Microcontroller

Lecture 2

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Introduction to Arduino

- Arduino is a small microcontroller board with a universal serial bus (USB) plug to connect to your computer and a number of connection sockets that can be wired to external electronics such as motors, relays, light sensors, laser diodes, loudspeakers, microphones, and more.
- open-source electronic prototyping platform enabling users to create interactive electronic objects.
- The Arduino is programmed in the Arduino C language. It was derived from C language, which is basically one of the modern programming languages

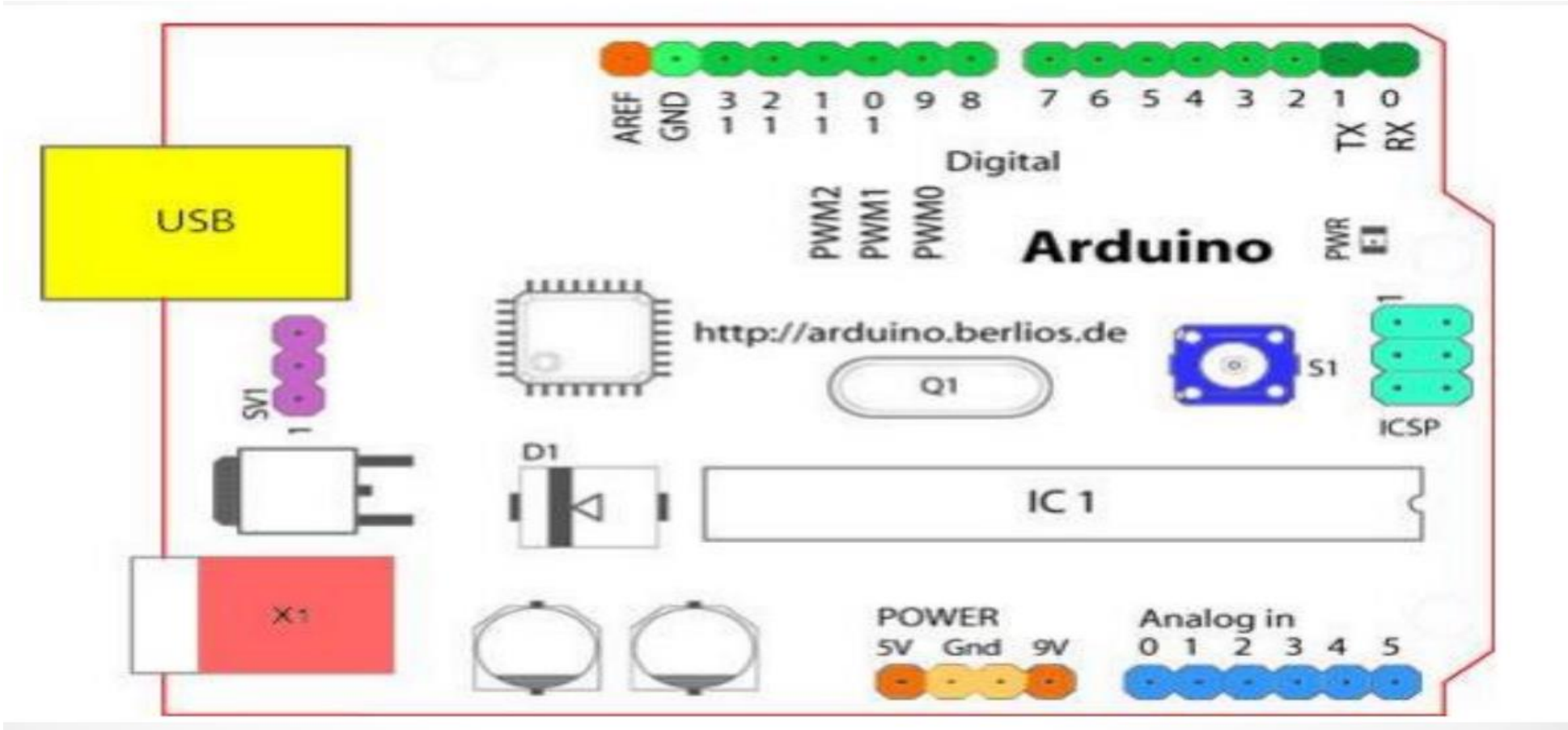
Advantage of Arduino

- Cheap .
- Ease of handling
- The simplicity of the programming language.
- It provides many attachments to it
- Open source, which helps to speed up their development.
- You can link it to powerful programming languages like MATLAP, JAVA.

