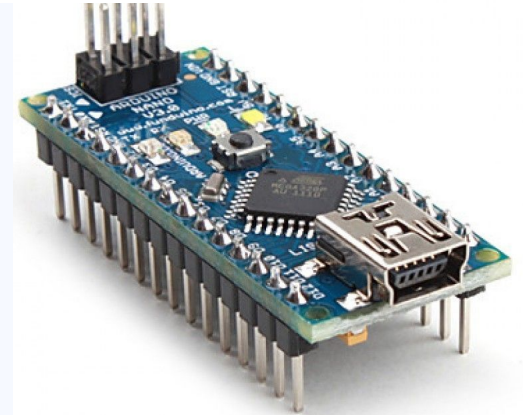
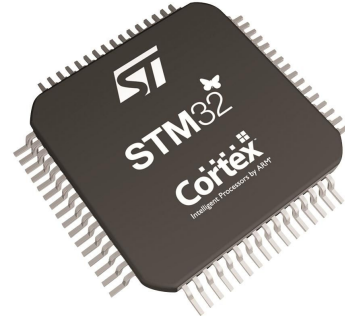


Introduction to Microcontrollers



**Satellite photos
are the
Earth's selfies.**

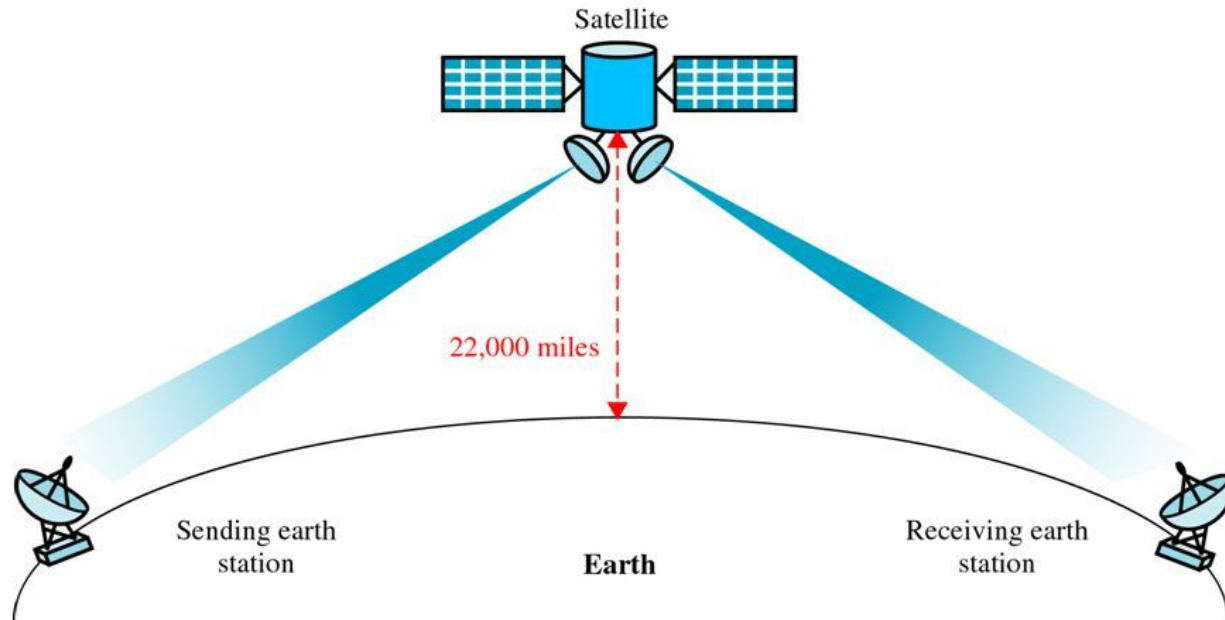


THAT AWKWARD MOMENT



**WHEN YOU PLAY SOCCER ALONE
AND GET CAUGHT BY A SATELLITE**

Satellite Communication



Basic Electronics in our Satellite

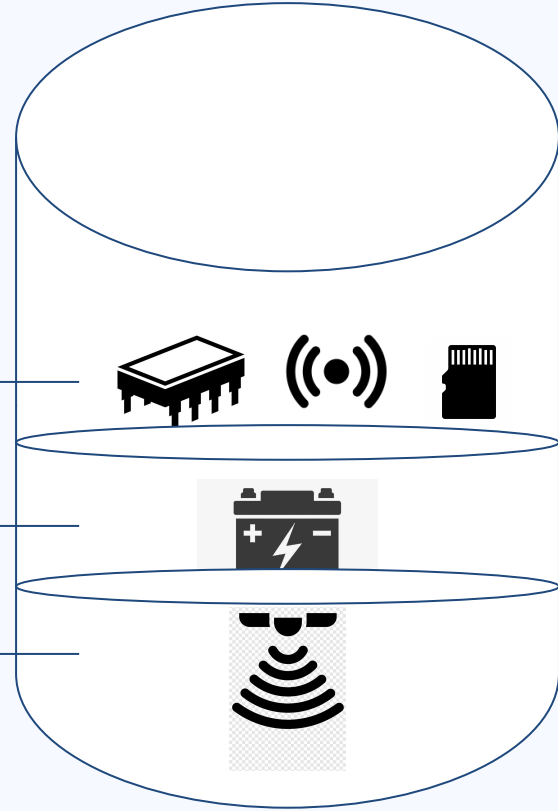
Mission

- Sense/measure weather data
- Process the data
- Store it
- Send it to ground station

Sensors and
Processors

Power
Source

Telemetry
System



What is a Processor?

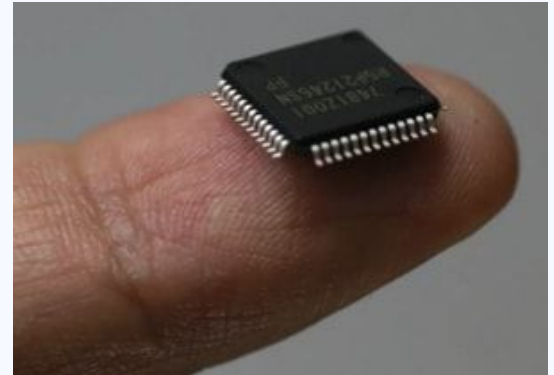
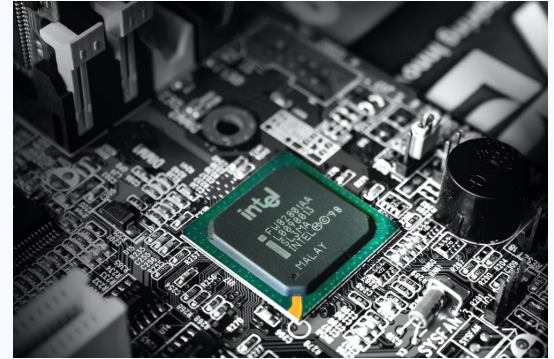
A processor or CPU (Central Processing Unit) is an electronic integrated circuit that processes the instructions given to it. It is the brain of any electronic system.

What does it do?

- Fetch the instructions from the program that we write.
- Understand the instructions and allocate them to the various components of the processor.
- Execute them.

Types of processor:

- Microprocessor
- Microcontroller



Microprocessor vs Microcontroller

- ★ Application: Your computer, phone, tablet etc
- ★ Example: Intel i3/i5/i7, AMD Ryzen
- ★ Complicated and costlier
- ★ High power, high speed - GHz
- ★ Only has CPU
- ★ General purpose
- ★ A microprocessor is the processor that performs arithmetic and logical operations

- ★ Application: Your washing machine, fridge, AC etc and our satellite
- ★ Example: Intel 8051, ATmega328P, STM32 series
- ★ Relatively simpler and much cheaper
- ★ Low power, low speed - MHz
- ★ Has CPU, memory (RAM, ROM, flash), I/O ports, other peripherals
- ★ Application specific
- ★ A microcontroller contains the processor along with other stuff meant for a specific application

