMv4, 5, 6, 7 and series.</li><li>• Its manufacturers are Apple, Nvidia, Qualcomm, Samsung etc.</li></ul>



# AVR Microcontrollers

## ATtiny series

- Microcontrollers of this subfamily has fewer features, fewer I/O pins, and less memory than other AVR series chips.
- Ex- ATtiny11, ATtiny12, ATtiny13, ATtiny85 etc

## ATmega series

- microcontrollers of this subfamily typically has advance features with average number of I/O pins, and sufficient memory space.
- Ex- ATmega16, ATmega8, ATmega328(Arduino uno), ATmega168, ATmega644 etc.

## ATxmega series

- Microcontrollers of this family provides combination of real time performance, high integration and low power consumption and simultaneously offers plenty of GPIO and huge amount of memory space.
- Ex- ATxmega162, ATxmega256 etc

# *How to use any Microcontroller in your project*

- Select the microcontroller which fulfills the demand of your project.
- Read the data sheet of that microcontroller.
- Get familiar with the IDE used for programming that microcontroller.  
(for eg. atmel studio for AVR, mlab x for PIC, keil uvision for ARM etc)
- Select your programming language(Embedded C or Assembly) and write your code in it
- Connect your programmer with the microcontroller and load the program file from your PC to your microcontroller.
- After programming your controller attach the minimum external circuit required to run it.





# *Introduction to Arduino*

- Arduino is the development board of AVR microcontrollers.
- The first Arduino board was introduced in 2005 in Italy to help students who had no previous experience in electronics or MCU programming to create working prototypes connecting the physical world to the digital world.





# Hardware overview of Arduino