Applications of Arduino

- Projects for measuring temperature, humidity, light ... etc.
- Distance measurement projects.
- Controlling home appliances over the phone
- Fire alarm loudspeaker.
- Water the plants automatically
- A device that follows the sun.
- Devices for locating vehicles or people via satellite (GPS).

Arduino contents



- Analog Reference pin (orange)
- Digital Ground (light green)
- Digital Pins 2-13 (green)
- Digital Pins 0-1/Serial In/Out - TX/RX (dark green) - These pins cannot be used for digital i/o
- Reset Button - S1 (dark blue)
- In-circuit Serial Programmer (blue-green)
- Analog In Pins 0-5 (light blue)
- Power and Ground Pins (power: orange, grounds: light orange)
- External Power Supply In (9-12VDC) - X1 (pink)
- Toggles External Power and USB Power (place jumper on two
- pins closest to desired supply) - SV1 (purple)
- USB (used for uploading sketches to the board and for serial communication between the board and the computer; can be used to power the board) (yellow)

Types of Arduino pins

There are three main types of Arduino pins: digital pins, analog pins and power pins :

- **Digital pins** can be used as both input and output pins on most Arduino microcontrollers. This means that a single pin can both send and receive digital data. Digital Arduino pins can be only "high" or "low." When a digital pin is high, a constant voltage is present. When the pin is low, this voltage is gone.
- **Analog pins** are used to read the state of a connected device, such as a sensor. Although digital pins can only tell if a connection is high or low, analog input pins are able to read the exact voltage value. This is useful for interfacing with analog sensors that have a wide range of possible values. For example, analog thermometer sensors often send a voltage reading that corresponds to the temperature. Using an analog input pin, an Arduino can read the value directly.

- **Power pins** Most Arduino microcontrollers have several power pins that receive and output a variety of voltages. The Vin, 5V, 3.3V, and GND pins are Arduino power pins. You can use the Vin pin to Power your Arduino with an unregulated 7 to 12-volt power source. Like a 9V battery or a wall adapter that is in the range of 7 to 12 volts. Alternatively, you can power your Arduino through the 5V pin with an external regulated 5V power supply. A 3.3V pin to power sensors and modules that need 3.3V power.
- There are several GND pins on the Arduino, any of which can be used to ground your circuit. The GND pins are used to close the electrical circuit and provide a common logic reference level throughout your circuit.

How to supply the power to an Arduino board?

- **USB**: that’s probably the most common way people try their projects. By simply plugin your Arduino board into your computer through an USB cable it will power up your Arduino. The 5V USB power is used to power a 5V Arduino directly, or it’s regulated down if it’s a 3.3Volt Arduino

Batteries: You can use two different types of batteries:

- **Disposable batteries**: One of the most common ways is to power up an Arduino with a 9V battery, just like the image below shows. Keep in mind that those batteries are a bit limited, so your Arduino won't be able to supply many sensors or motors.

- **Re-charged batteries**: Those are simply battery cells that you can recharge. Are a great solution for robotics.

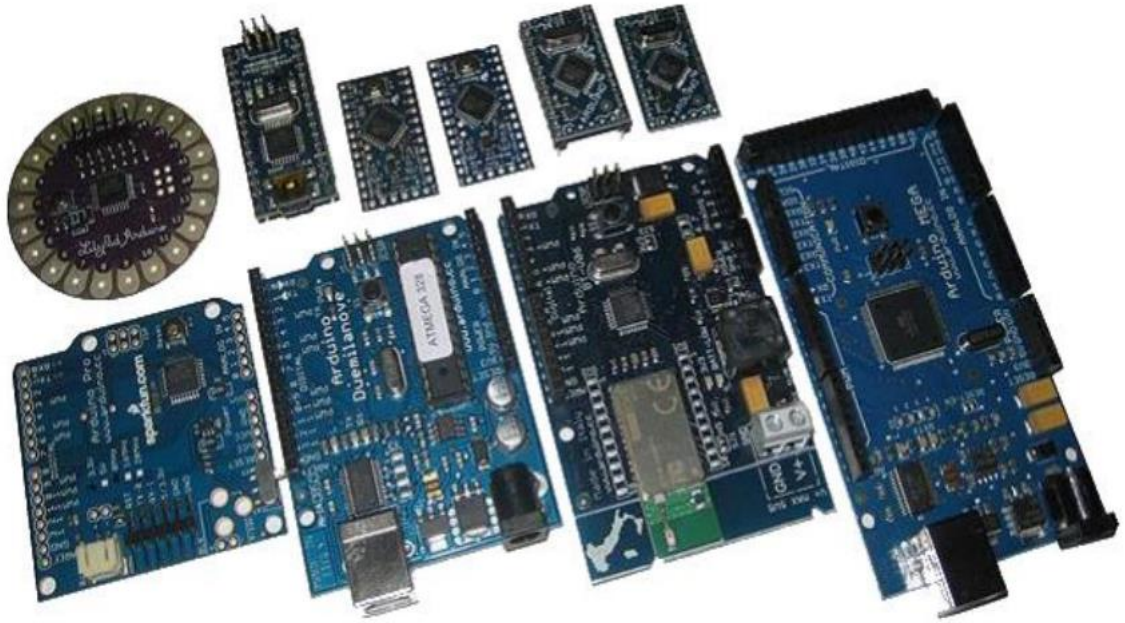
- **Power Adapter**: You must be careful when you're using a power adapter because sometimes they produce much more voltage than the actually power supply says in the label. And the voltage regulator on your Arduino won't be able to handle so much voltage