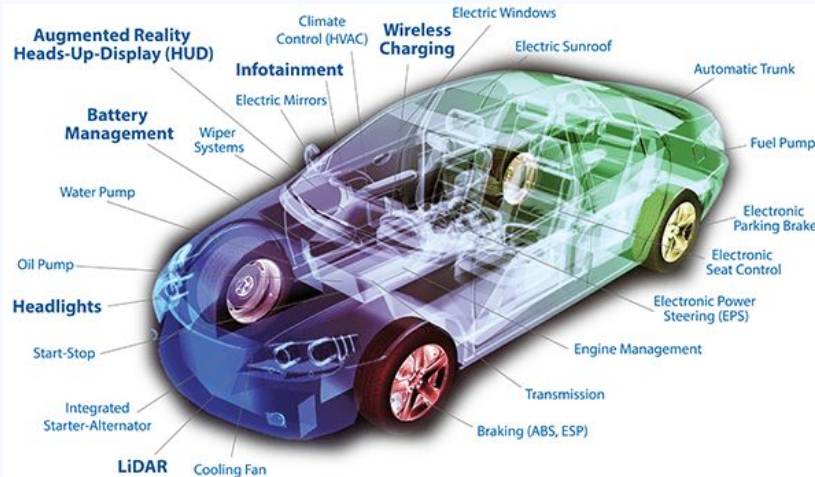
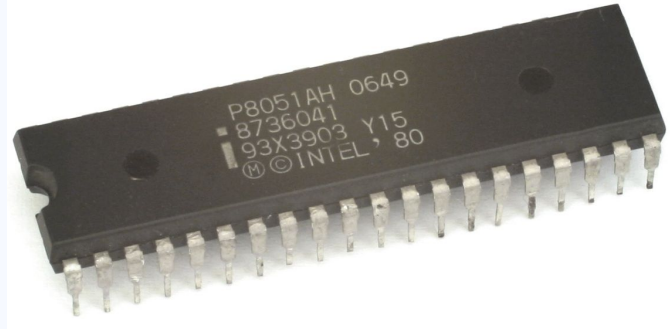
Who invented Microcontroller?

The microcontroller is a computer chip that controls most of the electronic gadgets and appliances people use on a daily basis.

It was during 1970 and 1971 when Intel was working on inventing the world's first microprocessor, that Gary Boone of Texas Instruments was working on quite a similar concept and invented the microcontroller. Boone designed a single integrated circuit chip that could hold nearly all the essential circuits to form a calculator. It was called

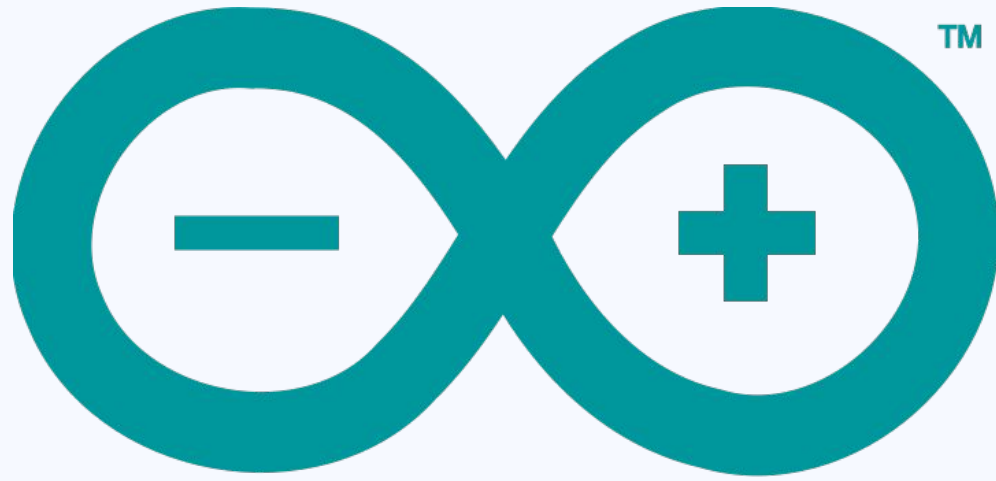
TMS1802NC.





Intel also created many significant microcontrollers besides producing the world's first ever microprocessor. The important ones produced by Intel are the 8048 and the 8051 microcontrollers. 8048 was introduced in 1976 and was the first of Intel's microcontrollers. It was used as the processor in the PC keyboard of IBM. The **8051** microcontroller was introduced in 1980 and is one of the most popular microcontrollers. It is even used now and is considered to be one of the most long-lived microcontrollers.

