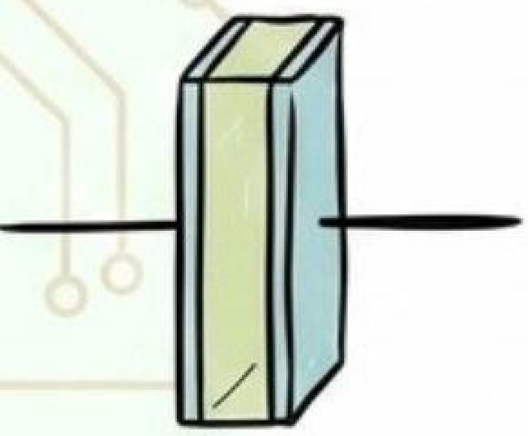
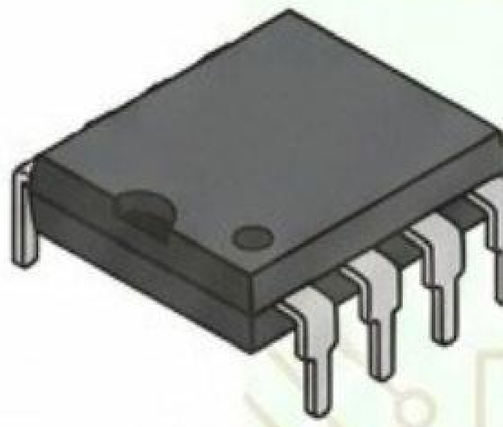
$$V = I * R$$



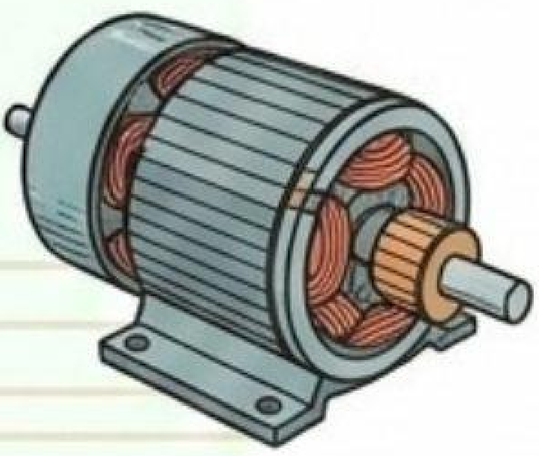
C

Eng. Hany Ismail

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** CE 421 **









$$P = V * I * \cos(\varphi)$$

** Chapter 1 - Lecture 1:

>> What is an Embedded System?

Sensor
Motor

> It is a computer has hardware and software embedded in it as one of it's components.

> Special purpose computer system designed to perform certain dedicated functions.

>> Common Characteristics of Embedded Systems:

الخصائص المشتركه

1. Single-functioned

وظيفة أحاديه

* Executes a single program, repeatedly.

2. Tightly-constrained

محكوم بقيود عاليه

* Low cost, low power, small, fast, etc.

3. Reactive and real-time

* Continually reacts to changes in the system's environment

* Must compute certain results in real-time without delay

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EE352 - EE360 - EE365 - EE410 - EE441 - EE442 - EE443 - EE451 - CE421

>> Benefits of Embedded Computer Systems:

>> Greater performance and efficiency — أداء وكفاءه أعلى

> Software makes it possible to provide sophisticated control. — تحكم متقدم

>> Lower costs

> Less expensive components can be used — بمكنه إستخدام لمكونات الأقل تكلفه

> Manufacturing costs reduced — تقليل تكاليف التصنيع

> Operating costs reduced — تقليل تكاليف التشغيل

> Maintenance costs reduced — تقليل تكاليف الصيانه

>> More features

> Many not possible or practical with other approaches

>> Better dependability — إعتماديه أفضل

> Adaptive system which can compensate for failures

> Better diagnostics to improve repair time

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>> Embedded System Functions:

>> Closed-loop control system

> Monitor a process, adjust an output to maintain desired set point (temperature, speed, direction, etc.)

>> Sequencing

> Step through different stages based on environment and system

>> Signal processing

معالجة الإشارات

> Remove noise, select desired signal features

>> Communications and networking

> Exchange information reliably and quickly

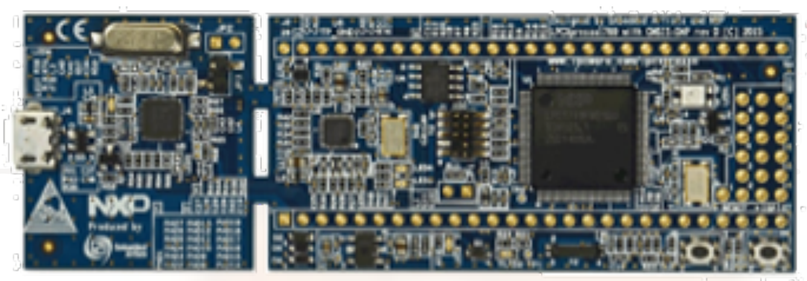
تبادل المعلومات بموثوقيه وسرعه

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** Microcontroller systems:

> Is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals.