Arduino Types

- Many different versions
- Number of input/output channels
- Form factor
- Processor

Types of Arduino

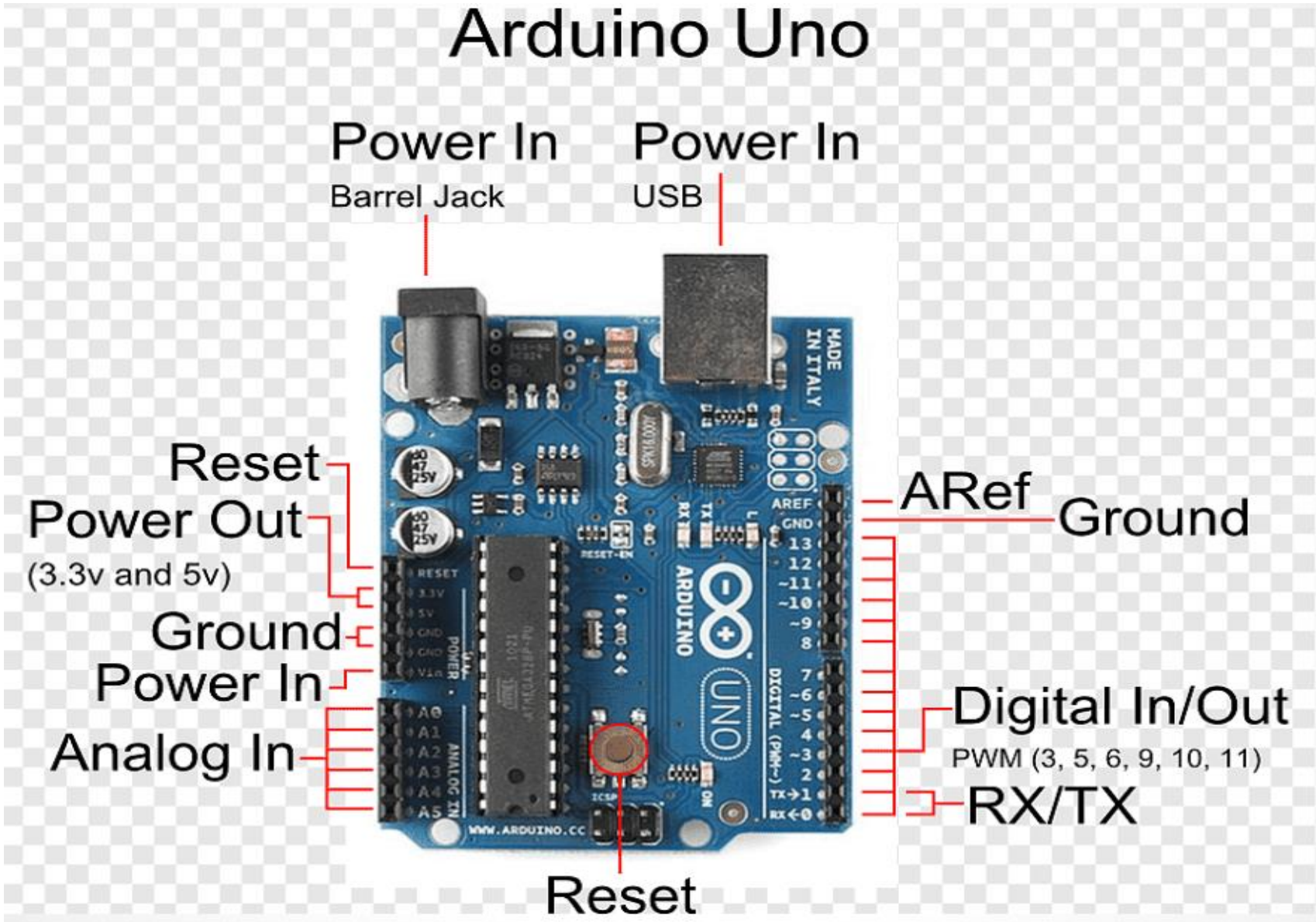
- Uno
- Leonardo
- Due
- Mega



Arduino Uno

- It is one of the most famous types of Arduino in the world. because it is cheap and also has a suitable number of legs and a suitable size.
- The microcontroller inside it is from ATMEL.
- It has 14 legs that you can use as an input or output for the digital signal (1 or 0) and 6 legs with a PWM feature.
- It also has 6 legs of the analog type (ANALOG) and one output for the system for UART serial communication

Arduino Uno


Power In
Barrel Jack