Today, in addition to the general purpose gadgets, unique microcontrollers are being created for areas like lighting, automotive, communications, and low-power driven consumer goods.



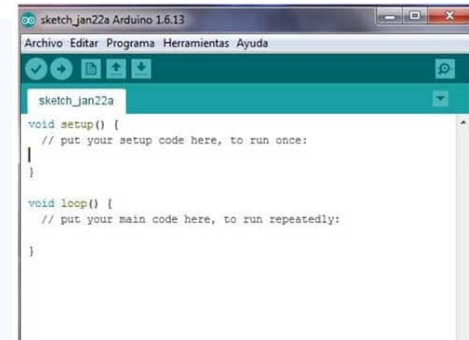
ARDUINO

A microcontroller? No.

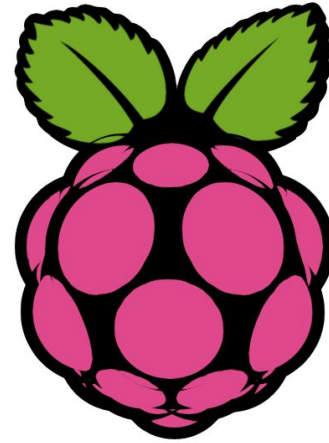
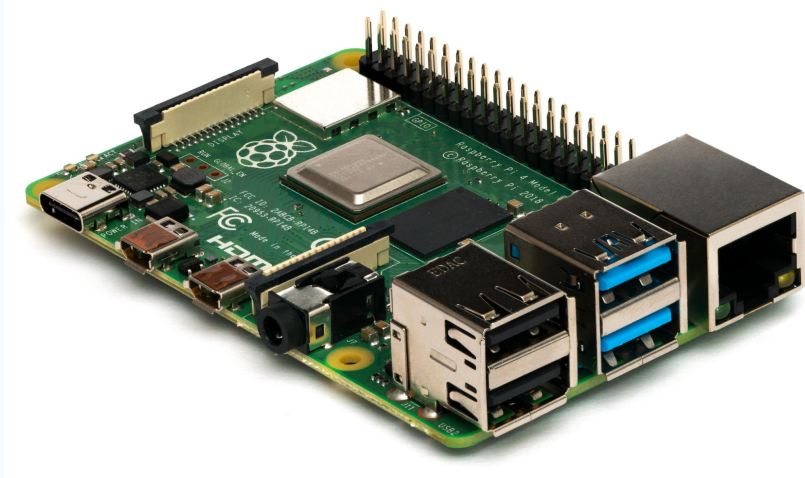
What is Arduino?

Arduino is an open source electronics platform.

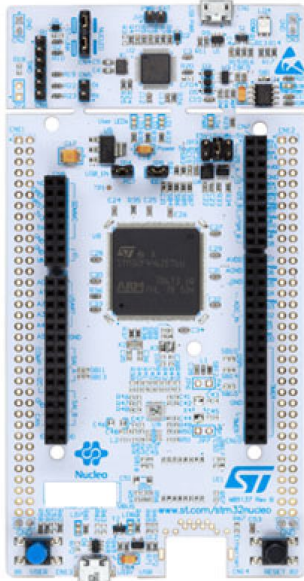
- ❖ Hardware
 - Arduino boards
 - Sensors and other electronics compatible with Arduino boards.
- ❖ Software
 - Software to write codes for these Arduino boards
- ❖ Community driven
 - Arduino forum to post your doubts
 - Free Arduino based projects available online