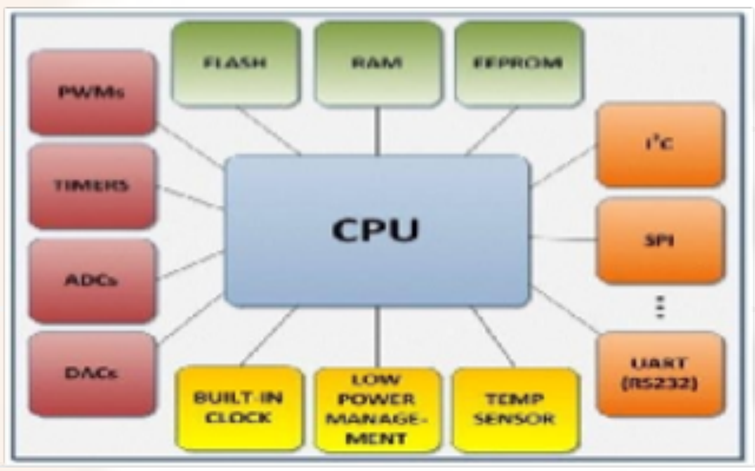
> Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications.

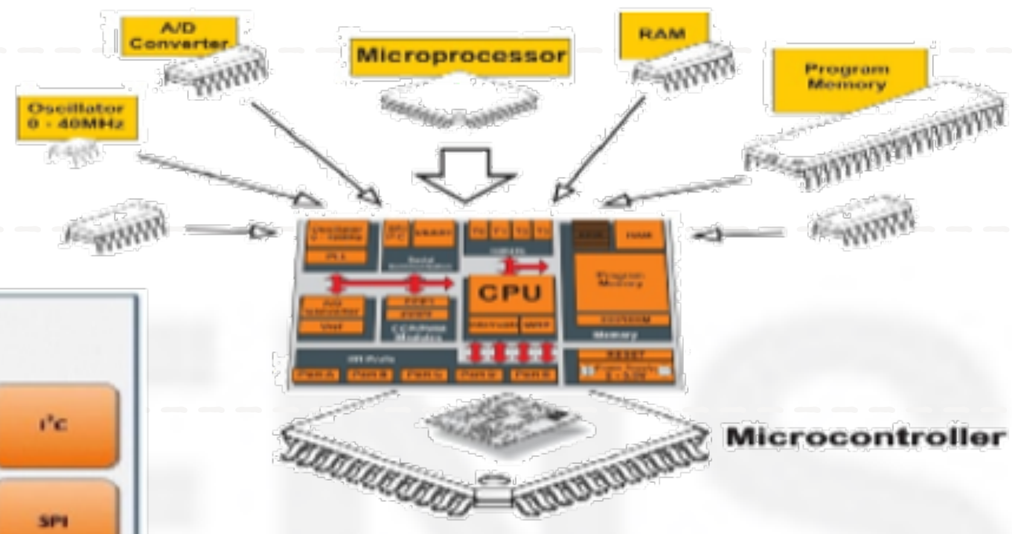


NXP – LPC1769 board



STM Discovery board – STMF4





← General purpose computer

<< Microcontroller vs. Microprocessor >>

>> Both have a CPU core to execute instructions. Centeral processing unit

>> Microcontroller has peripherals for concurrent embedded interfacing and control.

- >> Analog
- >> Non-logic level signals
- >> Timing
- >> Clock generators
- >> Communications
  - ◦ point to point
  - ◦ network
- >> Reliability and safety

** Real-time means Reactive:

> A real-time computer system must react to stimuli from its environment

> The instant when a result must be produced is called a deadline.

> If a result has utility even after the deadline has passed, the deadline is classified as soft, otherwise it is firm.

> If severe consequences could result if a firm deadline is missed, the deadline is called hard.

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القيود

** Constraints in Embedded system design:

* Cost

> Competitive markets penalize products which don't deliver adequate value for the cost

* Size and weight limits

> Mobile (aviation, automotive) and portable (e.g. handheld) systems

* Power and energy limits

> Battery capacity
> Cooling limits

* Environment

> Temperatures may range from -40°C to 125°C, or even more

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** Impact of Constraints:

>> Microcontrollers used (rather than microprocessors)

> Include peripherals to interface with other devices, respond efficiently

> On-chip RAM, ROM reduce circuit board complexity and cost

>> Programming language

> Programmed in C rather than Java (smaller and faster code, so less expensive MCU)

> Some performance-critical code may be in assembly language

>> Operating system

> Typically no OS, but instead simple scheduler

> If OS is used, likely to be a lean RTOS

↓

Real time operating system

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