Power In
USB
Reset
Power Out
(3.3v and 5v)
Ground
Power In
Analog In
ARef
Ground
Digital In/Out
PWM (3, 5, 6, 9, 10, 11)
RX/TX
Reset

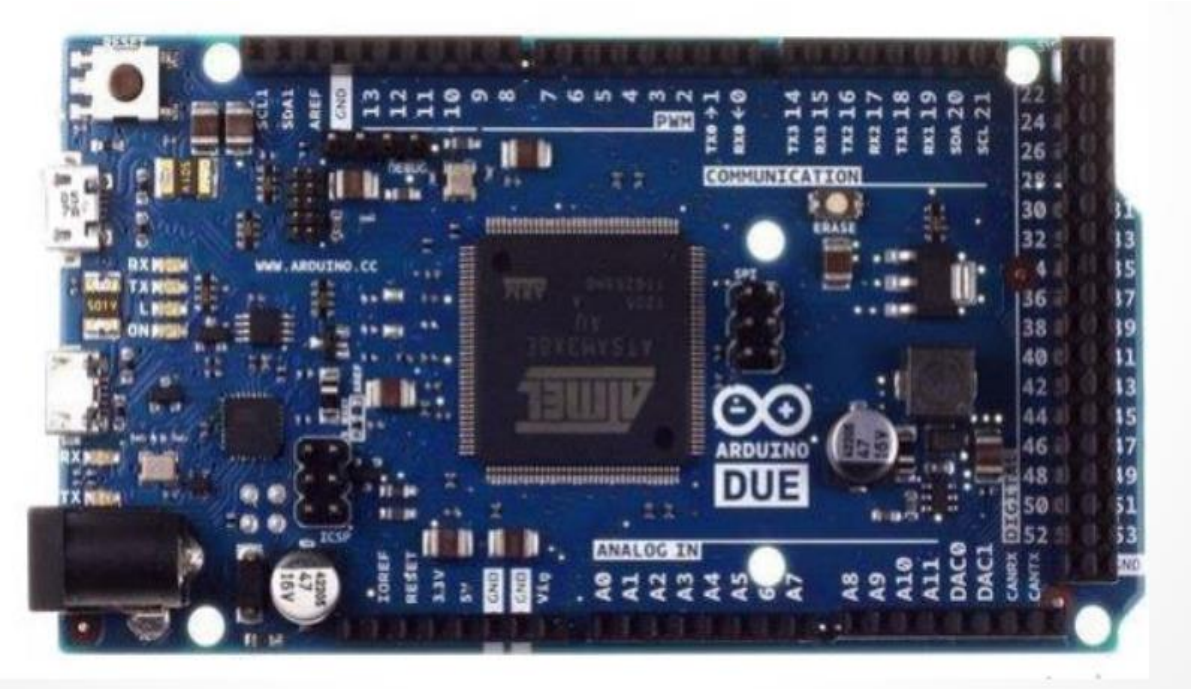
Leonardo

- It is slightly cheaper than the Uno and has the same connections as
- the Uno.
- Its processor chip is soldered onto the board and so cannot be removed.
- Its lower cost is in part due to the use of a processor that includes its

own USB interface rather than having to use a separate chip like the Uno

Due

- Much faster processor, many more pins
- Operates on 3.3 volts



MEGA

MICROCONTROLLER	ATmega2560
DIGITAL I/O PINS	54 (of which 15 provide PWM output)
ANALOG INPUT PINS	16