Other such platforms

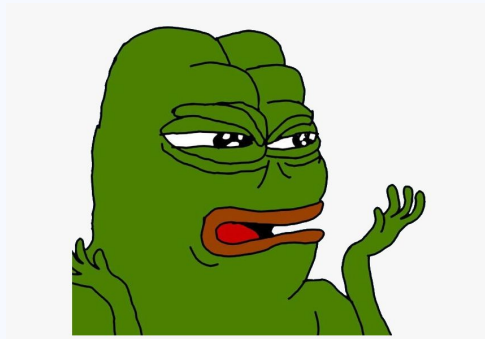


Raspberry Pi



ESPRESSIF

Arduino Boards

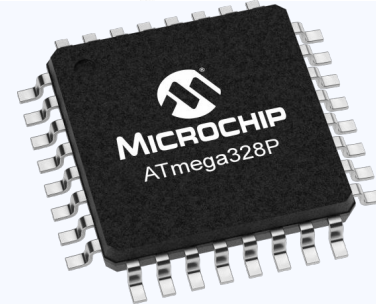
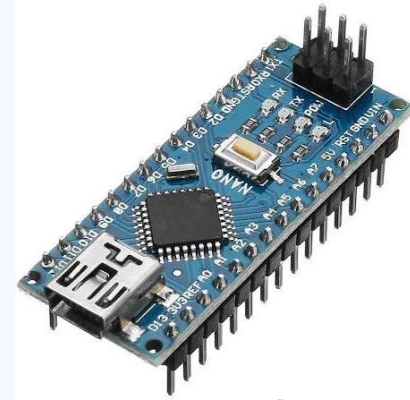




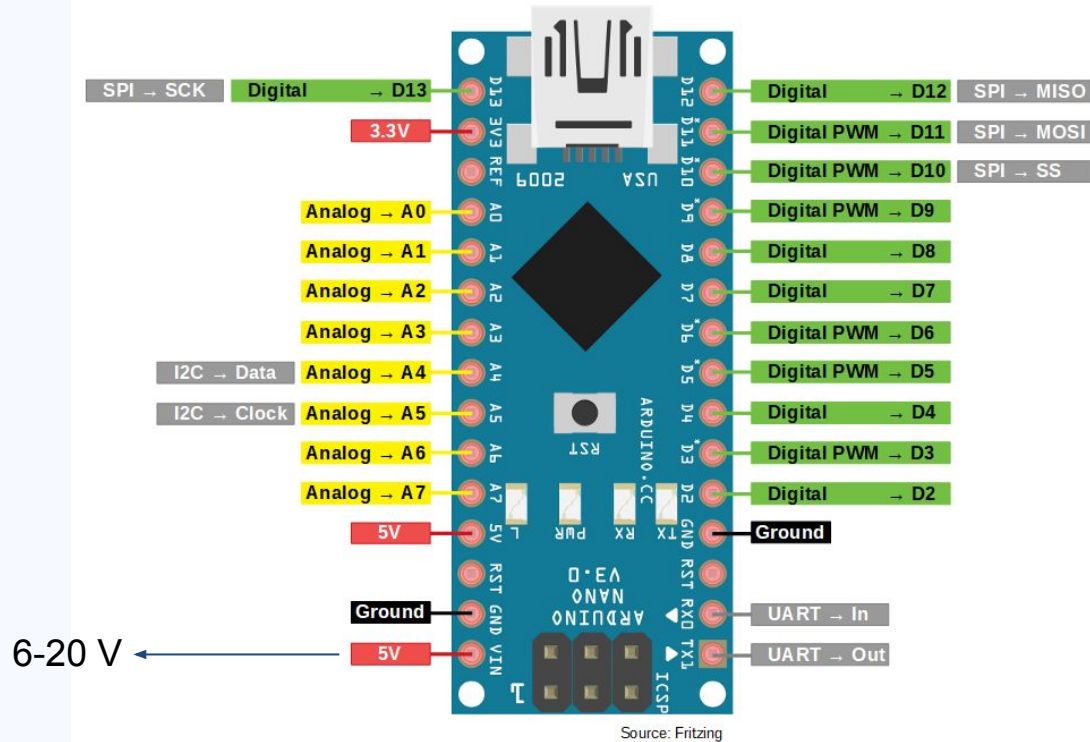
WHICH ONE TO CHOOSE

Arduino Nano Development Board

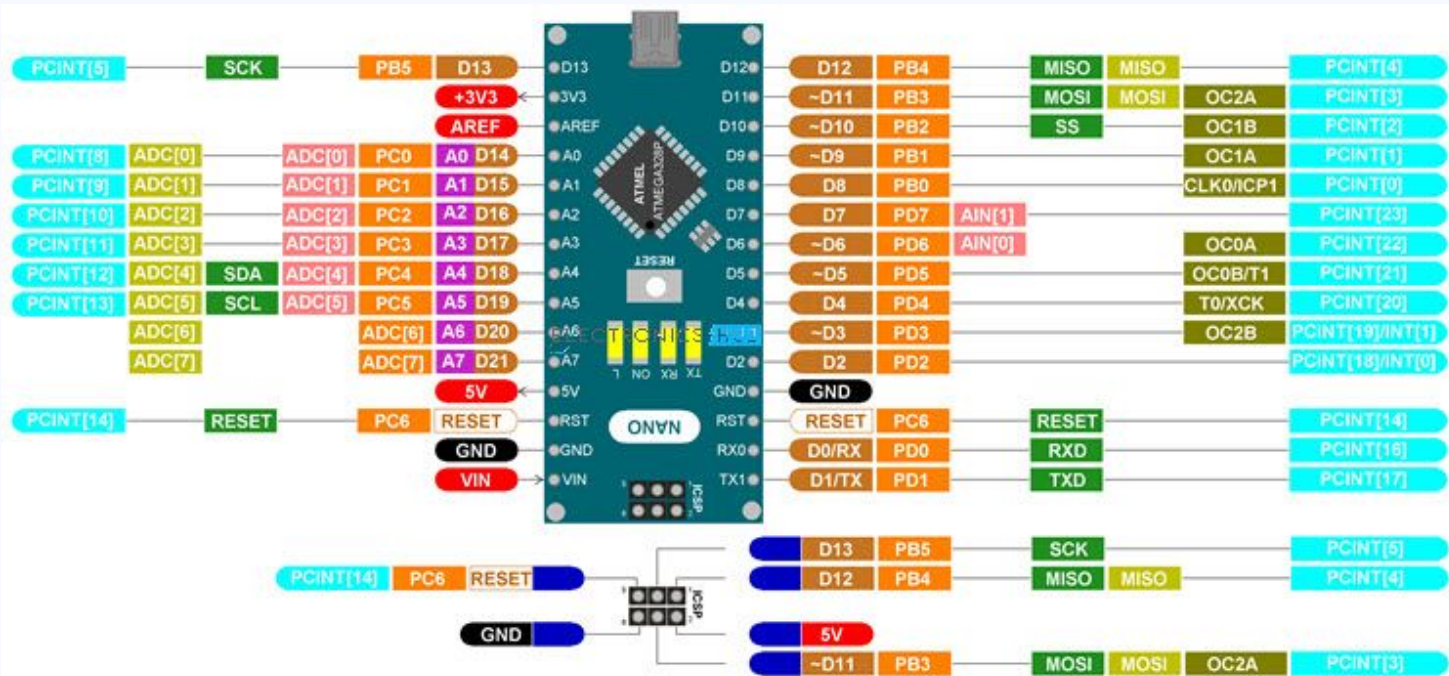
- ❖ Microcontroller: ATmega328P by Microchip
- ❖ Specifications
 - Clock Speed: 16 MHz
 - Flash Memory: 32 KB
 - SRAM: 2 KB
 - EEPROM: 1 KB
- ❖ Size: 18 x 45 mm
- ❖ Power: ≈ 0.3 Watts
 - micro-processor -> 15 Watts or more



Arduino Nano Pin Diagram




Source: Fritzing



Arduino IDE

1. Go to <https://www.arduino.cc/en/software>
2. Under “Downloads” section, click on the appropriate link.
Ex: If you have Windows 10 then click the “Win 7 and newer” link
Note: Don’t download the Windows app
3. Click “Just Download” option.
4. Run the installer that you just downloaded and let it install everything.

 Arduino IDE 1.8.15

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board.

Refer to the [Getting Started](#) page for installation instructions.

SOURCE CODE

Active development of the Arduino software is [hosted by GitHub](#). See the instructions for [building the code](#). Latest release source code archives are available [here](#). The archives are PGP-signed so they can be verified using [this](#) gpg key.

DOWNLOAD OPTIONS
Windows Win 7 and newer
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Linux 32 bits
Linux 64 bits
Linux ARM 32 bits
Linux ARM 64 bits
Mac OS X 10.10 or newer
[Release Notes](#) [Checksums \(sha512\)](#)

What's next?

- Programming basics
- Interfacing (Digital and Analog)
- Sensors
- Telemetry
- Programming the Arduino

Thank You